



Poznan University of Medical Sciences, Poland
Poland

JMS *Journal of Medical Science*

previously *Nowiny Lekarskie*

Founded in 1889

2018
Vol. 87, No. 1

QUARTERLY

Indexed in:

Polish Medical Bibliography, Index Copernicus,
Ministry of Science and Higher Education, Ebsco, Google Scholar

eISSN 2353-9801
ISSN 2353-9798

www.jms.ump.edu.pl

EDITOR-IN-CHIEF

Jarosław Walkowiak

EDITORIAL BOARD

David H. Adamkin (USA)
Adrian Baranchuk (Canada)
Grzegorz Bręborowicz (Poland)
Paolo Castiglioni (Italy)
Wolfgang Dick (Germany)
Leon Drobnik (Poland)
Janusz Gadzinowski (Poland)
Michael Gekle (Germany)
Przemysław Guzik (Poland)
Karl-Heinz Herzig (Germany)
Mihai Ionac (Romania)
Lucian Petru Jiga (Germany)
Berthold Koletzko (USA)
Stan Kutcher (Canada)
Oded Langer (USA)
Tadeusz Maliński (USA)
Leszek Paradowski (Poland)
Antoni Pruszewicz (Poland)
Georg Schmidt (Munich, Germany)
Mitsuko Seki (Japan)
Ewa Stępień (Poland)
Jerzy Szaflarski (USA)
Bruno Szczygieł (Poland)
Kai Taeger (Germany)
Marcos A. Sanchez-Gonzalez (Florida, USA)
Krzysztof Wiktorowicz (Poland)

ASSOCIATE EDITORS

Agnieszka Bienert
Maria Iskra
Ewa Mojs
Adrianna Mostowska

SECTION EDITORS

Jaromir Budzianowski — Pharmaceutical Sciences
Paweł Jagodziński — Basic Sciences
Joanna Twarowska-Hauser — Clinical Sciences

LANGUAGE EDITORS

Margarita Lianeri (Canada)
Jacek Żywiczka (Poland)

STATISTICAL EDITOR

Magdalena Roszak (Poland)

SECRETARIAT ADDRESS

70 Bukowska Street, room 104
60-812 Poznań, Poland
phone/fax: +48 61 854 72 74
email: jms@ump.edu.pl
www.jms.ump.edu.pl

DISTRIBUTION AND SUBSCRIPTIONS

37a Przybyszewskiego Street
60-356 Poznań, Poland
phone/fax: +48 61 854 74 14
email: sprzedazwydawnictw@ump.edu.pl

PUBLISHER

Poznań University of Medical Sciences

© 2018 by respective Author(s). Production and hosting by
Journal of Medical Science (JMS)

This is an open access journal distributed under the terms and
conditions of the Creative Commons Attribution (CC BY-NC)
licence

eISSN 2353-9801

ISSN 2353-9798

Publishing Manager: Grażyna Dromirecka

Technical Editor: Bartłomiej Wąsiel

**WYDAWNICTWO NAUKOWE UNIWERSYTETU MEDYCZNEGO
IM. KAROLA MARCINKOWSKIEGO W POZNANIU**

60-812 Poznań, ul. Bukowska 70
tel./fax: +48 61 854 71 51
www.wydawnictwo.ump.edu.pl

Ark. wyd. 7,7. Ark. druk. 8,5.
Zam. nr 143/18.

The Editorial Board kindly informs that since 2014 *Nowiny Lekarskie* has been renamed to *Journal of Medical Science*.

The renaming was caused by using English as the language of publications and by a wide range of other organisational changes. They were necessary to follow dynamic transformations on the publishing market. The Editors also wanted to improve the factual and publishing standard of the journal. We wish to assure our readers that we will continue the good tradition of *Nowiny Lekarskie*.

You are welcome to publish your basic, medical and pharmaceutical science articles in *Journal of Medical Science*.

Ethical guidelines

The Journal of Medical Science applies the ethical principles and procedures recommended by COPE (Committee on Conduct Ethics), contained in the Code of Conduct and Best Practice Guidelines for Journal Editors, Peer Reviewers and Authors available on the COPE website: <https://publicationethics.org/resources/guidelines>

CONTENTS

ORIGINAL PAPERS

- Piotr Kowal, Anna Marcinkowska-Gapińska*
Thixotropic effect of some biochemical factors in ischaemic stroke 7
- Iryna Han, Khristina Musij-Sementsiv, Volodymyr Zubachyk*
The effect of endodontic filling agents on the activity of the regeneration processes of bone tissue in the experiment. 11
- Marcin Cybulski, Wojciech Strzelecki, Paweł Chmielowski, Bogusław Stelcer, Bartosz Bilski, Maria Grzymisławska-Cybulska*
The Greatest Man in the World. The life and ethics of Albert Schweitzer in the eyes of students pursuing medical and legal degrees. 18

REVIEW PAPERS

- Dorota Cudziło, Agnieszka Sikorska, Maja Matthews-Kozanecka, Teresa Matthews-Brzozowska*
Analysis of the prevalence of dental and occlusal anomalies in children and adolescents in Poland and elsewhere – review of the publications from the last 10 years 24
- Krzysztof Stola*
User experience and design thinking as a global trend in healthcare 28
- Katarzyna Pastusiak, Juliusz Przysławski*
The criteria of the identification of metabolic obesity among people with normal body weight and their use in everyday practice 34
- Piotr Stępiak*
Healthy lifestyles in the perspective of *homo eligens*. 40

CASE STUDY

- Teresa Matthews-Brzozowska, Monika Łacka, Weronika Kawalkiewicz, Ewa Mojs, Leszek Kubisz*
Minimally invasive facial skin revitalization treatment – a case study 48

APPENDIX

- 27th Bilateral Symposium Poznan-Halle. Rare diseases in clinical practice. 15th–17th of December 2017. 55
- Instructions for Authors 67



ORIGINAL PAPER

DOI: <https://doi.org/10.20883/jms.2018.220>

Thixotropic effect of some biochemical factors in ischaemic stroke

Piotr Kowal, Anna Marcinkowska-Gapińska

Rheological Laboratory, Department of Neurology, Poznan University of Medical Sciences, Poland

ABSTRACT

Introduction. Yield shear stress (YSS) well characterizes the thixotropic status of blood, that exemplifies a reversible loss of blood fluidity due to a low shear rate. At the stable haematocrit ratio YSS depends mainly on the fibrinogen level.

Aim. Since the role of other biochemical factors in the YSS phenomenon in cerebral ischaemia has not been well known, we have undertaken this problem in a group of stroke patients.

Material and Methods. The study was carried out in 36 patients with acute ischaemic stroke and in 12 controls. YSS was estimated by means of microviscometric method. In all subjects the concentration of the following biochemical factors were assayed: albumin, IgG, IgA, IgM, apolipoprotein A, and B, cholesterol, triglycerides, LDL, HDL and fibrinogen. Then the thixotropic effect of all biochemical factors and their correlations to fibrinogen were estimated by means of mathematical formulas.

Results. We found a positive correlation in relation to the following thixotropic effects: for all subjects and separately for patients' group: Alb(YSS) ($p < 0.001$), ApoA(YSS) ($p < 0.001$), ApoB(YSS) ($p < 0.05$), chol(YSS) ($p < 0.01$), HDL(YSS) ($p < 0.05$); for patients group without additional diseases: Alb(YSS) ($p < 0.05$), ApoA(YSS) ($p < 0.005$), chol(YSS) ($p < 0.05$), HDL(YSS) ($p < 0.02$), LDL(YSS) ($p < 0.05$). There were not any significant correlations in controls.

Conclusions. Results of the study indicated that in the interaction between the red cells and fibrinogen some additional factors appearing or activating during ischaemic process may play a role.

Keywords: hemorheology, blood viscosity, plasma viscosity, blood proteins.

Introduction

The blood flow in blood vessels is a very complex matter. Under physiological conditions, the blood flow is determined both by the vascular factor and by the physical and physicochemical properties of blood [1–3]. In terms of rheological properties blood is a non-newtonian fluid, it is a suspension of cellular components of the plasma [1–4].

The main factors affecting the flow of blood are hematocrit, whole blood viscosity, plasma viscosity, aggregation and deformation of erythrocytes [2, 5]. In the low shear rate range aggregation of red blood cells is the major determi-

nant of blood flow. The size of the aggregation of red blood cells is a function of flow conditions, the properties of the cell membrane, the presence of large molecules (fibrinogen, α 2-globulin, IgM), and metabolic factors, such as osmolarity, and pH of blood. The consequence of the creation and disintegration of aggregates of erythrocytes is the thixotropic character of blood [2, 6, 7]. Thixotropy is a phenomenon occurring under isothermal flow of a liquid remaining for a long time at rest, resulting in reversible decrease of shear stress with time at a constant shear rate. An example of this phenomenon is the sol gel

transition. The consequence of these properties is a specific hysteresis flow curve, as well as the dependence of rheological parameters on the "history" of fluid [8]. Yield shear stress (YSS) well characterizes the thixotropic status of blood, that exemplifies a reversible loss of blood fluidity due to a low shear rate [9].

Material and Methods

Research was conducted in a group of 36 patients with acute ischemic stroke and 12 individuals showing no clinical signs of neurological or internal medicine disease. In the control group there were 8 women and 4 men (mean age 65 years). The group of patients included 15 men and 21 women (mean age 68 years). Fourteen of them had hypertension, 9 were diabetes and 2 had angina pectoris. From the interview it was established that 1 patient had a heart attack, 1 had an episode of transient cerebral ischemia while 7 patients were subject to more than one risk factor for stroke.

From all subjects venous blood was collected into tubes with EDTA (1 mg/ml). In the case of patient blood collection took place within the first 48 hours from the onset of clinical signs of cerebral ischemia. The blood was centrifuged at 3000 rpm, and so isolated red blood cells were washed twice with 0.9 % saline. For the haemorheological study 30% suspensions of erythrocytes in their own plasma were prepared.

All measurements were made at 37°C. For each shear rate the value of shear stress was calculated. The values of yield shear stress (YSS)

were determined from the dependence of the natural logarithms of shear tension and shear using numerical methods. The YSS value was estimated as the point of intersection of the extrapolated straight line with the axis of ordinates. The intensity of interaction of red blood cells and fibrinogen was determined by converting the calculated value of YSS to 100 mg of this protein. Blood samples collected from all the subjects were also used to obtain the serum, from which the contents of the following protein and lipid fractions were determined: albumin, IgG, IgA, IgM, apolipoprotein A₁ and B, cholesterol, triglycerides, LDL and HDL.

The value of YSS obtained for each sample was converted to 100 mg of a particular biochemical agent, thereby expressing the intensity of its effect on the interaction of red blood cells to fibrinogen (Thixotropic effect). Then we analyzed the relationship between that parameter and the level of fibrinogen.

Results

In **Table 1** we showed the distribution of the linear correlation coefficients between the level of fibrinogen and the strength of the thixotropic effect for selected biochemical factors of blood. Statistically significant positive correlations were demonstrated for the following factors when considering the total sample and separately groups of patients: Alb(YSS) ($p < 0.001$), ApoA(YSS) ($p < 0.001$), ApoB(YSS) ($p < 0.05$), chol(YSS) ($p < 0.01$), HDL(YSS) ($p < 0.05$); for patients without additional diseases: Alb(YSS) ($p < 0.05$),

Table 1. A summary of linear correlation coefficients between the fibrinogen and the level of the thixotropic effect for selected biochemical factors of blood in patients with acute cerebral ischemia and in the control group

Dependence	I n = 12	II n = 36	III n = 18	IV n = 48
Fib/IgG(YSS)	0.0005	0.2928	0.0230	0.2452
Fib/IgA(YSS)	0.1377	0.2801	0.0350	0.1554
Fib/IgM(YSS)	-0.4063	0.1280	-0.0640	0.1165
Fib/Alb(YSS)	-0.1069	0.6659*****	0.5830*	0.5804*****
Fib/ApoA(YSS)	0.1223	0.6659*****	0.7110****	0.5883*****
Fib/ApoB(YSS)	0.0935	0.4103*	0.4200	0.3005*
Fib/Chol(YSS)	0.1187	0.4535***	0.7170****	0.3987***
Fib/Tgc(YSS)	0.0851	0.0655	0.1820	0.0448
Fib/HDL(YSS)	0.2355	0.4096*	0.6530**	0.3984*
Fib/LDL(YSS)	0.0442	0.3217	0.5360*	0.2478

I – control group, II – ischaemic stroke, III – stroke patients group without additional diseases, IV – whole group; the significance level of differences: * $p < 0.05$; ** $p < 0.02$; *** $p < 0.01$; **** $p < 0.005$; ***** $p < 0.001$;

ApoA(YSS) ($p < 0.005$), chol(YSS) ($p < 0.05$), HDL(YSS) ($p < 0.02$), LDL(YSS) ($p < 0.05$). When considering only the control group no statistical significance for any of the examined relationships was found.

Discussion

Former findings show the role of synergism of some protein components of plasma with the interaction between red blood cells and fibrinogen in patients with ischemic stroke [10].

The results of studies of the effect of fibrinogen on the level of the thixotropic effect of some lipid fractions seem to confirm the supporting role of lipids in the aggregation of erythrocytes. In the applied method of mathematical analysis thixotropic effect level denotes the YSS value relative to 100 mg of a biochemical factor. It turns out that the increase of fibrinogen level significantly increases the thixotropic effect exerted by apolipoprotein A₁. As in the control group a negative correlation of the lipid fraction with the low shear rate value of blood viscosity was found, it suggests some duality of apolipoprotein A₁ function. The impact of fibrinogen on the thixotropic effect of apolipoprotein B, cholesterol and HDL from a statistical point of view is much weaker. Among the protein fraction, only albumins show an equally strong positive correlation of the thixotropic effect with fibrinogen level as in the case of apolipoprotein A₁. These phenomena also occur when analyzing the group of patients with no other additional diseases but they are not observed in the control group. This suggests the involvement of some additional factors in the process of red blood cell interactions with fibrinogen. These factors either appear upon occurrence of acute ischemic stroke or have been present before and only get activated by this event.

Some light was shed on this issue by the reports on the impact of the immunological phenomena on blood clotting disorders [11] and also on the presence of antiphospholipid antibodies and antycardiolipin in the part of the population of patients with cerebral ischemia (especially in patients over the age of 50) [12–15].

According to Donner *et al.* [16], in the presence of immunoglobulins albumins effect on the aggregation of red blood cells seems to be a complex phenomenon, depending on the ratio

of albumins to globulins. Albumin molecules do not induce rulonization of erythrocytes, however they have inhibitory or stimulatory effect on the aggregation of red blood cells stimulated by other proteins [16, 17].

In the process of erythrocyte aggregation fibrinogen plays an important role [9, 18, 19]. Fibrinogen has particularly strong affinity to the cell membrane of red blood cells. Aggregation of red blood cells in a solution of pure fibrinogen starts from the moment when the concentration of the protein is in the range of 2 g/l, however the presence of other proteins may reduce this threshold. According to Janzen *et al.* [20], aggregation of red blood cells is also possible in the absence of these macromolecules by means of so called depletion mechanism, but such phenomenon is more related to an experimental model. On the other hand, Skalak and Cheng [21] noted that even when red blood cells are not aggregated flow dysfunction can occur in the microcirculation as a result of hydrodynamic interactions between cells.

Conclusions

Mathematical model analysis of the contribution of various biochemical factors in the phenomenon of thixotropy shows that the process of interaction of red blood cells with fibrinogen takes place with the help of additional unknown factors which in the acute phase of cerebral ischemia either appear or get activated.

Acknowledgements

Conflict of interest statement

The authors declare no conflict of interest.

Funding sources

There are no sources of funding to declare.

References

1. Chien S. Rheology in the Microcirculation. In: Liss AR (ed.). Normal and Low Flow States. Adv Shock Resear. 1982;8:71–80.
2. Baskurt OK, Hardeman MR, Rampling MW, Meiselman HJ. Handbook of Hemorheology and Hemodynamics. IOS Press Amsterdam, Berlin, Oxford, Tokyo, Washington, DC, 2007.
3. Marcinkowska-Gapińska A, Kowal P. Hemorheological studies of chosen clinical cases. J Med Sci. 2015;84(3):197–200.
4. Chmiel H. Determination of blood rheological parameters and clinical application. Advances in Cardiovascular Physics. 1979;3:1–44.

5. Lerche D, Bämmler H, Kucera W, Meier W, Paulitschke M. Flow properties of blood and hemoreological methods of quantification. In: Scütt W, Klinkmann H, Lamprecht I, Wilson T (eds.). *Physical Characterization of Biological cells. Basic research and clinic relevance.* Verlag Gesundheit GmbH Berlin, 1991. p. 189–214.
6. Marossy A, Svorc P, Kron I, Gresova S, Hemorhology and circulation. *Clin. Hemorheol and Microcirc.* 2009;42:239–258.
7. Huang CR, Pan WD, Chen HQ, Copley AL. Thixotropic properties of whole blood from healthy human subjects. *Biorheology.* 1987;24(6):795–801.
8. Tropea C, Yarin AL, Foss JF. *Springer Handbook of Experimental Fluid Mechanics.* Springer-Verlag Berlin Heidelberg, 2007.
9. Kowal P. Quantitative study of fibrinogen molecules contribution to the inter-red cells connections in selected clinical groups of stroke patients. *Clin Hemorheol Microcirc.* 1998;1:37–41.
10. Kowal P, Walzl M, Lechner H. The influence of H.E.L.P. system on field shear stress in vascular disease. *Clin Haemoreol.* 1993;13(5):701–706.
11. Vermeylen J, Blockmans D, Spitz B, Deckmyn H. Thrombosis and immune disorders. *Clin Haematol.* 1986;15:393–412.
12. Członkowska A, Meurer M, Palasik W, Barańska-Gieruszczak M, Mendel T, Wierzchowska E. Anticardiolipin antibodies, a disease marker for ischemic cerebrovascular events in a younger patients populations? *Acta Neurol Scand.* 1992;3:304–307.
13. Hess DC, Krauss J, Adams RJ, Nichols FT, Zhang D, Rountree HA. Anticardiolipin antibodies: a study of frequency in TIA and stroke. *Neurology.* 1991;4:525–528.
14. Levine S, Kim S, Deegan M, Welch KMA. Ischemic Stroke Associated with Anticardiolipin Antibodies. *Stroke.* 1987;18:1101–1106.
15. Montalban J, Codina A, Ordi J, Vilardel M, Khamashata MA, Hughes GRV. Antiphospholipid antibodies in Cerebral Ischemia. *Stroke.* 1981;22:750–753.
16. Donner M, Mills P, Stoltz JE. Influence of plasma proteins on erythrocyte aggregation. *Clin Hemorheol.* 1989;9:715–721.
17. Maeda N, Sekiya M, Kameda K, Shiga T. Effect of immunoglobulin preparations on the aggregation of human erythrocytes. *Eur J Clin Invest.* 1986;16:184–191.
18. Baskurt O, Meiselman H. Erythrocyte aggregation: basic aspects and clinical importance. *Clin Hemorheol Microcirc.* 2013;53:23–37.
19. Koenig W, Ernst E. The possible role of hemorheology in atherothrombogenesis. *Atherosclerosis.* 1992;94(2–3):93–107.
20. Janzen J, Brooks DE. Do plasma proteins adsorb to red cells? *Clin Hemorheol.* 1989;9:695–714.
21. Skalak R, Cheng Z. Rheological Aspects of red blood cell aggregation. *Biorheology.* 1990;27:309–325.

Acceptance for editing: 2018-03-12
Acceptance for publication: 2018-03-27

Correspondence address:
Anna Marcinkowska-Gapińska
Rheological Laboratory, Department of Neurology
Poznan University of Medical Sciences, Poland
49 Przybyszewskiego Street, 60-355 Poznań, Poland
email: margap@ump.edu.pl



ORIGINAL PAPER

DOI: <https://doi.org/10.20883/jms.2018.260>

The effect of endodontic filling agents on the activity of the regeneration processes of bone tissue in the experiment

Iryna Han¹, Khristina Musij-Sementsiv², Volodymyr Zubachyk¹

¹ Department of Therapeutic Dentistry, Danylo Halytsky Lviv National Medical University, Lviv, Ukraine

² Department of the Orthodontics, Danylo Halytsky Lviv National Medical University, Lviv, Ukraine

ABSTRACT

Introduction. Highly important is to regenerate the inflammatory destructive processes of bone tissue outside the apical area of the tooth that would optimize reparative bone formation, mineralization of tooth tissues, restoration of periodontal function and stability of tooth to occlusive loads, especially with acquired extensive root apex. Low efficiency of endodontic treatment led to the searching of the new osteotropic drugs of osteoconductive action and biorevitalization to stimulate the repairing and regeneration of tissues outside the apical area and dense obturation of the apex of the tooth root.

Aim. of our research was to determine the dynamics of reparative processes in the bone tissue under the influence of drugs and compositions for endodontic treatment based on an analysis of indicators of a mineral metabolism, marker enzymes and an activity of antioxidant system and lipid peroxidation.

Material and Methods. An experiment was conducted on 120 white rats. It was created a bone defect, which was filled with studied biomaterials or left with a blood clot. From the experiment the rats were taken out on 14 and 90 day. In homogenates of bone tissue it was examined the activity of lysosomal enzymes – alkaline (ALP) and acid (AP) phosphatases and the content of microelements – calcium and phosphorus. In the blood of rats it was studied the concentration of general protein, lipid peroxidation products – malonic dialdehyde (MDA) and the enzyme activity of antioxidant system – catalase (CAT) and superoxide dismutase (SOD).

Results and Conclusions. Results of conducted experimental research of the effect of endodontic filling materials on the activity of the regeneration processes of bone tissue show that proposed compositions based on hydroxyapatite and beta-tricalcium phosphate, due to their osteoconductive and biorevitalization qualities, promote more active stimulation of bone tissue regeneration processes compared to generally accepted drugs.

Keywords: experiment, biomaterials, regeneration, alkaline phosphatase, acid phosphatase, calcium, phosphorus, malonic dialdehyde, catalase, superoxide dismutase, general protein.

Introduction

Nowadays the problem of regeneration of bone tissue and searching of methods of influence on the regeneration processes of bone is one of the actual problems of modern medicine. The essence of reparative regeneration consists in restoring the cells, tissues or organs after experiencing various pathological processes [1].

Highly important is to regenerate the inflammatory destructive processes of bone tissue outside the apical area of the tooth that would optimize reparative bone formation, mineralization of tooth tissues, restoration of periodontal function and stability of tooth to occlusive loads, especially with acquired extensive root apex [2]. Low efficiency of endodontic treatment led to the search-

ing of the new osteotropic drugs of osteoconductive action and biorevitalization to stimulate the repairing and regeneration of tissues outside the apical area and dense obturation of the apex of the tooth root [3, 4].

Aim

The aim of our research was to determine the dynamics of reparative processes in the bone tissue under the influence of drugs and compositions for endodontic treatment based on an analysis of indicators of a mineral metabolism, marker enzymes and an activity of antioxidant system and lipid peroxidation.

Material and Methods

An experiment was conducted on 120 white rats of Wistar line of herd breeding at the age of 9–10 weeks. Studies on the laboratory animals were conducted following the principles of bioethics in accordance with the European Convention for the Protection of Vertebrate Animals used for Experimental and other Scientific Purposes (Strasbourg, 1986), the Law of Ukraine № 3447-IV "On the Protection of Animals from Brutal Treatment" and were appropriately approved by the local ethics Committee. To create a bone defect intervention was performed under general anesthesia (0.5 ml of 4% solution of sodium thiopental into the peritoneum). On the left side of the lower jaw of rats it was made a trapezoid-shaped cut with a scalpel in the area between the incisor and right molar and mucous membrane was separated. It was created a bone defect of 3 mm in diameter and of 2.5 mm in depth by spherical and fissure burs under constant irrigation with saline 0.9%, which was filled with studied biomaterials or left with a blood clot and covered with mucous membrane and the stitches were put in. All animals were divided into 6 research groups and 20 individuals in each: first group – intact animals that served as a control; second comparative group – animals, on which it was created a bone defect without entering the biomaterial; third group – animals, on which it was used material Nano Gen to fill the defect; fourth group – animals on which it was entered mineral trioxide aggregate (MTA) in the created defect; fifth group – animals, whose defect was filled with the

composition based on beta-tricalcium phosphate (β -TCP); sixth group – animals, which created defect in a bone was entered with the composition made on the basis of calcium hydroxyapatite (HA) (Utility model patent number 95974, Ukraine, 2015). The animals, except the control group, were held on a bland diet on the first 3 days after the beginning of an experiment, and henceforth – on a standard diet and according to the sanitary norms in the vivarium. From the experiment the rats were taken out on 14 and 90 day by their decapitation under anesthesia. A blood sampling was provided and the bone defect area of an alveolar bone of the lower jaw of a rat was carved for the future biochemical research. In homogenates of bone tissue it was examined the activity of lysosomal enzymes – alkaline (ALP) and acid (AP) phosphatases and the content of microelements – calcium and phosphorus. In the blood of rats it was studied the concentration of general protein, lipid peroxidation products – malonic dialdehyde (MDA) and the enzyme activity of antioxidant system – catalase (CAT) and superoxide dismutase (SOD).

Results

On 14th day in the second group of animals with created bone defect without entering the biomaterial it was established that MDA had increased by 2.3 times compared to the control ($p < 0.001$) (Table 1). Similar changes in the number of MDA were observed in the third and fourth groups of animals, destruction of bone tissue of which was filled with the biomaterials MTA and Nano Gen ($p < 0.001$). In the fifth and sixth groups of animals where were used compositions based on β -TCP and HA it was marked an increase in MDA – by 2 and 1.9 times, respectively ($p < 0.001$). At the same time changes were observed in the enzyme activity of an antioxidant system. Thus, in the second group of animals the concentration of SOD and catalase was decreased only by 1.6 time ($p < 0.001$) and in the third and fourth groups of animals the enzyme activity was decreased by 1.47 and 1.5 time, respectively ($p < 0.001$). In the fifth and sixth research groups it was marked a reduction of SOD and catalase only by 1.25 and 1.21 time respectively compared to intact animals ($p < 0.001$). The imbalance in the system POL/AOS caused the reduction of antioxidant-proox-

Table 1. Indicators of POL products, AOS enzymes and general protein concentration in serum of rats' blood on 14 day (M ± m)

Groups of animals Experimental drugs	MDA kmol/L	SOD mkat/L	Catalase mkat/L	API	General protein g/L
I. Control (n = 10)	2,35 ± 0.03	7,46 ± 0,27	0,263 ± 0.012	3,29	71,6 ± 01,2
II. Comparison group (n = 10)	5,43 ± 0.06 ***°°	4,68 ± 0,22 ***°°	0,164 ± 0.003 ***°°	0,89	100,3 ± 1,6 ***°°
III. Nano Gen (n = 10)	5,38 ± 0.05 ***	4,97 ± 0,14 ***	0,175 ± 0.003 ***°	0,95	95,0 ± 1,3 ***°
IV. MTA (n = 10)	5,35 ± 0.06 ***	5,08 ± 0,16 ***	0,178 ± 0.003 ***°	0,98	93,5 ± 1,1 ***°
V. Composition based on β-TCP (n = 10)	4,63 ± 0.04 ***°°	5,98 ± 0,21 ***°°	0,212 ± 0.003 ***°°	1,34	86,3 ± 1,5 ***°°
VI. Composition based on HA (n = 10)	4,48 ± 0.06 ***°°	6,17 ± 0,19 ***°°	0,217 ± 0, 003 ***°°	1,43	84,6 ± 1,3 ***°°

Note: ° – an indicator of the likelihood difference compared to a control at $p < 0.01$, *** – $p < 0.001$; ° – indicator of the likelihood difference compared to the comparison group at $p < 0.05$, °° – $p < 0.01$, °°° – $p < 0.001$.

identant index (API) [5]. Thus, in the second group of experimental animals API decreased by 73%, and in the third and fourth groups – by 71% and 70%, respectively ($p < 0.001$). In the fifth and sixth study groups API index has decreased by only 59% and 56% respectively compared to the intact animals ($p < 0.001$).

At the same time it was detected an increase of the concentration of the general protein in the second group of animals by 1.4 times compared to the intact animals ($p < 0.001$), and in the third and fourth groups of animals – by 1.3 times compared to the control group ($p < 0.001$). In the fifth and sixth research groups the concentration of the general protein was increased by 1.2 compared to the intact group ($p < 0.001$).

CF is a biomarker of the bone tissue, which characterizes the activity of osteoclasts and the intensity of osteolysis [6, 7]. In the second, third and fourth groups of the animals it was observed an increase in the lysosomal enzyme AP by 1.5 times compared to indicators in the intact bone ($p < 0.001$) (Table 2). However, in the fifth and sixth research groups content of AP grew up only by 1.2 and 1.3 time, respectively ($p < 0.001$). Simultaneously, changes of the content and the other biomarker of bone fabric – ALP were observed in

the second group of animals the enzyme activity increased by 1.25 time ($p < 0.001$), and in the third and fourth groups of animals – by 1.3 times compared to the control group of animals ($p < 0.001$). In the fifth and sixth research groups ALP concentrations increased by 1.9 time compared to the intact bone ($p < 0.001$). Activity of processes of osteogenesis and osteolysis during the bone regeneration characterizes the index of mineralization, which is defined by ALP / AP. In the second, third and fourth groups of animals the index decreased by 18%, 16% and 14% respectively compared to the intact animals. However, in the fifth and sixth groups of animals it was observed an increase in the index by 44% and 47% respectively, demonstrating a prevalence of bone regenerative processes of osteogenesis over destruction of tissues.

On 14th day of study calcium content in the second and third groups of animals decreased by 1.8 time, in the fourth – by 1.6 time, in the fifth – by 1.5 time and in the sixth – by 1.3 time compared to indicators of the control group ($p < 0.001$) (Table 3). Simultaneously, it was observed a reduction of content of phosphorus ions in the second, third and fourth groups of animals by 1.8; 1.7 and 1.5 time, respectively, in the fifth group –

Table 2. Indicators of ALP mkat/L and AP mkat/L activity in homogenates of rats' bone tissue (M ± m)

Groups of animals Experimental drugs	Terms of observation					
	14 day			90 day		
	AP	ALP	ALP/AP	AP	ALP	ALP/AP
I. Control (n = 5)	1,58 ± 0.02	20,2 ± 0,3	12,8	1,58 ± 0.02	20,2 ± 0,3	12,8
II. Comparison group (n = 10)	2,41 ± 0.02 ***	25,3 ± 0,3 ***	10,5	1,69 ± 0.03 **	21,1 ± 0,3 °	12,5
III. Nano Gen (n = 10)	2,39 ± 0.01 ***	25,8 ± 0,2 ***°	10,8	1,65 ± 0.03	20,6 ± 0,3	12,5
IV. MTA (n = 10)	2,38 ± 0.02 ***	26,2 ± 0,3 ***°	11,0	1,64 ± 0.03	21,3 ± 0,3 **	13,0
V. Composition based on β-TCP (n = 10)	1,98 ± 0.03 ***°°	36,6 ± 0,2 ***°°	18,5	1,61 ± 0.03 °	22,7 ± 0,4 ***°°	14,1
VI. Composition based on HA (n = 10)	1,97 ± 0.03 ***°°	37,2 ± 0,4 ***°°	18,9	1,60 ± 0.02 °°	23,1 ± 0,3 ***°°	14,5

Note: ° – an indicator of the likelihood difference compared to a control at $p < 0.05$, ** – $p < 0.01$, *** – $p < 0.001$; ° – indicator of the likelihood difference compared to the comparison group at $p < 0.05$, °° – $p < 0.01$, °°° – $p < 0.001$.

Table 3. Indicators of calcium mmol/L and phosphorus mmol/L content in homogenates of rats' bone tissue (M ± m)

Groups of animals	Terms of observation					
	14 day			90 day		
	Calcium	Phosphorus	Calcium/ Phosphorus	Calcium	Phosphorus	Calcium/ Phosphorus
I. Control (n = 5)	13,31 ± 0,11	5,70 ± 0,13	2,33	13,31 ± 0,11	5,70 ± 0,13	2,33
II. Comparison group (n = 10)	7,14 ± 0,07 ***	3,13 ± 0,11 ***	2,28	8,02 ± 0,13 ***	3,81 ± 0,12 ***	2,11
III. Nano Gen (n = 10)	7,29 ± 0,09 ***	3,20 ± 0,11 ****°	2,28	8,19 ± 0,11 ***	3,88 ± 0,12 ***	2,11
IV. MTA (n = 10)	8,27 ± 0,13 ****°	3,61 ± 0,09 ****°	2,29	10,01 ± 0,12 ****°	4,57 ± 0,10 ****°	2,19
V. Composition based on β-TCP (n = 10)	8,85 ± 0,09 ****°	3,85 ± 0,09 ****°	2,30	11,43 ± 0,14 ****°	4,99 ± 0,10 ****°	2,29
VI. Composition based on HA (n = 10)	9,82 ± 0,12 ****°	4,27 ± 0,11 ****°	2,30	11,76 ± 0,14 ****°	5,09 ± 0,13 ****°	2,31

Note: * – an indicator of the likelihood difference compared to a control at $p < 0.05$, ** – $p < 0.01$, *** – $p < 0.001$; ° – indicator of the likelihood difference compared to the comparison group at $p < 0.05$, °° – $p < 0.01$, °°° – $p < 0.001$.

by 1.4 time, and in the sixth experimental group – by 1.3 time compared to indicators of the control group ($p < 0.001$). Decrease of index of calcium and phosphorus correlation points to calcium deficiency compared to phosphorus.

On 90th day after modeling the destruction it is observed an increase in the concentration of MDA in the second group of animals by 1.45 time compared to control ($p < 0.001$), in the third and fourth groups of animals – in 1.3 time ($p < 0.001$) and in the fifth and sixth experimental groups it is noticed the returning of indicators of processes of lipid peroxidation to those of the control group (**Table 4**). Simultaneously, the positive dynamics is observed in the functioning of the antioxidant system. The activity of catalase and SOD in all experimental groups approached to standard indicators, although SOD concentration in the second group of experimental animals has not reached the control indicators and was lower by 1.1 time ($p < 0.04$). In addition, to indicators of the control group approached the indicator of general protein concentration, except the one of the second group of experimental animals, where its content remained increased by 1.2 time compared to the control group of animals ($p < 0.001$).

Positive dynamics was also observed in the indicators of biomarkers of bone tissue. The concentration of the enzyme ALP in the second group of animals has increased by 1.2 time ($p < 0.04$), and in the third and fourth groups of animals – by 1.1 time compared to the control group of animals ($p < 0.02$ and $p < 0.3$ respectively). Simul-

taneously, the content of lysosomal enzyme AP remained increased – in the second group of animals by 1.2 time ($p < 0.01$), while in the third and fourth groups of animals – in 1.1 time compared to indicators in the intact bone ($p < 0.1$) (**Table 2**). In the fifth and sixth research groups alkaline the content of enzymes ALP and AP closed to indicators of the control group. This shows an absence of inflammation in the bone tissue and reconstruction of balance processes of osteogenesis and osteolysis.

The content of calcium ions remains below normal in the second and third groups by 1.6 time, in the fourth group – by 1.3 time and in the fifth and sixth research groups – within the indicators of the control group. A content of phosphorus ions is below normal in the second and third groups of animals by 1.5 time, in the fourth group – by 1.3 time, and in the fifth and sixth research groups – by 1.1 time compared to indicators of the control group (**Table 3**).

Discussion

Analysis of various scientific studies indicates that the speed and quality of regeneration of bone tissue destruction outside the apex depend on the use of endodontic filling materials that are used to stimulate and accelerate the process of osteo-regeneration [8, 9].

The goal of our research was to evaluate the influence of endodontic filling agents on the activity of bone regeneration processes by ana-

Table 4. Indicators of POL products, AOS enzymes and general protein concentration in serum of rats' blood on 90 day (M±m)

Groups of animals Experimental drugs	MDA kmol/L	SOD mkat/L	Catalase mkat/L	API	General protein g/L
I. Control (n = 10)	2,35 ± 0,03	7,46 ± 0,27	0,263 ± 0,012	3,29	71,6 ± 1,2
II. Comparison group (n = 10)	3,41 ± 0,04 ****°°	6,67 ± 0,21 °°	0,246 ± 0,009	2,03	85,1 ± 1,1 ****°°°
III. Nano Gen (n = 10)	3,11 ± 0,04 ****°°	6,85 ± 0,14	0,248 ± 0,01	2,28	74,8 ± 1,3 °°°
IV. MTA (n = 10)	2,98 ± 0,04 ****°°	6,9 ± 0,12	0,252 ± 0,011	2,4	74,5 ± 1,2 °°°
V. Composition based on β-TCP (n = 10)	2,41 ± 0,02 °°°	7,51 ± 0,22 °	0,257 ± 0,013	3,22	72,8 ± 1,2 °°°
VI. Composition based on HA (n = 10)	2,39 ± 0,02 °°°	7,6 ± 0,26 °	0,269 ± 0,013	3,29	72,4 ± 1,0 °°°

Note: ° – an indicator of the likelihood difference compared to a control at $p < 0.05$, **** – $p < 0.001$; ° – indicator of the likelihood difference compared to the comparison group at $p < 0.05$, °°° – $p < 0.001$.

lyzing the indicators of mineral metabolism, marker enzymes and the activity of antioxidant system and lipid peroxidation.

We found that destruction of bone tissue is accompanied by excessive activation of processes POL and essential decrease of the expression of enzymes AOS in the bone as well as in the blood that is indicated by the growth of MDA content and the decrease of SOD concentration and catalase. Since POL is considered to be one of the basic mechanisms of cell membrane structures damage, the prevalence of lipid peroxidation processes and the relative lack of antioxidant system enzymes cause damage of cell membranes with further interruption of their functions [10]. Similar results were observed in the works of other authors who evaluated these indicators when the bone tissue was damaged. Thus, O.V. Denga found that trepanation of the tooth and its infection leads to the increase of MDA level and the decrease of activity of one of the major antioxidant enzymes of catalase [11], V.H. Fedirko showed that polytrauma in case of osteoporosis caused the increase in the level of POL, the decrease of activity of SOD and catalase in the bone tissue [12], O.V. Lubchenko found that the course of experimental periodontitis is accompanied by excessive inflammation due to the increase of lipid peroxidation level and the decrease of antioxidant protection [13].

The increase of AP concentrations in our study indicates on the higher activity of osteoclasts and shows an acuter course of the inflammatory process. However, a higher concentration of ALP in bone tissue homogenate confirms the increase of the number of osteoblasts and their functional activity that promotes more intense bone formation in the area of bone tissue destruction. The analysis of our results veri-

fies that the increase of concentrations of bone tissue biomarkers – AP and ALP is accompanied with the decrease of mineralization index that is defined by ALP/AP correlation and describes the activity of osteogenesis and osteolysis processes. We have detected reduction of index of calcium and phosphorus correlation that points on calcium deficiency compared to phosphorus. Similar results were observed in the works of S.I. Palamarchuk and A.V. Borisenko that showed an increase of enzymes AP and ALP activity and a reduction of the of calcium soluble protein concentration [14, 15].

Applying of drugs Nano Gen, MTA and proposed compositions based on β-TCP and HA for medical purpose, processes of osteogenesis occurred with different intensity. The most expressed positive trend was observed by application of the proposed compositions whose compound included a means for revitalization and bioreparation, containing hyaluronic acid, modified by vitamin C and by amino acids – proline, lysine and glycine. This led fibroblasts to synthesize proteins of intercellular matrix – procollagen and collagen and stimulated tissue regeneration. Similar results were observed in experimental studies of Jung-ju Kim and co-authors who studied the regeneration of created bone tissue defect, which was filled with hyaluronic acid in combination with collagenous sponge and demonstrated osteoinductive effect and stimulated bone tissue reparative processes in the area of the defect [16].

Applying the compositions, the most expressed positive dynamics is confirmed by balancing of POL and AOS, activity of mineralization processes in the area of the bone defect and also returning of general protein concentration to indicators of the comparison group. Applying drugs Nano Gen

and MTA, processes of osteogenesis proceeded more slowly, imbalance remained between POL and AOS and a slight increase in general protein concentration was observed.

Therefore, we found that the proposed compositions have antioxidant and noticeable osteotropic qualities and better stimulate the regeneration processes of bone tissue.

Conclusions

1. In case of experimental bone destruction, it is observed an imbalance between AOS and POL with a predominance of lipid peroxidation processes that leads to progress of inflammation as well as to violation of bone tissue mineralization and is confirmed by appropriate results of biochemical research both in serum of blood and in the bone tissue.
2. In the groups of animals, where the compositions based on hydroxyapatite and β -tricalcium phosphate were used, compared to groups of animals, where generally accepted drugs were used, it was observed less noticeable violations in the system POL / AOS. This stimulated a decrease of inflammatory activity and an earlier restoration of osteogenesis and osteolysis balance and accelerated calcification processes.
3. The proposed compositions, due to their osteoconductive and biorevitalization qualities, promote more active stimulation of bone tissue regeneration processes compared to generally accepted drugs.

Summary

The article presents a comparative assessment of the dynamics of the reparative process of the bone tissue under the influence of drugs MTA and Nano Gen and compositions based on beta-tricalcium phosphate and calcium hydroxyapatite, containing organic biorevitalizants, by analyzing the indicators of mineral metabolism, marker enzymes and activity of antioxidant system and lipid peroxidation. The experiment was conducted on 120 white rats, on which was made a bone tissue defect filled with investigative biomaterials. From the experiment animals were withdrawn on 15 and 90 days by decapitation under anesthesia. A blood sampling was provided and the

bone defect area of the alveolar bone of the lower jaw of a rat was carved for the future biochemical research. In homogenates of bone tissue it was investigated an activity of lysosomal enzymes – alkaline and acid phosphatase, content of calcium and phosphorus. It was explored a concentration of general protein, lipid peroxidation products – malonic dialdehyde (MDA) and the enzyme activity of antioxidant system – catalase and superoxide dismutase (SOD) in the blood of rats. The most expressed positive dynamics was observed by applying the proposed compositions that characterizes a balance of POL and AOS processes, returning of indicators of general protein concentration to indicators of the comparison group and activity of mineralization processes in the area of the bone defect.

Acknowledgements

Conflict of interest statement

The authors declare no conflict of interest.

Funding sources

There are no sources of funding to declare.

References

1. Bumeyster VI, Pogorelov MV. A modern view on reparative osteogenesis. *The world of medicine and biology*. 2008;4:104–110.
2. Mytchenok OV, Lazar AD, Zhytaryuk LV. A modern view on conservative surgical treatment method of chronic periodontitis. *Ukrainian Dental Almanac*. 2013;2:94–97.
3. Zubachyk VM, Han IV. Comparative evaluation of osteotropic action of endodontic filling materials on the model of experimental destruction of rats' jaw bone tissue. *Ukrainian Dental Almanac*. 2016;1(2):12–16.
4. Pilyayev AH, Yurovska IO, Kosareva LI. A study of the probability of a successful result of chronic periodontitis treatment in teeth with a destroyed apical aperture. *Collection of Articles*. 2013;17;1:313–315.
5. Dvulit IP. Reasoning of an impact of mouthwashes based on bioflavonoids of citrus on condition of antioxidant-prooxidant systems of gums and blood serum of rats with experimental periodontitis. *Achievements of Clinical and Experimental Medicine*. 2015;1:51–53.
6. Rublenko MV, Semenyak SA, Ulyanchych NV. The dynamics of reparative osteogenesis biomarkers in case of a bone defect substitution. *Scientific Journal LNUVMBT named after SZ. Gzhytsky*. 2014. 16;3(60):278–294.
7. Lysenko OS, Levitsky AP, Borisenko AV. Osteostimulating activity of osteotropic compositions on the basis of nanostructured bioceramics. *Journal of Dentistry*. 2014;1:2–8.
8. Luzin VI, Ivchenko VK, Ivchenko AV. Chemical composition features of the regenerate of metadiaphy-

- seal defects filled with materials based on biogenic hydroxyapatite. *Ortopedia, Traumatologia, Rehabilitacja*. 2005;7(1):69.
9. Sculean A, Nikolidakis D, Nikou G, Ivanovic A, Chapple IL, Stavropoulos A. Biomaterials for promoting periodontal regeneration in human intrabony defects: a systematic review. *Periodontol 2000*. 2015 Jun;68(1):182–216.
 10. Panasiuk MT, Tymochko MF. The value of lipid peroxidation in normal and in case of adaptation to experimental influences. *Experimental and Clinical Physiology and Biochemistry*. 1997;2:92–100.
 11. Denga OV, Tsevuh DB, Levitsky AP. Biochemical indicators of tissues around teeth in experimental periodontitis therapy. *Journal of Dentistry*. 2007;4:40–45.
 12. Fedirko HV. The dynamics of indicators of lipid peroxidation and antioxidant protection of bone tissue in animals with hypokinetic osteoporosis and poly-injury. *Journal of Problems of Biology and Medicine*. 2013;1(98):156–158.
 13. Lubchenko OV. Comparative evaluation of anti-inflammatory and antioxidant properties of filling cements "Retapeks" and "Pro Root MTA" on the model of experimental periodontitis. *Journal of Dentistry*. 2011;2:5–9.
 14. Palamarchuk SI, Borisenko AV. Osteostimulating composition for regeneration of alveolar bone in the experiment. *Journal of Dentistry*. 2012;2:10–15.
 15. Sousa C, Abreu H, Viegas. Serum total and bone alkaline phosphatase and tartrate-resistant acid phosphatase activities for the assessment of bone fracture healing in dogs. *Arq Bras Med Vet Zootec*. 2011;63:1007–1011.
 16. Jung-ju Kim, Hyun Young Song, Heithem Ben Amara, Kang Kyung-Rimt & Ki-Tae Koo. Hyaluronic Acid Improves Bone Formation in Extraction Sockets With Chronic Pathology: A Pilot Study in Dogs. *Journal of Periodontology*. Jul. 2016;87(7):790–795.

Acceptance for editing: 2018-03-12
Acceptance for publication: 2018-03-27

Correspondence address:

Iryna Han
Department of Therapeutic Dentistry
Danylo Halytsky Lviv National Medical University
69 Pekarska Street, 79010 Lviv, Ukraine
phone: +380676733304
email: irynagan@gmail.com



ORIGINAL PAPER

DOI: <https://doi.org/10.20883/jms.2017.271>

The Greatest Man in the World. The life and ethics of Albert Schweitzer in the eyes of students pursuing medical and legal degrees

Marcin Cybulski¹, Wojciech Strzelecki¹, Paweł Chmielowski², Bogusław Stelcer^{1,3}, Bartosz Bilski⁴, Maria Grzymisławska-Cybulska^{5,6}

¹ Department of Clinical Psychology, Poznan University of Medical Sciences, Poland

² Institute for Social and Market Research TriC, Poland

³ Institute of Human Nutrition and Dietetics, Poznan University of Life Science, Poland

⁴ Department of Preventive Medicine, Poznan University of Medical Sciences, Poland

⁵ Provincial Administrative Court in Poznan, Poland

⁶ The Law Institute, SWPS University of Social Sciences and Humanities, Poland

ABSTRACT

Introduction. Albert Schweitzer (1875–1965) was an Alsatian doctor, philosopher-ethicist, theologian, Lutheran pastor and musician-organ player and musicologist. In 1913 he started his medical practice in Lambaréné (Gabon) in which he built from scratch his greatest legacy – The Albert Schweitzer Hospital. Due to an involvement of doctors and nursing staff from all over the world this hospital has been functioning and developing to this day. In 1952 he was awarded the Nobel Peace Prize for his engagement into the promotion of peace, disarmament and the prevention of imperial arms race. Currently, his spiritual and scientific legacy constitutes an element of biophilic angle in academic curricula at all levels of education also in medical sciences mainly in the United States and Western Europe.

Material and Methods. The research is based on a questionnaire evaluating the level of awareness of Albert Schweitzer's person, his legacy and concepts. The survey was completed by 53 law students of the SWPS University of Social Sciences and Humanities in Poznan and 435 medical studies students of the University of Medical Sciences in Poznań. The respondents did the following various studies: medicine, dentistry, pharmacy, obstetrics, paramedicine, dietetics, optometry, physiotherapy and occupational therapy.

Results. Only 5.5% (n27) of the students from both Universities know about Albert Schweitzer and his works. Albert Schweitzer is not perceived as a medical doctor, entrepreneur-philanthropist, Lutheran pastor, political activist, musician, musicologist and the winner of the Nobel Peace Prize. Not many people have heard about the Reverence for Life (19%, n93), however, they recognise Albert Schweitzer's connection to philosophy and ethics.

Conclusions. Despite the Albert Schweitzer's presence in the Polish bioethical debate and his popularity in the 60s to the 80s, today he becomes obsolete. Even at the university level education in the areas of science in which morality and ethics provide basic professional principles – an unaided recall of his name and works among young people is rare.

Keywords: Albert Schweitzer, ethics, bioethics, medical education, legal education.

Introduction

Albert Schweitzer (1875–1965) was an Alsatian theologian and Lutheran pastor. Regardless his theological education, he was also interested in

philosophy and music. He was awarded a doctorate in philosophy and later was qualified as an assistant professor in theology [a post doctorate degree awarded in many European countries] [1].

However, at the same time he was developing academically in the field of musicology. His research on the life and work of Johann Sebastian Bach (1908) is still one of the most complete sources of knowledge on the Bach's music [2]. Schweitzer was also a practicing musician (he learnt how to play organ under the watchful eyes of Eugène Munch and Charles-Marie Widor) [3]. His experience with philosophy, theology and musicology made him change the direction of personal development and at the beginning of the 20th century he began to study medicine and in the end he got a PhD qualification in this field. In 1913, in Lambaréné (Gabon, Africa), he and his wife, Helene Bresslau, founded a hospital for local communities [4]. The project was financed by private funds as well as public donations. The Albert Schweitzer Hospital still exists and is one of the better-equipped medical and research facilities in Africa which hosts specialists from all over the world – also doctors and nurses from Poland. Similar medical centres were created in Haiti and Mexico [5].

In the last period of his life Schweitzer took up music and philanthropy. Moreover, he worked on the principles of the reverence for life idea (*veneratio vitae*) which encapsulates respect for all forms of life and can be summed up by the quote "I am life that wills to live in the midst of life that wills to live" [6]. It stipulates that from recognising and understanding the will of life becomes an obligation to respect and cherish it. Sustaining and supporting life is good while destroying or harming it is bad. Among many well-known quotes there is a particular one which gained a lot of recognition *Das Glück ist das einzige, was sich verdoppelt, wenn man es teilt*. In 1952 Albert Schweitzer was awarded the Nobel Peace Prize for his engagement into promotion of peace, disarmament and the prevention of imperial arms race [7]. In his social and peace activities he cooperated with such famous people as: Albert Einstein and Bertrand Russell. Today, his work and ideas are still present in many countries' educational curricula – mainly in Lutheran ones. There is also a wider following of the Schweitzer's ideas in the United States, Germany, Japan and France [8]. In the beginning of 21st century Albert Schweitzer is a highly recognised personality not exclusively in the fields of medicine and science. In Poland it is prof. dr hab. n. med. Henryk Gaertner from Cracow who spreads the Schweitzer's ideas [9, 10]. Another centre whose mission is to make those ideas popular is the Pol-

ish Albert Schweitzer's Society in Poznan which is driven by the engagement of the scientists of the Poznan University of Medical Sciences [11].

Material and Methods

The research is based on our own survey, created just for the purpose of this study in which we assessed the awareness level of Albert Schweitzer, his work and ideas. The questionnaire included 5 questions. The participation in the study was anonymous and voluntary. The time for the questions was unlimited. The interviewees did not use any external sources of information. The survey was completed by 53 law students (out of the total of 160) at the SWPS University of Social Sciences and Humanities in Poznań, Poland and 435 students (out of the total of 4972) at the University of Medical Sciences in Poznań, Poland. The respondents did the following various studies: medicine (n69), dentistry (n76), pharmacy (n61), obstetrics (n63), paramedicine (n45), dietetics (n52), optometry (n21), physiotherapy (n23) and occupational therapy (n25). The respondents' average age was 21 and it ranged from 18–24. There were 358 women (73%) and 130 men (27%) in the researched group.

Results

They were first asked if they had ever heard about Albert Schweitzer. Only 5.5% of the students from both Universities knew about Albert Schweitzer and his works. Among the younger respondents (under 21 year old, the median) fewer people knew about Albert Schweitzer (5.0%) than in the older group (6.3%), however those differences are not big nor statistically significant. Neither of the fields of studies seemed to have significant impact on their answers. Among the law and medicine students, 5.7% and 5.5% respectively, recognized the name of Albert Schweitzer.

Next, the study participants were asked who Albert Schweitzer was and to describe with different levels of probability (from 1 to 6 where 1 meant – the least probable and 6 – the most) whether he did any of the things listed in the questionnaire. The most participants claimed he was an ethicist and a philosopher (an average of 4.12 out of 6) and a doctor working in Gabon (an average of 3.21). The fewest people knew that he was

a musician and musicologist (an average of 2.12). Not all the answers given in this questionnaire were correct as the researchers wanted to check the students' knowledge of the activities which Albert Schweitzer did not actually do. A detailed breakdown of the results is presented in **Table 1**.

One factor did not matter in perceiving Schweitzer's role – the respondents age. Among the answers who Schweitzer might have been there were no statistically significant discrepancies between the under 21 age group and the older one.

However, there were statistically significant differences relating to the University in which the respondents studied. Those differences were noticeable in the answers "pastor" (the average amounted to 2.30 for the law students while for the medicine students it was 2.76, $p = 0.13$ $df = 486$) as well as for "doctor working in Gabon" (the average 2.62 for the law students and 3.28

for the medicine, $p = 0.38$ $df = 486$). A detailed breakdown is presented in **Table 2**.

Not many interviewers have heard about Schweitzer's Reverence for Life Ethics, only one respondent out of five (19.1%). When considering the respondents' age, the awareness of Reverence for Life ethics was not statistically significant. In the younger group it was 16.4% and 23.3% of the in the older one. There were no significant differences regarding the respondents' field of study. Among the law students and the medicine students it was 22.6% and 18.6% respectively.

However, when describing what the Reverence for Life Ethics meant, the majority of the respondents gave correct answer – they said it had been a set of ethical values on the respect for life (average value of 4.48 out of 6). It is quite surprising that many respondents, a large part of them studying medicine, answered this question by marking that

Table 1. Who was Albert Schweitzer? (from 1 to 6 where 1 meant the least probable and 6 – the most)

Assess with some level of probability that Albert Schweitzer was:	Average
Pastor	2.71
Politician and social movements leader:	2.73
Entrepreneur-philanthropist	2.67
Albert Einstein's friends and Bertrand Russell's co-worker	2.65
Doctor working in Gabon	3.21
Ethicist and philosopher	4.12
Church history researcher	2.59
Musician and musicologist	2.12
Nobel Peace Prize winner	2.67

Table 2. "Who was Albert Schweitzer?" – with regard to the respondents' field of study

Albert Schweitzer was:	Field of study	N	Average
Pastor	Law	53	2.30 ^a
	Medicine	435	2.76 ^a
Politician and social movements leader	Law	53	2.68
	Medicine	435	2.74
Entrepreneur-philanthropist	Law	53	2.40
	Medicine	435	2.71
Albert Einstein's friend and Bertrand Russell's co-worker	Law	53	2.30
	Medicine	435	2.69
Doctor working in Gabon	Law	53	2.62 ^b
	Medicine	435	3.28 ^b
Ethicist and philosopher	Law	53	4.26
	Medicine	435	4.11
Church history researcher	Law	53	2.68
	Medicine	435	2.58
Musician and musicologist	Law	53	1.98
	Medicine	435	2.13
Nobel Peace Prize winner	Law	53	2.87
	Medicine	435	2.64

a – t student $p = 0.13$ $df = 486$; b – t student $p = 0.38$ $df = 486$

it was a part of the Doctor's Oath, an element of the old Hippocratic Oath (3.55). A detailed breakdown of the answers distribution is shown in **Table 3**.

Regarding this question, the field of studies did not play statistically significant role. However, there were some major differences, connected with the respondents' age, in answers to two questions: *one of the parts of the Doctor's Oath, an element of the old Hippocratic Oath* (average of 3.68 for 21 and under, 3.34 for over 21 respondents, $p = 0.12$ $df = 486$) and *a set of ethical principles on the Respect for Life* (average of 4.35 for 21 and under and 4.68 for over 21, $p = 0.02$

Goetting in his foreword to the book about Albert Schweitzer *Begegnungen mit Albert Schweitzer* wrote: "There are not many people who, just like Albert Schweitzer, were ahead of their time by influencing the way of thinking and life of the people around them by means such as: word, activity and example. That is why we believe he is one of the greatest humanist of all times [11]".

The analysis of literature points out to the extraordinariness of Schweitzer, being the reason for his popularity – his works were translated into at least 20 languages [4], his ideas were adopted by curricula in many countries (e.g. Japan, Turkey or Korea) [10] whilst in research conducted in Europe in the 1950's, young people were asked

Table 3. What is the Reverence for Life Ethics? from 1 to 6 where 1 meant the least probable and 6 – the most)

The Reverence for Life Ethics is:	Average
One of the part of the Doctor's Oath (an element of the old Hippocratic Oath)	3.55
A book's title	3.24
A set of ethical principles on the respect for life	4.48
A set of lectures given by world peace activists (e.g. Bertrand Russell, Albert Einstein, Albert Schweitzer)	3.14

Table 4. "What is the Reverence for Life Ethics?" – taking into account the respondents' age.

The Reverence for Life Ethics is:	Age median	N	Average
One of the part of the Doctor's Oath (an element of the old Hippocratic Oath)	≤ 21	298	3.68 ^a
	> 21	190	3.34 ^a
A book's title	≤ 21	298	3.30
	> 21	190	3.16
A set of ethical principles on the respect for life	≤ 21	298	4.35 ^a
	> 21	190	4.68 ^a
A set of lectures given by world peace activists (e.g. Bertrand Russell, Albert Einstein, Albert Schweitzer)	≤ 21	298	3.09
	> 21	190	3.21

a – t Student, $p = 0.12$ $df = 486$; b – t Student, $p = 0.02$ $df = 486$

$df = 486$). A detailed breakdown of the answers distribution is shown in **Table 4**.

Discussion

The low level of knowledge of Albert Schweitzer among the researched students of those branches may seem quite surprising due to his presence in multiple domains of science and art. It was difficult to characterize, describe or somehow classify him. A wide variety of his activities slips away the one-dimensional pattern of thinking. It is not easy to get a complete knowledge of a person who was at the same time a musician, doctor, philosopher and theologian, and when needed, also an architect and carpenter. He was also described as a peace activist, caretaker and writer. Gerald

who their ideal modern hero was and it was Albert Schweitzer who appeared to be the first [4]. He is one of a few people with a wide moral recognition that in a two-piece book there were almost a 100 authors representing different continents, views and political ideas paying tribute to Albert Schweitzer [4, 12, 13]. However, it is a fact that the popularity of the doctor from Lambaréné and the interest in his person have decreased significantly. It is partly contributed to the fact that his values may seem too traditional for the young generation [4] as well as his language might not be communicative to the youth. It might be also owing to an anxiety, when meeting such an ethics role-model, caused by obvious comparisons.

One might assume that in Western Europe the awareness of this person is higher due to his

presence in public life. In those countries there are many schools (excluding universities, colleges and institutes) which have Albert Schweitzer as their patron: in Germany – 19, France – 7, the Netherlands – 5, the USA – 3 [14]. The data is incomplete, however, even the above-mentioned numbers would cause a higher level of awareness of Albert Schweitzer. In Poland there is one school: *Gimnazjum i Liceum Ogólnokształcące Ewangelickiego Towarzystwa Edukacyjnego im. Alberta Schweitzera* [Albert Schweitzer Junior High and High Schools curated by the Lutheran Education Association] in Gliwice. Many research and academic institutions in the world use Albert Schweitzer's name and promote his works: the Albert Schweitzer Institute of Chapman University (California, the USA), the Albert Schweitzer Institute of Quinnipiac University (Connecticut, the USA), the Albert Schweitzer International University (Madrid, Spain) with its branches in Switzerland and Argentina and Association Internationale pour l'Oeuvre du Docteur Albert Schweitzer de Lambaréné (AISL) – widely known as the International Schweitzer Foundation.

The low awareness of Albert Schweitzer in Poland is mostly contributed to the history of the country and this person's life story. Henryk Gaertner, who contributed the most to spread Schweitzer's ideas in Poland, believes that "Poland's distance from Lambaréné, long-term and multiple socioeconomic difficulties of the post-war period in our country, and also Schweitzer's turbulent story, as well as (...) many obstacles in West-East relationships did not create good grounds (...) for free dissemination and deeper understanding of his ideas and works [in Poland]" [10].

The question "Who was Albert Schweitzer", given in the questionnaire, was quite a challenge for the respondents as they were unlikely to be sure what type of activities were linked with this name. Even more, to give a correct answer, one would require references to many fields and domains he contributed to. On the one hand, it might be surprising but on the other, also researchers and scientists sometimes find it difficult, not to answer who he was, but rather to describe who he predominantly was. Alfons Skowronek refers to this discussion as follows: "Ten years ago, in 1975, in Warsaw an intradisciplinary symposium was organised to celebrate the 100th anniversary of Albert Schweitzer's birth. During the con-

ference I had an opportunity to present my work on Albert Schweitzer as a theologian. I claimed that (...) he was in fact mainly a great theologian. However, a lively discussion (...) informed me that Schweitzer was predominantly the greatest and most current social ethicist. Another participant to this discussion pointed out that he was (...) mainly an extraordinary peace activist. Some philosophers were proponents of the view that he was a philosopher and writer above all other qualities. Then a person dealing with medicine named Schweitzer an exemplary doctor with a true calling. Lastly, there was a musicologist who defended the opinion that for music passionates Schweitzer is only associated with studies of Bach and perfect organs' mastery" [15].

In today's world Schweitzer ideas seem to be very relevant and valuable not only in medicine, but also in philosophy. Zbigniew Filar believes that "it is a challenge to the medicine of our times, and as such so often accused of losing its great humanistic ideas and going towards the soulless technology" [10].

The humanity in our geopolitical situation needs Schweitzer's ideas. As his concern of the human race was expressed in his speeches on peace and the crisis of culture, rooted, according to Schweitzer, in thoughtless technological advancements [16]. He believed that those advancements should be accompanied by ethical development of humanity as the lack of it may cause the main ideas of humanism to perish. He was convinced that the renaissance of culture is only possible when a person is appreciated as a thinking being, functioning in society as a sensitive moral subject [17]. Among three areas of progress that he enumerated: development of knowledge, skills and spirit – the last one was considered to be the most important for him [16, 18]. He was concerned about human race and wrote, referring to the spiritual and ethical state of modern societies: "On many occasions I had to conclude that the public opinion does not reject openly-expressed de-humanising ideas, but instead, it tolerates them and de-humanised policy of states and nations is applauded as effective" [3]. Those fears seem to be worryingly and dangerously relevant today. Progress, and the knowledge that comes along with it, detached from the ethical development is, according to Schweitzer, not useful in life and lacks deeper meaning [19].

Looking at Schweitzer's ideas from an anthropological angle, it may point us to some important issues: Firstly, they show well how a group of individual subjects comes together as a population defined by cultural features. Secondly, it helps to understand the purpose of his ideas and activities in light of the theory of culture. Thirdly, what seems to be the most important (in the context of the current multilayered crisis), it helps to understand the significance of culture's constructs for the future and sustainable growth of the modern societies. It is all possible mainly due to the consistency and universal applications of Schweitzer's ideas [20].

Conclusions

The awareness of Albert Schweitzer and his works in Poland, despite some educational efforts, is very low also among the students doing various medical degree, who should be guided by his biophilic principles in their professional lives. The current situation is related to Poland's historical and religious and cultural backgrounds. Although the ideas of Albert Schweitzer are quite popular in the countries influenced strongly by the Lutheran religion, as well as they are present in curricula in schools and also in pop-culture, the Polish reality is different. Despite the first wave of recognition in the 60–80s, the memory of Schweitzer, his works and ideas is fading away. In 1947, The Life Magazine named Albert Schweitzer "the greatest man in the world" [21]. We can just hope that his greatness shall not be forgotten.

Acknowledgements

The authors would like to express their thanks to Professor for his inspiration and the promotion of Albert Schweitzer's ideas in Poland.

Conflict of interest statement

The authors declare no conflict of interest.

Funding sources

There are no sources of funding to declare.

References

- Götting G. Spotkanie z Albertem Schweitzerem. Warszawa: Instytut Wydawniczy PAX; 1961.
- Schweitzer A. Jan Sebastian Bach. Biografia. Warszawa: Wydawnictwo W.A.B.; 2009.
- Schweitzer A. Z mojego życia... Warszawa: Instytut Wydawniczy PAX; 1981.
- Lazari-Pawłowska I. Myśli i ludzie. Schweitzer. Warszawa: Wiedza Powszechna; 1976.

- Gaertner H, Stelcer B, Wissel E. Albert Schweitzer. Stulecie szpitala w Lambaréné (Gabon), *Archiwum Historii i Filozofii Medycyny*. 2013;76(1):46–50.
- Schweitzer A. *Out of my Life and Thought*, Baltimore: Johns Hopkins University Press; 1998.
- Cavendish R. Albert Schweitzer's Nobel Prize. October 30th, 1953. *History Today*. 2003;53(10):57.
- Abrel R. The Educational Legacy of Albert Schweitzer. *Leadership in our time. Vital Speeches of the Day*. 1980;46(13):391–395.
- Gaertner H. Albert Schweitzer. *Nauka dla wszystkich*. 1978;283:3–33.
- Gaertner H. Albert Schweitzer. *Życie, myśl i dzieło*, Kraków: Wydawnictwo WAM; 2007.
- Gotting G. Przedmowa. In: Schweitzer A. *Życie*, Warszawa: Instytut Wydawniczy PAX; 1974: 5–6.
- Bähr HW. *Albert Schweitzer, Sein Denken und sein Weg*. Tübingen: J.C.B Mohr (Paul Siebeck); 1962.
- Götting G. *Albert Schweitzer, Beiträge zu Leben und Werk*. Berlin: Berlin Union-Verlag; 1966.
- Google search, phrases: „Albert Schweitzer School”, „Albert Schweitzer Ecole”, „Albert Schweitzer Schule”, date: 20.02.2017.
- Skowronek A. Albert Schweitzer jako teolog. In: Albert Schweitzer. *Życie i dzieło. Materiały z międzynarodowej sesji w Krakowie w dn. 21–26.10.1985*, Warszawa: Ośrodek Chrześcijańskiej Myśli Społecznej AUGUSTINUM; 1986: 39–49.
- Strzelecki W. Kryzys kultury według Alberta Schweitzera. In: Pawlak P, Strzelecki W, da Costa GJM, editors. *Kultura-media-etyka. Media w perspektywie etycznej i kulturowej w kontekście rewolucji teleinformatycznej*, Poznań: Poznańskie Towarzystwo Przyjaciół Nauk; 2013: 117–26.
- Piątek Z. Etyka szacunku dla życia Alberta Schweitzera a ekofilozofia. *Problemy ekorozwoju*. 2008;3(2):51–61.
- Schweitzer A. *Życie*, Warszawa: Instytut Wydawniczy PAX; 1974.
- Łobocki M. *Altruizm i wychowanie*, Lublin: Wydawnictwo Marii Curie-Skłodowskiej; 2004.
- Strzelecki W, Pawlak P. Albert Schweitzer – konteksty społeczno-kulturowe. In Stelcer B, Strzelecki W, editors. *Humanizm w medycynie*, Poznań: Wydawnictwo Naukowe UMP; 2017: 106–18.
- Fuller JM. Albert Schweitzer (1875–1965): Organist, Theologian, Nobel Laureate. In: Cooper DKC, editor. *Doctors of Another Calling. Physicians Who Are Known Best in Fields Other than Medicine*, Newark: University of Delaware Press; 2014: 275–84.

Accepted for editing: 2018-02-12

Correspondence address:

Marcin Cybulski
Department of Clinical Psychology
Poznan University of Medical Sciences, Poland
Collegium Stomatologicum
70 Bukowska St, 60-812 Poznan
phone: +48605227567
email: cybulski@ump.edu.pl



REVIEW PAPER

DOI: <https://doi.org/10.20883/jms.2018.153>

Analysis of the prevalence of dental and occlusal anomalies in children and adolescents in Poland and elsewhere – review of the publications from the last 10 years

Dorota Cudziło¹, Agnieszka Sikorska², Maja Matthews-Kozanecka³,
Teresa Matthews-Brzozowska²

¹ Department of Orthopedics and Orthodontics, Institute of Mother and Child in Warsaw, Poland

² Department of Orthopedics and Orthodontics, Poznan University of Medical Sciences, Poland

³ Department of Social Sciences, Poznan University of Medical Sciences, Poland

ABSTRACT

Introduction. Dental and occlusal anomalies constitute a very common disorder of the mastication organ.

Aim. The objective of this work was to analyse papers published over the last decade on the prevalence of the mastication irregularities in Poland and elsewhere.

Material and Methods. The work analyses 22 publications, i.e. 6 papers on disorders in children and adolescents in Poland and 16 papers discussing such abnormalities elsewhere.

Results. Prevalence of malocclusion in the population of children and adolescents in Poland fluctuates between 52.5% and 88%, depending on the region. As regards scientific works published abroad, malocclusion oscillates between 33% and 95.6%, depending on the country.

Conclusions. Occlusal defects are diagnosed in children and adolescents both in Poland and elsewhere and the prevalence of the mastication anomalies depends neither on race nor on ethnic origin.

Keywords: dental and occlusal anomalies, mastication organ disorders, children, adolescents.

Introduction

The outcomes of numerous studies conducted in Poland and abroad show unanimously that dental and occlusal irregularities are a very common disorder of the mastication organ. The mastication organ, also called the stomatognathic system, constitutes a morphological and functional system in which the morphological elements of the craniofacial area, controlled by the central nervous system, participate in numerous functions, such as: mastication, preliminary digestion, swallowing, breathing, articulation of sounds and expression of the emotional sphere. **Negative fac-**

tors affecting the development of the mastication organ may result in mastication anomalies.

Aim

The objective of this work is to analyse the papers published over the last decade on the prevalence of the mastication irregularities in Poland and elsewhere.

Material and Methods

The analysis covered the publications available in Polish and foreign medical data bases. Finally,

6 papers discussing the prevalence of dental and occlusal defects in children and adolescents in Poland (**Table 1**) and 16 works on such disorders in children and adolescents abroad, were selected (**Table 2**).

Results

In the *małopolskie* province, a group of 190 ten-year-olds was examined. Malocclusion was identified in 88% of the subjects, of which dis-

tocclusion accounted for 25.8% [1]. In a group of 9–11-year-olds, composed of 128 subjects from the region of Lublin, dental and occlusal irregularities were diagnosed in 59.4% [2]. In the *zachodnio-pomorskie* province, the assessment of the occlusion in 12-year-olds revealed malocclusion in 56.6% of the subjects [3]. In the same year, a group of 600 subjects aged 13–15, was examined in Białystok. **Every age group comprised 200 subjects. Malocclusion was diagnosed in 64.5% of the 13-year-olds, 67.5% of the**

Table 1. Prevalence of dental and occlusal anomalies in children and adolescents in Poland based on selected literature

Nr	Year	Authors	Voivodeship	Number of subjects	Age in years	Malocclusions in %
1	2007	Ziemiańska-Maczek	małopolskie	190	10	88%
2	2009	Warsz et al.	małopolskie	128	9–11	59,4%
3	2009	Rojek et al.	pomorskie	120	12	56,6%
4	2009	Grodzka et al.	podlaskie	200	13	64,5%
				200	14	67,5%
				200	15	66,5%
5	2012	Kozanecka et al.	śląskie	1871	7–18	52,5%
6	2014	Osmólska-Bogucka et al.		100	9–12	82%

Table 2. Prevalence of dental and occlusal anomalies in children and adolescents worldwide based on selected literature

Nr	Year	Authors	Country	Number of subjects	Age in years	% of malocclusions
1	2007	Marques et al.	Brasil	600	13–15	47,3%
2	2007	Gelgör et al.	Turkey	2329	12–17	65,2%
3	2009	Martins et al.	Brasil	264	10–12	50% increased overjet 47,7% classe I maloc 36,7% increased overbite 22,3% classe II maloc
4	2009	Sidlauskas et al.	Lithuania	1681	7–15	84,6%
5	2012	Bourzgui et al.	Maroko	1000	8–12	84,2%
6	2013	Bugaighis et al.	Libya	343	12–17	95,6%
7	2013	Kumar et al.	India	1200	10–15	53,7%
8	2013	Lagana et al.	Albania	2617	7–15	40,4% classe I maloc 29,2% classe II maloc
9	2013	Reddy et al.	India	2135	6–12	48,30% classe I maloc 13,9% classe II maloc 11,8% stłoczenia
10	2014	Akinis et al.	Nigeria	620	13–20	80,3% classe I maloc 6,3% classe II maloc
11	2014	Al-Zubair	Jemen	3003	12	36,6%
12	2014	Nguyen et al.	Vietnam	400	12 and 18	67% classe I maloc 36,3% increased overjet 26,3% increased overbite
13	2014	Kumar et al.	India	985	6–13	33%
14	2014	Perillo et al.	Italy	516	13	% no data, the most frequent cross-bite and dental crowding
15	2015	Hanna et al.	Lebanon	655	6–11	75% classe I maloc 20% classe II maloc
16	2015	Feldens et al.	Brazil	704	12–13	69,6%

14-year-olds and 66.5% of the 15-year-olds. Distocclusion accounted for 51.4% and dental anomalies for 39.4% of all of the subjects [4]. In the group of 1,871 of children and adolescents from the Silesia region, aged 7–18, malocclusion was identified in 52.5%. The most common defect was distocclusion [5]. In the group aged 9–12, malocclusion was detected in 82%, the most common defects being: crossbite (39%) and distocclusion (37.7%), whereas dental abnormalities accounted for 70.7% [6].

The results of the research worldwide show that the mastication anomalies are a common irregularity and affect entire populations. Prevalence of dental and occlusal anomalies does not depend on ethnic origin or social and economic situation.

In Brazil, a group of 600 children aged 13–15 was examined. Dental irregularities were identified in 47.3% of the subjects [7]. In the group aged 10–12 (264 subjects), class I defects were diagnosed in 47.7%, increased overjet in 50% and increased overbite in 36.7%, whereas class II defect, i.e. distocclusion, in 22.3%. Dental defects were observed in 62.5% [8]. In the southern Brazil, a group of 704 teenagers was examined, of which 69.6% had mastication problems, unsatisfactory aesthetics of the dentition, increased overjet and dental irregularities in the upper dental arch [9].

Studies on the prevalence of dental anomalies among the populations of the Middle East have indicated that in Turkey, in a group of 2,329 children aged 12.5–17.4, the most common irregularity was malocclusion class II division 1, with increased overjet and overbite (i.e. from the group of distocclusion defects) and the dental anomalies in the anterior section were identified in 62.5% of the population [10].

In Yemen, the need for orthodontic treatment was assessed in a group of 3,003 12-year-olds – 36.6% of them were found to require such a therapy. Anomalies in the anterior sections of the mandible and maxilla were identified in 33.3% of the cases [11]. In Lebanon, a group of 655 pupils, aged 6–11, was examined. Class I defects were diagnosed in ca. 75%, class II defects in 20% [12].

The research conducted in Africa revealed the most common to be class I defects, increased overjet and overbite. **The prevalence of malocclusion and the need for orthodontic treatment was assessed in the Moroccan children aged**

8–12. The research comprised 1,000 school children. Malocclusion class I was observed in 61.4%, whereas class II defects were diagnosed in 24%. Overjet of 1–4mm was confirmed in 63.8% cases and increased overbite was identified in 23.6% of the subjects. 84.2% of the children required orthodontic treatment [13].

In Libya, the study covered 343 children aged 12–17. Malocclusion was diagnosed in 95.6% of the subjects: class I defects were found in 66.5%, class II in 25.4%, dental anomalies in the upper dental arch were detected in 13.9%, whereas the lower arch defects accounted for 12.2% [14]. Among 620 Nigerian teenagers, aged 13–20, class I defect was diagnosed in 80.3%, class II in 6.3% and dental anomalies in the upper arch in 14.4% [15].

Other studies on dental abnormalities conducted in Europe demonstrated a high percentage of occlusal anomalies. Of 1,681 Lithuanian pupils, studied in three age groups (7–9, 10–12 and 13–15 years old), malocclusion was diagnosed in 84.6% of the subjects. The most common defect was class I (68.4%) and dental anomalies, i.e. 44.1% in the upper arch and 40.3% in the lower arch. Distocclusion defects – class II – occurred in 27.7% of the cases [16]. As regards the studies conducted on 2,617 Albanian children aged 7–15, malocclusion class I (40.4%) and class II (29.2%) dominated [17]. In Italy, 516 pupils, aged 13, were examined. Dental defects, crowding and crossbite, were found to be the most common [18].

As regards Asia, in India the prevalence of malocclusion in children aged 6–12 was assessed in a group of 2,135 subjects. Class I defects were identified in 48.3%, class II in 13.9% and crowding of the lower teeth in the anterior section in 11.8% [19]. In a different region of India, the study covered the pupils of 5 schools, aged 10–15. Malocclusion was identified in 53.7% of the cases. Class I defects were observed in 75.2% and class II in 23%. Overbite was assessed as increased in 27.7% and overjet in 25.1% [21]. The examination of the Indian children from the Maharashtra region, aged 6–13, showed malocclusion in 33% of the subjects (Kumar et al. 2014). In a group of 200 Vietnamese pupils, aged 12, and a group of 200 pupils, aged 18, class I defect was diagnosed in 67% jointly in both groups, class II defect in 17.5%, increased overjet in 36.3% and increased overbite in 26.3% (Nguyen et al. 2014).

Conclusions

The analysis of the outcomes obtained by the quoted authors allows us to draw the following conclusions: occlusal defects are diagnosed in children and adolescents both in Poland and elsewhere and the prevalence of the mastication anomalies depends neither on race nor on ethnic origin.

Acknowledgements

Conflict of interest statement

The authors declare no conflict of interest.

Funding sources

There are no sources of funding to declare.

References

1. Ziemiańska-Maczek J. Częstość występowania wad zgryzu u dzieci jedenastoletnich z terenów wiejskich powiatu nowotarskiego województwa małopolskiego. *Implantoprotetyka*. 2007;8(3):40–42.
2. Warsz M, Rudnicka-Siwiek K. Ocena stanu narządu żucia u 9–11-letnich dzieci ze szkół podstawowych z okolic Lublina pozbawionych gabinetów stomatologicznych. *Dent Med Probl*. 2009;46(2):162–167.
3. Rojek R, Lisiecka K. Analiza stanu zgryzu 12-latków w dawnym województwie szczecińskim w latach 1987–2003. *Mag Stomatol*. 2009;1:20–24.
4. Grodzka I, Szarmach I, Bugała-Musiatiowich B. Zależności między nieprawidłowościami zgryzowymi a parafunkcjami w populacji młodzieży gimnazjalnej w Białymstoku. *Dent Med Probl*. 2009;46(3):311–318.
5. Kozanecka, Kawala B. Częstość występowania wad zgryzu a potrzeba leczenia ortodontycznego w populacji młodych dorosłych Polaków – przegląd piśmiennictwa. *J Stomat*. 2012;65:424–434.
6. Osmólska-Bogucka A, Buczek O, Bilińska M, Zadurska M. Parafuncje niezwarciowe u dzieci i rodziców oraz ich wpływ na występowanie wad zgryzu u dzieci na podstawie badania ankietowego i klinicznego. *Nowa Stomatologia*. 2014;2:63–69.
7. Marques CR, Couto GB, Orestes Cardoso S. Assessment of orthodontic treatment needs in Brazilian schoolchildren according to Dental Aesthetic Index (DAI). *Community Dent Health*. 2007;24(3):145–148.
8. Martins Mda G, Lima KC. Prevalence of malocclusions in 10- to 12-year-old schoolchildren in Ceará, Brazil. *Oral Health Prev Dent*. 2009;7(3):217–223.
9. Feldens CA, Nakamura EK, Tessarollo FR, Closs LQ. Desire for orthodontic treatment and associated factors among adolescents in Southern Brazil. *Angel Orthod*. 2015;85(2):224–232.
10. Gelgor IE, Karaman AI, Ercan E. Prevalence of malocclusion among adolescents in central Anatolia. *Eur J Dent*. 2007;1(3):125–131.
11. Al-Zubari Nabil Muhsen. Orthodontic treatment need of Yemeni children assessed with dental aesthetic index. *J Orthod Sci*. 2014;3(2):41–45.
12. Hanna A, Chaaya M, Moukarzel C, El Asmar K, Jaffa M, Ghafari JG. Malocclusion in elementary school children in Beirut: severity and related social/behavioral factors. *Int J Dent*. 2015;2015:351231.
13. Bourzgui F, Sebbar M, Hamza M, Lazrak L, Abidine Z, El Quars F. Prevalence of malocclusion and orthodontic treatment need in 8–12-year-old schoolchildren in Casablanca, Morocco. *Prog Orthod*. 2012;13(2):164–172.
14. Bugaighis I, Karanth D. The prevalence of malocclusion in urban Libyan schoolchildren. *J Orthod Sci*. 2013;2(1):1–6.
15. Aikins EA, Onyeaso CO. Prevalence of malocclusion and occlusal traits among adolescents and young adults in Rivers State, Nigeria. *Odontostomatol Trop*. 2014;37(145):5–12.
16. Sidlauskas A, Lopatiene K. The prevalence of malocclusion among 7–15-year-old Lithuanian schoolchildren. *Medicina (Kaunas)*. 2009;45(2):147–152.
17. Lagana G, Masucci C, Fabi F, Bollero P, Cozza P. Prevalence of malocclusion, oral habits and orthodontic treatment need in a 7- to 15-year-old schoolchildren population in Tirana. *Prog Orthod*. 2013;14:12.
18. Perillo L, Esposito M, Caprioglio A, Attanasio S, Santini AC, Carotenuto M. Orthodontic treatment need for adolescents in the Campania region: the malocclusion impact on self-concept. *Patient Prefer Adherence*. 2014;8:353–359.
19. Reddy ER, Manjula M, Sreelakshmi N, Thabitha Rani S, Aduri R, Dharamraj Patil B. Prevalence of malocclusion among 6 to 10 year old Nalgonda school children. *J Int Oral Health*. 2013;5(6):49–54.
20. Kumar P, Londhe SM, Kotwal A, Mitra R. Prevalence of malocclusion and orthodontic treatment need in schoolchildren – an epidemiological study. *Med J Armed Forces India*. 2013;69(4):369–374.
21. Kumar M, Banerjee P, Gondhalekar R, Gondhalekar R, Lall R, Parwani R. Dental occlusion among school going children of Maharashtra. *J Int Oral Health*. 2014;6(4):53–55.
22. Nguyen SM, Nguyen MK, Saag M, Jagomagi T. The need of orthodontic treatment among Vietnamese school children and young adults. *Int J Dent*. 2014;2014:132301.

Acceptance for editing: 2018-03-12
Acceptance for publication: 2018-03-27

Correspondence address:

Dorota Cudziło
Department of Orthopedics and Orthodontics
Institute of Mother and Child in Warsaw
email: klinika.ortodoncji@ump.edu.pl



REVIEW PAPER

DOI: <https://doi.org/10.20883/jms.2018.281>

User experience and design thinking as a global trend in healthcare

Krzysztof Stola^{1,2}

¹ Poznan University of Economics and Business, Poland

² Moscow State University of Management, Russia

ABSTRACT

Human-centered design describes a process and methodology that begins and ends with accommodating the needs and desires of our end users – the patients, families, providers, and other stakeholders, who each play a crucial role in the innovative healthcare creation process. Based on the desktop research it was found that human-centered design methodologies and tools are trending in the different fields and areas of healthcare design systems. It was found that customer-centric approach is the key fact of innovation creation process whether it is product or service, technology or organization level. The conclusion is that it is time for healthcare to start solving real people problems by implementing the human-centered approach in order to achieve high results and create innovative solutions that will match their customers and stakeholders needs and desires.

Keywords: human-centered design, innovation, patients.

Introduction

Successful future healthcare systems should have the ability to innovate in delivering services that cut across organizational, political, geographical and sectorial boundaries, whether they are private or public. In the modern world, when the industries are falling, and rapid technology innovations are changing both business and social world, the need of flexibility and innovation in the sectors are the key for their long-term existence. The importance of constant innovation and improvement are also crucial for the healthcare system long-term persistence. The system has to change their archaic management and functional concepts and implement flexible and lean methodologies such as Design Thinking and User Experience Design. "The good news is that healthcare is not alone in facing this challenge of developing board-based competency and capacity to innovate within complex systems. High-

ly competitive and rapidly evolving industries, such as customer electronics, have succeeded in doing so by identifying and understanding customers latent needs, and challenges as the basis for developing executive and marketable solutions that meet customer expectations" [1]. There is a strong believe based on facts and the history of the sectors that health care both in public and private sector has to apply technological, product or systematic innovative changes that will deliver seamless, compelling, and effective stakeholder and user experiences. In this article I will consider the current and potential future value that Design Thinking and User Experience Design may offer healthcare management to improve their flexibility and inattentiveness.

Definition

User Experience (UX) and Design Thinking are the common and popular concepts and theories

existing in both business and social world that are so closely related to the practical world, that researchers often says that there is no theoretical body staying behind these concepts. But every single concept has its own definition whether it comes from the theoretical or practical world. It is also crucial to realize that these three concepts are different, and nowadays in the modern world most of the people do not see and notify the difference between theme, using the theme as one core concept of human-centered design in every field of business and social life. There also is some true cause every single concept mentioned above is the part of a human-centered design.

To understand the difference between these concepts and their implementation in the real world it is key to understand the definition of every single one separately. As it was mentioned above, all of these concepts are mostly popularized as a part of human center design approach. In the ISO 9241–210 definition, human-centered design is „an approach to systems design and development that aims to make interactive systems more usable by focusing on the use of the system and applying human factors/ergonomics and usability knowledge and techniques" [2]. The definition focus on the interaction, system and human needs which are also a crucial part of user experience and design thinking. In his book *Change by Design*, Tim Brown, CEO of IDEO, leading Design Thinking consulting agency, describe Design Thinking as "a discipline that uses the designer's sensibility and methods to match people's needs with what is technologically feasible and what a viable business strategy can convert into customer value and market opportunity" [3]. On the other hand, professor of form theory and head of the Industrial Design department Paul Hekkert define user experience as "the entire set of affects that is elicited by the interaction between a user and a product, including the degree to which all our senses are gratified (aesthetic experience), the meanings we attach to the product (experience of meaning), and the feelings and emotions that are elicited (emotional experience)" [4]. The complexity of terminology and problems with its use, perfectly explain Don Norman, previous Apple Computer manager and world-famous designer and researcher. In his book, he explains his effort as follows: "I invented the term because I thought human interface

and usability were too narrow. I wanted to cover all aspects of the person's experience with the system including industrial design, graphics, the interface, the physical interaction, and the manual. Since then the term has spread widely, so much so that it is starting to lose its meaning... user experience, human centered design, usability, all those things, even affordances. They just sort of entered the vocabulary and no longer have any special meaning. People use them often without having any idea why, what the word means, its origin, history, or what it's about" [5]. As Don Norman marked in his vast definition of user experience, people often use different concepts to name the process of applying human centered design methods into business and social interaction processes and situations. The same situation is in the healthcare, there is no difference if the researchers using terms Design Thinking or User Experience Design, applying universal values from both concepts into real-life problems. The same sort of thinking is observed in the Design Thinking: Past, Present and Possible Futures article in which authors comment that "As social constructionists, we regard an approach that begins with the question, 'What is design thinking?' as an essentialist trap. We do not believe that there is a unique meaning of 'design thinking', and accordingly, we should not look for one. Instead, we look for where and how the concept is used in different situations, both theoretical and practical, and what meaning is given to the concept" [6].

Current situation

"In healthcare, Design Thinking has been carried out as a method for improvement work and innovation within different organizations in recent years, primarily in the United States. The purpose of using Design Thinking and how it has been implemented varies, but usually, the work is oriented towards product development, process improvement, or redesigning patient or employee experiences" [7]. Context of Design Thinking using in healthcare organizations is the very base for the trend in Design Thinking and User Experience Design approaches to solving problems in case of products, services, technologies and management. Following organizations that successfully implemented Design Thinking into their

roots, we can easily notice the key trends and functions of Design Thinking and User Experience Design approaches being implemented onto the organizations.

- › Implementation of Design Thinking tools and methods into strategic and operational problem solving learnt by employees and managers. This approach has been made by GE Healthcare. The aim of the company was to equip the employees with tools to manage problem-solving with much more imagination and creativity than before. The organization has had much focus on Six Sigma as a method of improvement but want to change focus from only operations efficiency towards "imagination at work". The new approach implementation tends to be difficult for some, much due to the discomfort included in rethinking the ways of working and regarding yourself as a designer of the organization. The results from their increased design activity have been described as a booster of innovation and thus the bottom line [8].
- › Creation of new business units and services in the organization using Design Thinking tools, and methods. This approach has been made by Memorial Hospital of South Bend. In 2002 they turned to IDEO (a worldwide known consulting agency in the field of Design Thinking) to get help regarding developing a new heart and vascular center for the hospital. In the first part they observed and analyze customers, technology and competition. In the second phase called "Deep Dive", series of three, two-day gatherings focused on brainstorming, visualising and ideation process. The "Deep Dive" activities acted as an eye opener for the involved from the hospital: "I look deeper and see things I've never seen before... how people really interact with each other." Finally, several problem/improvement areas were isolated and addressed, that incrementally help the Hospital in the creation of the new business unit of the organization [9].
- › Creation of centers and incubators for new ideas to be evolved to become ready for incorporating into the care delivery. This approach has been made by Mayo Clinic. In 2008 they set up their very first bridge between Human Centered Design methodologies and medical practice. Their Center for Innovation uses

structured methodologies to increase the work of innovation and acts as an incubator for new ideas to be evolved to become ready for incorporating into the care delivery. The Center for Innovation has an in-house lab where observations, interviews and research of patients, relatives and "traditional consumers" are made. Further, they work with visualization, modelling, prototyping and testing of possible healthcare delivery solutions [10].

- › Better patient needs and expectations understanding, assessment and implementation of the human-centered approach. This was the way Chief Andrew Isaac Health Clinic in Fairbanks used Design Thinking methodology to understand the patients as well as the problems and conditions. The designers went out to see how the people lived in order to understand their culture, sense of community and expectations for a healthcare provider. Further, they did extensive work on understanding the problems and conditions in the former facility. This work resulted in an entirely new model of how to deliver care to the patients in the new facility [11].
- › Implementation of the Design Thinking methods as the basis for creating innovation oriented strategies. This approach has been made by Kaiser Permanente the largest managed care organization in the United States. Together with IDEO in 2003, their set up a small team working with a DT approach with the expressed purpose to develop better and more efficient processes for some of their high-value activities. Through appropriation of a human-centered design process closely related to IDEO's framework, they undertake carefully chosen projects and improvement areas aiming to improve the care experience for the patients and work experience for the employees [12].
- › Empathy development by bringing together healthcare stakeholders, employees, managers and patients. This approach was made by Cleveland Clinic. They create an annual event "Patient Experience Summit" which brings together patient experience leaders, healthcare CEOs, innovators, nursing leaders, policy makers, major stakeholders, industry experts and patients who are committed to not just the patient or caregiver experience, but also

the human experience. The theme of this year's three-day inter-professional conference is Empathy Where You Are and features expert speakers, panel discussions and workshops representing multiple healthcare professions and disciplines engaged in exploring innovative ways to demonstrate empathy and provide value to patients and caregivers throughout their journey of care. As caregivers, improving the patient experience is our collective responsibility. Success comes from the ability to work together, network, share best practices and challenge each other to identify new ways to practice [13].

- › Implementation of the Design Thinking methodology to planning and creation the whole new part of the organization (a new hospital). This approach was held at Stanford Hospital. SHC administrators have also incorporated design thinking into planning the new Stanford Hospital, scheduled to open to patients in 2018. Recently, SHC staff used design thinking to complete a plan to redesign two nursing units in the current hospital to serve only patients with cancer. "Patients and their families were involved from the start," said Helen Waters, a design and innovation leader with Stanford Health Care. "We wanted to know what they needed and what they felt was missing." The process included seven months of conducting interviews and tabletop exercises and simulating actual work routines in the proposed layouts of the nursing units to be redesigned [14].
- › Using Design Thinking methodology to develop new tools and technologies that can help healthcare users getting knowledge and creating their own highest quality expected experience. This approach was made by MedStar Health working with a Bethesda-based tech startup firm, Mytonomy, to pioneer a novel approach to patient education that delivers individualized instruction through a unique microlearning software platform that can be accessed from anywhere via the internet. Based on a highly successful pilot with interventional cardiology patients at MedStar Washington Hospital Center, MedStar and Mytonomy announced today that they are expanding the project to cardiovascular patients across the system and will be adding

new learning modules to address other types of procedures and conditions [15].

- › In order to innovate in health care, there is a strong need to redesign how medical universities train and teach doctors of the future. This approach was made at Thomas Jefferson University. As Stephen Klasko, an MD with an MBA, who is CEO of Jefferson Health System and Thomas Jefferson University says, "We take students during their first year of medical school, and we teach them design methodology. This involves empathy, rapid prototyping and iteration, and we teach them before they enter their pre-clinical years how to solve health care problems through design methodology – to really think outside the box and become creative problem solvers" [16].

All of the examples mentioned above show that Design Thinking and User Experience Design is a huge trend in the world healthcare nowadays. Unfortunately, when we would like to reach of these methods implementation examples in Poland it will be hard to find it. In our local healthcare systems, there are almost no examples information about successful implementation of Design Thinking or User Experience Design. There are only a few cases of Polish companies working on a product or service using Design Thinking methodology. One of the examples is Husarska Design Studio. Using Design Thinking methods and tools they designed in cooperation with rehabilitation specialists an innovative rehabilitation robot Luna EMG for a foreign contractor EGZOTech [17]. There is still huge perspective on implementation of this trend in Polish healthcare reality.

Future trend predictions

It is crucial to understand that in the near future Human Centered Design methodologies will become the main triggers of innovation in healthcare. These innovations will appear in three different sections:

- › Products & services. Soon we will see more innovations created by Design Thinking approach than ever before. New products and services will be developed on the basis of the user center design approach. The users will be deciding, whether the product or service match their needs or not. As an example of

Design Thinking approach implementation in new products and services creation is an idea of a young Hungarian designer, Ádám Miklósi to redesign the traditional ECG Holte. He faced the challenge of using a great technology in minimum size and applying some kind of patches onto various skin types for a longer period of time. The result is a colorful, water-proof and minimally-sized wearable design called the Dab, which is easy to apply on the body and results in accurate measurements. The future will bring more and more solutions where designers and healthcare professionals work together. And as patients will be the point-of-care and people will take care of themselves better – we need the successful symbiosis of the two fields more than ever before.

- › Teaching process. In the rapidly changing world, the need to innovate and change dramatically increase. There is a strong need in the medical university students teaching process change. According to Matthew Trowbridge, MD, an associate professor of emergency medicine at the University of Virginia School of Medicine, design thinking is one way to prepare students for a career characterized by change. "Health care is changing so fast that for a first-year medical student, it's almost impossible to predict what clinical care will look like during their career." He called it "almost irresponsible" to not provide students with a structured response to manage change [19].
- › Technology. The technology will profoundly change how the modern healthcare and medicine is working on. This does not have to be advanced science. As an example of Thomas Jefferson Medical University students show, we can use the technology we have today to change the products and services of tomorrow. Dr Ku, an emergency medicine doctor, and his colleagues introduced a course that pairs medical students with architecture students. The group is using design thinking to develop a digital mapping tool that uses GPS-like software to understand how patients, doctors and nurses move about and interact in the emergency room, with the aim of improving communication and decreasing wait times [20].

- › Organization. Hospitals and medical centers as an organizations are also forced to change by their patients and staff working there. The change is urgent, that is why developing patient-centered experience it the key step to change the entire organization. This tailored, human-centered approach to problem-solving is the foundation of design thinking. Hospitals versed in design thinking would identify this general challenge and then assign a team or task force (ideally a multidisciplinary one) to spend weeks or even a few months studying the patients it affects. The team would use qualitative research methods, such as surveys, focus groups, and observations, to better understand people's experiences [21].

Summarize

There is no doubt that Human Centered Design methodologies are significant trends in the healthcare system improvement and innovation. There are a dozen examples how Design Thinking and User Experience Design can make a positive and significant impact on the whole industry. There are many more examples that can be the finest proof of Human Centered Design methodologies as an innovation catalyst in healthcare. Cases mentioned in this article are just a few of the vast spectrum of methodology capabilities in innovation creation and implementation.

Acknowledgements

Conflict of interest statement

The authors declare no conflict of interest.

Funding sources

There are no sources of funding to declare.

References

1. Roberts JP, Fisher TR, Trowbridge MJ, Bent C. A design thinking framework for healthcare management and innovation. *Healthcare: The Journal of Delivery Science and Innovation*. 2016;4(1):11–14.
2. ISO 9241-210:2010. Ergonomics of human-system interaction – Part 210: Human-centred design for interactive systems. International Organization for Standardization [accessed: 28.02.2018]. Available from: <https://www.iso.org/standard/52075.html>.
3. Brown T. *Change by Design. How Design Thinking Transforms Organizations and Inspires Innovation*. New York, NY: Harper Business 2009. p. 86.
4. Schifferstein H, Hekkert P (eds.). *Product Experience*, Amsterdam: Elsevier Science 2007. p. 2.

5. Norman D, Miller J, Henderson A. What you see, some of what's in the future, and how we go about doing it: HI at Apple Computer. In: Miller J, Katz IR, Mack RL, Marks L (eds.). Proceedings of the International Conference on Human Factors in Computing Systems, CHI '95, Conference Companion: Mosaic of Creativity. New York, NY: ACM. p. 155.
6. Johansson-Sköldberg U, Jill Woodilla J, Çetinkaya M. Design Thinking: Past, Present and Possible Futures. *Creativity and Innovation Management*. 2013;22(2):121–146.
7. Tideholm A, Rydén O. Design Thinking as Facilitator for Innovation in Swedish Healthcare. A case study at Karolinska University Hospital. Göteborg, Sweden 2015. p. 10.
8. Wong V. How Business Is Adopting Design Thinking. *Bloomberg Business* [accessed: 28.02.2018]. Available from: <http://www.bloomberg.com/bw/stories/2009-11-03/how-business-is-adopting-design-thinking-businessweek-business-news-stock-market-and-financial-advice>.
9. Tideholm A, Rydén O, Design Thinking as Facilitator for Innovation in Swedish Healthcare. A case study at Karolinska University Hospital. Göteborg, Sweden 2015. p. 11.
10. Design Thinking in Health Care. Mayo Clinic's Center for Innovation [accessed: 28.02.2018]. Available from: <http://centerforinnovation.mayo.edu/design-in-health-care>.
11. Silvis J. "Design Thinkin". For Healthcare. *Healthcare Design Magazine* [accessed: 28.02.2018]. Available from: <http://www.healthcaredesignmagazine.com/architecture/design-thinking-healthcare>.
12. McCreary L. Kaiser Permanente's Innovation on the Front Lines. *Harvard Business Review*. 2010;88(9):92–97.
13. Patient Experience Empathy and Innovation Summit – Event Summary. [accessed: 28.02.2018]. Available from: <http://www.cvent.com/events/patient-experience-empathy-and-innovation-summit/event-summary-f3ab6e447144477585c0ab875790eb71.aspx?RefID=Hileman%20Redirect>.
14. Wykes S, Design thinking as a way to improve patient experience. *Stanford Medicine* [accessed: 28.02.2018]. Available from: <https://med.stanford.edu/news/all-news/2016/06/design-thinking-as-a-way-to-improve-patient-experience.html>.
15. MedStar Health Pioneers Innovative Patient Education Platform with Tech Partner. MedStar Institute for Innovation [accessed: 28.02.2018]. Available from: <https://mi2.medstarhealth.org/news/2016/09/07/medstar-health-pioneers-innovative-patient-education-platform-tech-partner/#q={>.
16. The Medical Revolution You Haven't Heard About... Yet. *Knowledge@Wharton* [accessed: 28.02.2018]. Available from: <http://knowledge.wharton.upenn.edu/article/why-design-is-critical-to-the-future-of-health-care>.
17. Neurological Rehabilitation Expo: exhibition stand project and robot Luna EMG. *Husarska Design Studio* [accessed: 28.02.2018]. Available from: <http://husarska.pl/pl/targi-neurological-rehabilitation-expo-projekt-stoiska-i-robot-luna-emg>.
18. Symbiosis of Design And Healthcare: The Story of an ECG Device. *The Medical Futurist* [accessed: 28.02.2018]. Available from: <http://medicalfuturist.com/symbiosis-of-design-and-healthcare>.
19. Bach B, Design thinking is key to preparing doctors and improving health care, *Medicine X speakers say*. *Scope* [accessed: 28.02.2018]. Available from: <http://scopeblog.stanford.edu/2016/09/19/design-thinking-is-key-to-preparing-doctors-and-improving-health-care-medicine-x-speakers-say>.
20. Kalaichandran A, Design Thinking for Doctors and Nurses. *The New York Times* [accessed: 28.02.2018]. Available from: <https://www.nytimes.com/2017/08/03/well/live/design-thinking-for-doctors-and-nurses.html>.
21. Kim SH, Myers CG, Allen L, Health Care Providers Can Use Design Thinking to Improve Patient Experiences. *Harvard Business Review* [accessed: 28.02.2018]. Available from: <https://hbr.org/2017/08/health-care-providers-can-use-design-thinking-to-improve-patient-experiences>.

Acceptance for editing: 2018-03-12
Acceptance for publication: 2018-03-27

Correspondence address:
Krzysztof Stola
108A/15 Bukowska Street
60-397 Poznań, Poland
phone: +48690900344
email: k.stola@blueowl.pl



REVIEW PAPER

DOI: <https://doi.org/10.20883/jms.2018.259>

The criteria of the identification of metabolic obesity among people with normal body weight and their use in everyday practice

Katarzyna Pastusiak, Juliusz Przysławski

Chair and Department of Bromatology and Human Nutrition, Poznan University of Medical Sciences, Poznan, Poland

ABSTRACT

Obesity and the metabolic syndrome caused by it constitute one of the biggest health issues of the 21st century. However, a problem of “a concealed form of obesity” – metabolic obesity with a normal body weight, which manifests clinically through the occurrence of metabolism disorders related to obesity among people with a normal body mass index – was pointed out in the 1980s. This affliction entails similar health consequences and causes many more problems in diagnosis and early treatment because a lack of obesity does not make doctors search for the traits of metabolic syndrome among seemingly healthy patients. The aim of this study is to present a proposition of diagnostic criteria for this disease in the historical perspective and to consider the possibilities of their use in everyday clinic practice.

Keywords: metabolically obese normal weight, metabolic syndrome, diagnostic criteria

Introduction

The obesity and metabolic syndrome related to it constitute one of the biggest health threats of the 21st century. For many centuries, researchers have been searching for the reason for this issue and, first of all, for effective treatment methods. However, it was noticed in the 1980s that excessive body mass cannot be a basis for the development of all troubles related to metabolic syndrome. A concept of a metabolically obese normal weight (MONW) was created. This occurs among people with an appropriate Body Mass Index (BMI) value and is typified by a combination of metabolism disorders characteristic for obese people with metabolic syndrome. Taking into consideration the fact that in the population of “healthy people”, the percentage of the total number of MONW subjects may concern even up to 30%, some efforts were undertaken in order to identify this disease [1].

The first criteria for identification of metabolic syndrome among non-obese people was proposed in 1998 by Rudermann et al. [1]. A system composed of 22 traits was created on the basis of the analysis of earlier research. Each of them was marked with a numerical value (**Table 1**). The Metabolically Obese Normal-Weight (MONW) was supposed to be recognised when the sum of those values reached 7 points. This system seems to be easy to use in everyday practice, although it requires the use of the results of biochemical tests that are rarely conducted among non-obese people [2].

Further criteria of the MONW diagnosis were based on the indices of carbohydrate metabolism disorders and insulin resistance, adipose tissue content in the organism and also with the use of the criteria of metabolic syndrome (**Table 2**).

Table 1. MONW identification criteria according to Ruderman et al. [2]

Examined parameter	Indicated abnormality		Number of points
BMI	25–27 kg/m ²		2
	23–25 kg/m ²		1
Waist circumference	Women	Men	
	> 76.2 cm	> 91.4 cm	2
	71.1–76.2 cm	86.3–91.4 cm	1
Interview concerning the body mass	Weight gain after 18 years of age.	Weight gain after 21 years of age.	
	> 4 kg		1
	> 8 kg		2
	> 12 kg		3
Glucose concentration	IFG		2
	Gestational diabetes		3
	IGT		4
	Type 2 diabetes		4
Triglyceride concentration	100–150 mg/dl		1
	> 150 mg/dl		2
	> 150 mg/dl + HDL < 35 mg/dl		3
Uric acid concentration	> 8 mg/dl		2
Blood pressure	125–140/85–90 mmHg		1
	>140/90 mmHg		2
Medical history	Ischemic heart disease < 60 year of age		3
	Polycystic ovary syndrome		4
Family history	Ischemic heart disease < 60 year of age		2
	High blood pressure < 60 year of age		2
	Hypertriglyceridemia		3
	Type 2 diabetes, IGT		3
Predisposing factors	Low birth weight < 2 kg		2
	Low physical activity < 90 min. of anaerobic exercise/week.		2
High-risk ethnic group			1–3

IFG – impaired fasting glucose; IGT – impaired glucose tolerance; HDL - HDL-cholesterol fraction

Carbohydrate metabolism and insulin resistance

The problem of MONW's characteristics was elaborated by Dvorak's team. He defined MONW on the basis of a BMI below 26.3 kg/m with co-existing insulin resistance (determined by means of the euglycemic clamp technique). The glucose utilisation at a level of 8 mg/min/kg of the Fat Free Mass (FFM) was adopted as the boundary value [3]. A disadvantage of this method is a necessity of carrying out the euglycemic clamp technique examination, which is technically difficult and labour intensive, thereby unsuitable as a tool to be applied in everyday practice [4]. The next attempts aimed at identification of the above-mentioned disorder were undertaken by Molero-Conejo et al. who proposed the recognition of MONW based on body mass index values below 27 kg/m², ipso facto, taking into consideration slightly overweight people and a fasting insulin concentration above 84 mmol/l [5]. The MONW diagnosis proposed by

Goodpaster et al. was based on the same concept. It adopted BMI values below 25 kg/m² and the co-existence of impaired glucose tolerance evaluated by means of an Oral Glucose Tolerance Test (OGTT) and, as a result, making these criteria more realistic to use in everyday practice [6]. An equally simple method was proposed by Canus et al. who recognised MONW on the basis of the same BMI values and the Homeostasis Model Assessment (HOMA) insulin resistance index above 1.69 [7]. It is quite strict criterion because in customary assessment, insulin resistance is recognised only at the value of 2.5. The authors considered though that among people with a normal body mass, we can observe a clinically significant reduction of the tissue's sensitivity to insulin already in the case of much lower values [4]. It is also worth mentioning a proposal of Succurro et al. who, just like his predecessors, assessed the BMI, although they introduced a new index – M_{FFM} – indicating an average glucose infusion rate within the last 60 minutes of the examination

Table 2. MONW recognition criteria according to other authors [4-18, 20, 22-25]

Year	Author	BMI criterion	Other criteria
1999	Dvorak et al.	< 26.3 kg/m ²	Glucose concentration < 8 mg/min/kg FFM in euglycemic clamp
2003	Molero-Conejo et al.	< 27 kg/m ²	Insulin concentration 84 mmol/l (fasting)
2003	Goodpaster et al.	< 25 kg/m ²	Incorrect OGTT
2003/2004	Katsuki et al.	< 25 kg/m ²	Fat tissue in CT > 100 cm ²
2004	Conus et al.	< 25 kg/m ²	HOMA > 1.69
2004	St. Onge et al.	< 27 kg/m ²	Metabolic syndrome criteria according to the NCEP/ATP III
2006	De Lorenzo et al.	< 25 kg/m ²	Percentage of fat tissue > 30%
2008	Wildman et al.	< 25 kg/m ²	Two or more of the following abnormalities: 1. High blood pressure ≥ 130/85 mmHg Hypertension in treatment 2. Higher TG concentration: ≥ 1.7 mmol/l 3. Reduced HDL level: M: < 1 mmol/l W: < 1.3 mmol/l treatment of this disorder. 4. Higher glucose concentration: FG ≥ 6.1 mmol/l Therapy with medicines reducing the glucose level in blood. 5. Insulin resistance HOMA > 5.13 6. Generalised inflammation: hsCRP > 0.1 mg/l
2008	Marques-Vidal et al.	< 25 kg/m ²	Percentage of fat tissue < the 95th percentile depending on sex and age or fat mass index ≥ 8.3 kg/m ² for men, 11.8 kg/m ² for women
2008	Succurro et al.	< 25 kg/m ²	M _{FFM} < 10.2 mg/min. x kgFFM
2010	Romero-Corral et al.	< 25 kg/m ²	Percentage of fat tissue > 33.3% among women > 23.1% among men
2012	Shea et al.	< 25 kg/m ²	Percentage of fat tissue: ≥ 35% among women ≥ 20.8% among men + Wildman's criteria
2012	Kim et al.	< 25 kg/m ²	Percentage of fat tissue ≥ 30% among women ≥ 20% among men
2012	Choi et al.	< 25 kg/m ²	Metabolic syndrome criteria according the IDF
2013	Madeira et al.	< 25 kg/m ²	Sum of values of measurement of fold above the scapula and triceps muscle > the 90th percentile for a given sex or a percentage of fat tissue: > 30% among women > 23% among men
2015	Kim et al.	< 25 kg/m ²	Ferritin level > 127.03 ng/ml for women > 46.87 ng/ml for men
2015	Lee et al.	< 25 kg/m ²	TyG value > 8.73 for women > 8.82 for men
2016	Galić et al.	< 25 kg/m ²	Metabolic syndrome criteria according the IDF

by the euglycemic clamp technique expressed in mg/min x kg FFM [8].

Fat mass content

Other diagnostic criteria were proposed by Katsuki et al. who initiated a view on the non-obese patients through the Fat Mass (FM) content in

the organism. As their predecessors did, they adopted a BMI below 25 kg/m² as the indicative parameters, but they took into consideration the abdominal FM determined by means of computed tomography. The deposit of abdominal FM above 100 cm² was adopted as the boundary value [9–11]. However, the execution of computed tomography entails high costs and the exposure

of the patient to ionizing radiation, which excludes this method from use in everyday practice. In turn, de Lorenzo et al. assumed that in order to recognise the Normal Weight Obese (NWO), it is necessary to determine the BMI value within the limits of 18–25 kg/m² and the FM content in the organism over 30% determined by means of dual energy x-ray absorptiometry (DXA). Admittedly, it is a safer and cheaper method, but it is still insufficiently available to be used on a daily basis [12]. The same methods were used by next researchers, adopting however different cut-off points. Romero-Corral et al. considered the FM level above 33.3% for women and 23.1% for men as increasing the risk of cardiovascular diseases [13]. Similarly, Shea et al. adopted the values of 35% FM for women and 20.8% FM for men as boundary values. They introduced though an additional criterion consistent with the Wildman's diagnostic criteria presented below [14, 15]. Kim et al. also considered 30% FM value for women and 20% FM value for men as decisive, initiating the use of the measurement of FM content in the organism by the method of bioimpedance, which is a far more available and cheaper technique as compared to the DXA [16]. Marques-Vidal et al., while assessing the frequency of NWO occurrence in a population of the Swiss, were guided by the FM content over the 95th percentile or the value of the Fat Mass index (%FM and BMI ratio) \geq 8.3 kg/m² for men and 11.8 kg/m² for women [17]. Madeira et al. were assessing the thickness of a fold above the scapula and triceps muscle, recognising those people among whom the sum of these values was above the 90th percentile as the NWO persons. Alternatively, they were assessing the percentage of FM in the organism, applying the limit of 30% for women and 23% for men [18].

Metabolic syndrome criteria

Metabolic syndrome criteria were used for the first time in the MONW diagnosis by St. Onge et al. who proposed an assessment of people with a BMI below 27 kg/m² according to the criteria of the National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP III), which assumes the co-existence of at least three of five of the following disorders:

- › waist circumference above 102 cm among men and 88 cm among women;

- › triglycerides concentration in serum over 1.7 mmol/l;
- › concentration of HDL fraction cholesterol below 1.3 mmol/l among men and below 1.03 mmol/l among women;
- › blood pressure over 130/85 mmHg;
- › fasting glucose concentration over 6.1 mmol/l [19, 20].

In turn, in order to identify the MONW people, Wildman et al. used the criterion of a BMI below 25 kg/m², considering the co-existence of two or more metabolic abnormalities from their own list as the occurrence of metabolism disorders:

- › higher level of blood pressure;
- › lipid profile disorders, including a higher triglycerides level and reduced HDL cholesterol level;
- › higher fasting glucose concentration;
- › insulin resistance (HOMA > 5.13);
- › generalised inflammation (hsCRP (high-sensitivity C Reactive Protein) > 0.1 mg/l);
- › or treatment of the above-mentioned disorders [15].

A Korean researcher Choi et al. also used the BMI below 25 kg/m² in the diagnosis of MONW, and they used criteria of the recognition of metabolic syndrome proposed by the International Diabetes Federation (IDF), considering the co-existence of three or more of the following issues as an abnormality:

- › waist circumference \geq 90 cm among men and \geq 80 cm among women (for the Korean population);
- › blood pressure \geq 130/85 or recognised hypertension;
- › hypertriglyceridemia \geq 1.7 mmol/l;
- › reduced HDL cholesterol level among women < 1.3 mmol/l, among men < 1.0 mmol/l or treatment in order to increase its level;
- › fasting hyperglycemia \geq 6.1 mmol/l or recognised type 2 diabetes [21, 21].

Identical criteria were adopted in this year's research by Galić et al. [23].

Other parameters

In the literature in the area of the diagnosis of metabolic syndrome with normal body weight, we can also find proposals of the use of other indexes – including biochemical. Among others, an additional correlation between the occurrence of MONW and ferritin concentration in blood serum

over 127.03 ng/ml for women and 46.87 ng/ml for men was stated [24]. A positive correlation is observed also with the TyG index value (concentration of triglycerides \times fasting glucose/2) over 8.73 for women and 8.82 for men [25]. These parameters may be used to an early MONW recognition in the future.

Conclusions

It results from the short overview concerning the criteria of the diagnosis of MONW that the constant diagnostic element adopted by all the authors is the Body Mass Index (BMI). However, there is no common agreement on the boundary value for increased body mass (range from 23 to 27 kg/m²). In terms of assessment of metabolism disorders, the majority of researchers draw attention to carbohydrate metabolism or insulin resistance recognised on the basis of various criteria. The others considered the content and distribution of fat tissue in the body as the basis for the MONW recognition [9–18]. The researchers centred around Rudermann consider metabolism disorders, i.e. higher triglyceride content, reduced HDL cholesterol level, higher blood pressure [2, 15, 20, 22, 23] and generalised inflammation [15] as crucial. It is worth noting that the first criteria (**Table 1**) also took into consideration a higher uric acid concentration, body mass gain as an adult, predisposing medical history and family factors, while the most recent studies suggest a correlation between the occurrence of MONW and the ferritin level and TyG index [24, 25].

To sum up, despite a great deal of research conducted so far, it seems necessary to set up a group of experts in order to prepare uniform guidelines that will be applicable in everyday clinical practice.

Acknowledgements

Conflict of interest statement

The authors declare no conflict of interest.

Funding sources

There are no sources of funding to declare.

References

1. Tomiyama AJ, Hunger JM, Nguyen-Cuu J, Wells C. Misclassification of cardiometabolic health when using body mass index categories in NHANES 2005–2012. *Int J Obes (Lond)*. 2016 May;40(5):883–886.
2. Ruderman NB, Chrisholm D, Pi-Syner X, Schneider S. The metabolic obese, normal weight individual- revisited. *Diabetes*. 1998 May;47(5):699–713.
3. Dvorak RV, De Nino WF, Adas PA, Pohlman ET. Phenotypic characteristic associated with insulin resistance in metabolically obese but normal weight young women. *Diabetes*. 1999 Nov;48(11):2210–2214.
4. Bucyk B, Tupikowska M, Bednarek-Tupikowska G. Kryteria rozpoznania zespołu metabolicznego z prawidłową masą ciała (MONW). *Endokrynol Otyłość*. 2009 Dec;5(4):226–232.
5. Molero-Conejo E, Morales LM, Fernandez V, Raleigh X, Gómez ME, Semprún-Ferreira M, et. al. Lean adolescents with increased risk for metabolic syndrome. *Arch Latinoam Nutr*. 2003 Mar;53(1):39–46.
6. Goodpaster BH, Krishnaswami S, Resnick H, Kelley DE, Haggerty C, Harris TB, et. al. Association between regional adipose tissue distribution and both type 2 diabetes and impaired glucose tolerance in elderly men and women. *Diabetes Care*. 2003 Feb;26(2):372–379.
7. Conus F, Allison DB, Raabasa-Lhoret R, St-Onge M, St-Pierre DH, Tremblay-Lebeau A, et. al. Metabolic and behavioral characteristics of metabolically obese but normal-weight women. *J Clin Endocrinol Metab*. 2004 Oct;89(10):5013–5020.
8. Succurro, Marini MA, Frontoni S, Hribal ML, Andreozzi F, Lauro R, et. al. Insulin Secretion in Metabolically Obese, but Normal Weight, and Metabolically Healthy but Obese Individuals. *Obesity*. 2008 Aug;16(8):1881–1886.
9. Katsuki A, Sumida Y, Urakawa H, Gabazza EC, Murashima S, Maruyama N, et. al. Increased visceral fat and serum levels of triglyceride are associated with insulin resistance in Japanese metabolically obese, normal-weight subjects with normal glucose tolerance. *Diabetes Care*. 2003 Aug;26(8):2341–4234.
10. Katsuki A, Sumida Y, Urakawa H, Gabazza EC, Murashima S, Matsumoto K, et. al. Plasma levels of adiponectin are associated with insulin resistance and serum levels of triglyceride in Japanese metabolically obese, normal-weight man with normal glucose tolerance. *Diabetes Care*. 2003 Oct;26(10):2964–2965.
11. Katsuki A, Sumida Y, Urakawa H, Gabazza EC, Murashima S, Nakatani K, et. al. Increased oxidative stress is associated with serum levels of triglyceride, insulin resistance and hiperinsulinemia in Japanese metabolically obese, normal-weight man. *Diabetes Care*. 2004 Feb;27(2):631–632.
12. De Lorenzo A, Nartoli R, Vaia F, Di Renzo L. Normal weight obese (NWO) women: an evaluation of candidate new syndrome. *Nutr Metab Cardiovasc Dis*. 2006 Dec;16(8):513–523.
13. Romero-Corral A, Somers VK, Sierra-Johnson J, Korenfeld Y, Boarin S, Korinek J, et. al. Normal weight obesity: a risk factor for cardiometabolic dysregulation and cardiovascular mortality. *Eur Heart J*. 2010 Mar;31(6):737–746.
14. She JL, King MTC., Yi Y, Gulliver W, Sun G. Body fat percentage is associated with cardiometabolic dysregulation in BMI-defined normal weight subjects. *Nutr Metab Cardiovasc Dis*. 2012 Sep;22(9):741–747.
15. Wildman RP, Muntner P, Reynolds K, McGinn AP, Rajpathak S, Wylie-Rosett J, et. al. The Obese

- Without Cardiometabolic Risk Factor Clustering and the Normal Weight With Cardiometabolic Risk Factor Clustering Prevalence and Correlates of 2 Phenotypes Among the US Population (NHANES 1999–2004). *Arch Inter Med*. 2008 Aug 11;168(15):1617–1624.
16. Kim JY, Han SH, Yang BM. Implication of High-Body-Fat Percentage on Cardiometabolic Risk in Middle-Aged Healthy, Normal-Weight Adults. *Obesity*. 2013 Aug;21(8):1571–1577.
 17. Marques-Vidal P, Pécoudo A, Hayoz D, Paccaud F, Mooser V, Waeber G, et al. Prevalence of normal weight obesity in Switzerland: effect of various definitions. *Eur J Nutr*. 2008 Aug;47(5):251–257.
 18. Madeira FB, Silva AA, Veloso HF, Goldani MZ, Kac G, Cardoso VC, et al. Normal Weight Obesity Is Associated with Metabolic Syndrome and Insulin Resistance in Young Adults from a Middle-Income Country. *Plos One*. 2013;8(3):e60673. doi: 10.1371/journal.pone.0060673. Epub 2013 Mar 28.
 19. NCEP/ATP III. Third report of the National Cholesterol Education Program (NCEP) expert panel on detection, evaluation, and treatment of high blood cholesterol in adults (Adult Treatment Panel III). Final report. *Circulation*. 2002 Dec 17;106(25):3143–3421.
 20. St. Onge MP, Janssen I, Heynsfield SB. Metabolic syndrome in normal weight Americans. New definitions of metabolically obese, normal weight individuals. *Diabetes Care*. 2004 Sep;27(9):2222–2228.
 21. Alberti K, Eckel, Grundy S, Zimmet PZ, Cleeman JI, Donato KA, et al. Harmonizing the Metabolic Syndrome. A Joint Interim Statement of the International Diabetes Federation Task Force on Epidemiology and Prevention; National Heart, Lung and Blood Institute; American Heart Association; World Heart Federation; International Atherosclerosis Society; and International Association of the Study of Obesity. *Circulation*. 2009 Oct 20;120(16):1640–1645.
 22. Choi J, Se-Young O, Lee D, Tak S, Hong M, Park SM, et al. Characteristics of diet patterns in metabolically obese, normal weight adults (Korean national Health and Nutrition Examination III, 2005). *Nutr Metab Cardiovasc Dis*. 2012 Jul;22(7):567–574.
 23. Galić BS, Pavlica T, Udicki M, Stokić E, Mikalački M, Korovljević D, et al. Somatotype characteristics of normal-weight and obese women among different metabolic subtype. *Arch Endocrinol Metab*. 2016 Feb;60(1):60–65.
 24. Kim JW, Kim DH, Roh YK, Ju SY, Nam HY, Nam GE, et al. Serum Ferritin Levels Are Positively Associated With Metabolically Obese Normal Weight A Nationwide Population-Based Study. 2015 Dec;94(52):e2335. doi: 10.1097/MD.0000000000002335.
 25. Lee SH, Han K, Yang HK, Kim HS, Cho JH, Kwon HS, et al. A novel criterion for identifying metabolically obese but normal weight individuals using the product of triglycerides and glucose. *Nutr Diabetes*. 2015 Apr 27;5:e149. doi: 10.1038/nutd.2014.46.

Acceptance for editing: 2018-03-12
Acceptance for publication: 2018-03-27

Correspondence address:

Juliusz Przysławski
Chair and Department of Bromatology and Human
Nutrition, Poznan University of Medical Sciences
42 Marcelinska Street, 60-354 Poznan, Poland
phone: +48618547197
fax: +48618547198
email: jotespe@ump.edu.pl



REVIEW PAPER

DOI: <https://doi.org/10.20883/jms.2018.267>

Healthy lifestyles in the perspective of *homo eligens*

Piotr Stępiak

Department of Medical Law, Poznan University of Medical Sciences, Poland

ABSTRACT

The article is devoted to lifestyles in the context of health. According to vision of A. Siciński – lifestyle is a culturally conditioned way of meeting needs, habits and norms. They regulate the value systems adopted by an individual or group. Lifestyle is formed by the interaction of widely understood living conditions and individual patterns of behavior. Behaviors in turn are determined by personal characteristics and sociocultural factors. Lifestyle and health behaviors are shaped throughout a person's life, but its foundations are formed in childhood and adolescence. The author of the article considers that a key category in the analysis of pro or anti-healthy lifestyle is the free choice of man.

A man can decide how he wants to live and also in what health he wants to live. His choices determine the way of life. The theoretical basis for discussing in this article the above-mentioned issue will be Siciński's concept of so-called *homo eligens* which is little known, but worthy of dissemination. It is the most important part of his theory of lifestyles.

Keywords: life style, health, freedom of choice, patient, humanistic paradigm.

The article is devoted to factors influencing lifestyles in contemporary Poland in the context of their impact on health. The concept of lifestyle is a conceptual category that is often found with such concepts and definitions as a way of life, a cultural pattern of behavior, values and attitudes.

In the literature, there are many definitions of the lifestyle. For example, according to A. Tyszka, it is a culturally conditioned way of life, a model of life, a motive of action, a hierarchy of values, a directive and a means of their implementation. The lifestyle consists of a syndrome of subjective factors (e.g., aspirations) and objective factors (e.g., economic conditions). It expresses the balance between aspirations, awareness of needs, preferences and the possibility to satisfy needs¹.

¹ A. Tyszka, *Uczestnictwo w kulturze. O różnorodności stylów życia*, Warszawa, 1971, p. 87.

In turn, according to B. Fatyga, lifestyle is a culturally conditioned way of meeting needs, habits and norms. It is regulated by value systems adopted by individuals and groups. It manifests as an entirety of processes with multi-faceted, internal structural relationships. It means a specific set of daily behaviors of members of a certain community. They reflect their position enabling social identification².

According to another author – A. Siciński – lifestyle is a culturally conditioned way of meeting needs, habits and norms. They regulate the value systems adopted by an individual or group. Lifestyle is formed by the interaction of widely understood living conditions and individual pat-

² B. Fatyga, *Rzeczy i ich miejsce w konsumpcyjnym stylu życia. Antropologia współczesności. Animacja działań lokalnych*, Uniwersytet Warszawski; retrieved from: <http://www.antropologia.isns.uw.edu.pl>; access: 30.10.2017.

terns of behavior³. Behaviors in turn are determined by personal characteristics and sociocultural factors. Their patterns and standard reactions are transmitted to human in the process of his socialization. It decides on his lifestyle.

Taking into account the elements of the above definitions, for the purposes of this article, in some simplification, I assume that the concept of lifestyle means a culturally conditioned way of meeting needs, habits and norms. It is defined by value patterns accepted by individuals and groups. In terms of my interests, they define their attitude to health.

Lifestyle and health behaviors are shaped throughout a person's life, but its foundations are formed in childhood and adolescence. The process of its formation can be observed both at the individual level, i.e., a particular human being, and at the social level.

Different social groups that implement different lifestyles represent certain segments of the social structure, and thus also certain status features, including the economic position. The systems of these values are fundamental to the distinction between lifestyles at different levels of stratification. According to B. Fatyga they are called the principles of styles⁴. By transforming these principles into an individual level, they allow the implementer of life to feel their lives as relatively coherent and meaningful. By making choices between these values, a person acquires the qualities of the person who chooses.

Therefore, the author of the article considers that a key category in the analysis of pro or anti-healthy lifestyle is the *choice*. Its incorporation allows for the construction of a specific continuum, in which various behaviors that show human relation to own health can be accommodated. On the one hand, the extreme point of this continuum is determined by biologically, socially and culturally conditioned behaviors, i.e., those that a man doesn't affect. These behaviors are forced and necessary. On the other hand, the behaviors resulting from free choices, undertaken

in principle without any limiting conditions. These behaviors are the emanation of the free will of man.

In this context, the purpose of further consideration will be to draw attention to the importance of lifestyle choices that are visible in attitude towards one's own health, as well as their determinants. A man can decide how he wants to live and also in what health he wants to live. His choices determine the way of life, located on the indicated continuum between its extreme points.

The theoretical basis for discussing the above-mentioned issue will be Siciński's concept of so-called homo eligens which is little known, but worthy of dissemination. It is the most important part of his theory of lifestyles.

This author, considering the complexity of the problems related to the analysis of everyday life, points to the need to adopt different classifications of lifestyles. Following this thought, it should point out that one of them can be based on the criterion of relation to one's own health. It is visible in the decisions taken in this regard. According to A. Siciński, the main category of pro or anti-health lifestyle analysis would be the category of choices preceding these decisions. The basic criterion for distinguishing between the styles is the ability to select a style associated with a situation of choice. The other criteria relate to the lifestyle of the person making a choice in the environment in which they live.

Assuming indicated by A. Siciński perspective of the choices made by people in their daily life⁵, it can point to the typology of lifestyles that affect health. These are:

- › style restricting the ability to make health choices by an individual, formed in the unfavorable social (family) context;
- › style of avoiding health choices;
- › style of amplifying health as a primate value, a goal, a specific prescription for life;
- › conservative style which consists in suppressing health problems; preserving the existing health situation;
- › style of modifying the health situation.

The above typology shows, therefore, certain sets of attitudes and behaviors, as well as the general philosophy of human life. It takes into account the three spheres of reality, i.e., the

³ A. Siciński, *Style życia w miastach polskich (u progu kryzysu)* (in:) *Styl życia. Koncepcje, propozycje, odniesienia* (eds.) A. Siciński, Warszawa 1998, p. 19.

⁴ B. Fatyga, *Rzeczy i ich miejsce w konsumpcyjnym stylu życia. Antropologia współczesności. Animacja działań lokalnych*, Uniwersytet Warszawski; wersja internetowa, retrieved from: <http://www.antropologia.isns.uw.edu.pl>; access: 30.10.2017.

⁵ A. Siciński, *op. cit.*, p. 58.

worldview, goals and life aspirations, behaviors and activities, and the sphere of men's products.

The above-mentioned different lifestyles, which affect health, depend on the environment, social and cultural conditions, the economic and political situation of the state, and norms, values and beliefs that are recognized by the individual.

In this perspective, it is necessary to return to the earlier concept of *homo eligens*. The author, A. Siciński believes that it can be treated in two ways. First, as an existential thesis. It is based on the conviction that the meaning of human behavior cannot be reduced to the sum of reaction to conditions. Its essence is the ability to make choices, and thus to cross these determinants⁶.

This possibility is a traditional subject of dispute between representatives of various sciences, especially the humanities. Without discussing its essence, it should only be remembered that it has formed two essential positions in this respect, i.e., deterministic and indeterministic. Generally it can be said that this distinction results from the difficulty in resolving the issue of the extent to which a person can manage his or her behavior, so a person can decide about his or her actions in a more or less free way. In the context of my interest, it is the extent to which an individual can develop a pro or anti-health lifestyle.

Analyzing the various positions in this area, a compromise position of moderate indeterminism can be adopted for consideration of health choices. According to this variant, the free will of man in the choice of his own health experiences various, variable constraints. Except in extreme situations, they usually don't eliminate it completely. However, it would be sarcastic to note that man, to some extent, can liquidate his free will by himself. An example of this situation is an alcohol dependence, a lifestyle that is called alcoholism or addiction to drugs, recently also Internet addiction.

However, the analysis of the above mentioned issues in their relation to pro or anti-health lifestyles would be very interesting and probably needed, but for further consideration in this article, the second dimension of the concept of *homo eligens* is more useful. It is about its methodological aspect. It concerns the possibility of understanding social and psychological phe-

nomena. It is impossible without a look through the prism of the choices made by people. They must be taken into account during the construction of different dependency patterns, including in the medical sciences. Because, regardless of the degree of development, such as operating techniques, health or disease, the person decides ultimately, i.e., the patient. As a *homo eligens* can, e.g., refuse to undergo medical treatment. It will be under conditions, such as full consciousness, the manifestation of his free will. The complexity of this problem is evident in the difficult debate over the admissibility of euthanasia.

The concept of *homo eligens* as a methodological thesis may provide a good starting point for borders of medical interventions in health. Paradoxically, they are determined by the most interested, i.e., the patient. However, the issue is to what degree it is independent of the doctor. Discussion of medical decisions must take into account this aspect.

Considering the possibility of using the *homo eligens* concept to reflect on the essence and the determinants of these decisions, it is worth emphasizing that they are more about health in a broader perspective. In this approach, accepting the definition of health is decisive. The concept of health can be defined in different ways. At this point, I will indicate only positive and negative definitions. Representatives of the first of these trends point to the absence of disease or pain, and thus the state of functioning of the body and its individual organs, which don't disclose any of the known types of diseases and pathology⁷. It could be called normal, with the proviso that this is a rather an obscure term. It should be noted that this approach has a clear biological and medical dimension. It is difficult to refer them to the vision of *homo eligens*.

Contrary to this, proponents of the positive way of defining health more broadly define its essence, paying attention also to other aspects. This way is therefore more useful for thinking about lifestyle decisions. The definition formulated by the World Health Organization in 1948 is an example. According to it, health is a state of equilibrium and bio-psychosocial well-being

⁶ A. Siciński, *Styl życia, kultura, wybór*, Warszawa 2002, p. 81.

⁷ Cf. e.g.: R. Gil, A. Dziedziczko, *Pojęcie świadomości zdrowotnej, zdrowia i choroby*. *Zdrowie Publiczne*, n° 2/2004, p. 253.

that allows an individual to adapt to the environment and realize life plans and aspirations. The indicators of good health can be: human activity, self-fulfillment, ability to perform social roles and tasks, positive relationships with the environment, and ability to adapt to social change⁸.

This definition has many advantages for further discussion in this article. It is worth mentioning them briefly. Thus, it departs from the earlier, reductionist understanding of health in biological terms. It accentuates its multidimensional, which is evident in the diverse needs of man, i.e., biological, psychic and social. It also draws attention to subjective health, breaking the monopoly of medicine for its definition. Finally, it sets health in a wider social context and emphasizes its association with cultural values and norms.

This definition allows associating health with the different lifestyles of the modern world. On the basis of this it is also possible to raise the question of the importance of the health choices made by a man with free will. These issues are becoming more important, because it becomes increasingly widespread view that one of the most important factors affecting the man's health in the modern world is the lifestyle.

Lifestyle can be analyzed at two levels, i.e., individual and social. I will continue focusing on the first one which refers to the concept of *homo eligens* indicated in the title of the article.

A person who chooses, forms his style of life in an autonomous way, using the attribute of free will, also in the choices about their own health. He or she has more or less fundamental influence on this style. In this context, it is easy to show that among the determinants of human health, free choices are of prime importance. They decide whether it is a pro or anti-health style.

It is worth recalling that in the national health programs since 1996, it is assumed that lifestyle dominates among the different determinants of good health. Its part is estimated at 50.00% in their general structure, while genetic factors at 20.00% and health care at 10.00-15.00%⁹.

Analyzing the importance of a particular lifestyle for maintaining good health in more detail and in light of the above indicators, it is important to

note that its determinants are defining behavior. It is about health-promoting behaviors, which, in the light of modern medical knowledge, have a positive effect on health. Although they are formed throughout life or not, the period of childhood and adolescence is decisive in this respect. However, it is worth noting that the importance of free choices in terms of health behavior is relatively small at this stage of human development. This is due to the fact that his psyche is still developing and the degree of maturity and autonomy of thinking is not generally high. On the other hand, the value and importance of good health are socialized. The message and patterns passed by parents, school, peers, mass media, and various services and medical entities have the impact on the effects of this socialization (positive or negative). Our own health experiences, which in the period of adolescence aren't generally large, but grow over time, also play a role. Pro or anti-health behaviors become an indicator of psychological and social maturity. They also decide on the fixation of a particular lifestyle.

Regardless of the various sources of message and cultural patterns, at the social level, the following standards of healthy lifestyles are commonly indicated and accepted.

- › In the field of physical health – attention to the body and the immediate environment, physical activity, rational nutrition, tempering, sleep – appropriate duration and quality.
- › As related to psychosocial health – using and providing social support, avoiding excess stress and dealing with problems and stress.
- › In terms of preventive behaviors:
 - self-control of health, self-examination, submission to preventive examinations,
 - safe behavior in everyday life (especially in the road, at work), safe behavior in sexual life,
 - avoiding risky behaviors (e.g., smoking, alcohol abuse, abuse of medicines not recommended by the doctor, use of drugs and other psychoactive substances)¹⁰.

A similar list of healthy behaviors was formulated by J. Wardle, A. Steptote¹¹. They assumed

⁸ D. Callahan, The WHO definition of health, *Hastings Century Studies*, n° 3/1973, p. 77.

⁹ J. Domaradzki, O definicjach zdrowia i choroby, *Folia Medica Lodziensia*, n° 40/2013, p. 7.

¹⁰ Cf. D. Ponczek, I. Olszowy, Styl życia młodzieży i jego wpływ na zdrowie, *Problemy Higieny i Epidemiologii*, n° 2/2012, p. 262.

¹¹ J. Wardle, A. Steptote, The European Health and Behaviour Survey: rationale, methods and initial results from the United Kingdom, *Social science and Medicine*, vol. 8/1991, p. 929.

that leading a healthy lifestyle requires: not smoking, to reduce alcohol consumption, physical activity, use a healthy, balanced diet with a particular focus on the right breakfast and not eating between meals, safe sexual behavior, stress avoidance and stress reduction skills, moderate exposure to the sun, adhering to road safety rules, finally, performing periodic preventive examinations and self-examination (self-control of the body)¹².

Referring to the issue of free human choices which affect different behaviors within the pro or anti-healthy lifestyle, it should be emphasized that the final decisions are made by the individual. An important research task is to identify the factors that affect certain decisions and choices. As I have already indicated the concept of *homo eligens* is particularly useful as a methodological thesis for undertaking such research. It allows to define the way and the logic of the procedure. However, this provides the basis for an analysis of lifestyles influencing the health situation only at the level of individual behavior. It is therefore only one of the methodological proposals, clearly compromise. Its possible adaptation to a higher level of analysis, for example the local environment, or the general society would require considerable simplification, and even resign from the analysis of the factor of free choice as too individual. Synthesized approaches are based on frameworks of factors determining pro or anti-health lifestyles. They include what is suitable for generalizations, typical, useful for discussion at different levels of analysis. Therefore, it is difficult, to include in them a poorly perceptible factor of individual choice, i.e., individual, autonomous decision.

The combination of individual and social level of health decisions is one of the most difficult questions in research methodology. The author has no ambition to solve it. Nevertheless, I will try to point out certain premises and assumptions in this direction, based on the humanistic vision of the human being – the patient.

So, first of all, it is worth combining the theses of A. Siciński, concerning the styles of life in contemporary Poland, including the lifestyles of the

¹² E.g., piersi u kobiet. Cf.: A. Ostrowska, Prozdrowotne style życia [in:] Styl życia a zdrowie, z zagadnień promocji zdrowia (eds.) A. Ostrowskiej, Warszawa 1999, p. 28.

family¹³ with the attempt to integrate the theory of socialization Ch. E. Frazier and Jan Włodarek¹⁴.

This combination provides a good theoretical basis for constructing humanistic research models of lifestyle influencing health. Therefore, this allows to include the concept of *homo eligens* in the field of view. It can be used to avoid a too reductionist interpretation of the possible indicators of pro-health attitudes, thus to determine the impact that factors other than biological-medical factors have on these attitudes. The point is to draw attention to the importance of different styles of life in the typical environments of modern Poland. As I have already indicated, they are associated with free health choices.

Ignoring them as pro or anti-health factors results in an incomplete dependency model. This determines that the determinants of health-oriented attitudes don't decide definitively about their formation or not. On the other hand, the lifestyle is a sociological category, a free choice – philosophical, so with a reductionist approach to the problem, their use in medical schemes can be a source of resistance.

However, constructing models with a broader intellectual perspective, going beyond a strictly medical point of view, is becoming more and more intentional. It takes into account current, interdisciplinary trends in scientific methodology. It is therefore worth trying to indicate the theoretical premises for them. They should take into account the following assumptions.

1. They must be multi-factorial, multi-faceted. Lifestyle is a complex factor resulting from the overlap or interaction of many different determinants simple or single-minded.
2. It should be indicated what a lifestyle factor means.

Unfortunately, this isn't easy, so the research model that include this factor can be quite unclear. In Poland, lifestyle research was conducted, among others, by A. Siciński¹⁵. By this

¹³ Cf.: T. Siciński (eds.) Style życia w miastach polskich. Wrocław 1988; Badania „rozumiejące” style życia: narzędzia. Praca zbiorowa (eds.) A. Siciński i A. Wyki, Warszawa 1988.

¹⁴ Cf. these Authors: Integracja teorii dewiacji. Podejście indukcyjne z zastosowaniem materiału biograficznego. Ruch Prawniczy, Ekonomiczny i Socjologiczny 1981, n° 4, p. 171 et seq.

¹⁵ A. Lipski, Styl życia jako problem zdrowia społecznego, Ruch Prawniczy, Ekonomiczny i Socjologiczny, zeszyt 1/1998.

concept, he understood the set of daily behaviors, specific to a given community or individual, or, in other words, a distinctive "way of being" that distinguishes a given collective or individual from others", manifesting its social position¹⁶. According to this author, this term includes not only human behavior, but also "psycho-physical mechanisms that underlie these behaviors: human motivations, needs, accepted values", so all the factors that cause that behavior and others are chosen from the repertoire of behaviors which are designated by a given culture, in more or less conscious or even unconscious manner¹⁷.

As we can see, changing the above theses into an operational definition of pro or anti-health lifestyle is a difficult task, its solution would require the completion of specific indicators. However, A. Siciński shows examples, the most important of them in the behavioral and axiological dimensions are:

- › human time budget (including the periodicity of his behavior),
- › work,
- › consumption of material goods (including "general attitude towards the world of things"),
- › hygiene and attitudes towards health (and illness),
- › intellectual and aesthetic needs (participation in culture and education),
- › recreation,
- › participation in sociopolitical life,
- › attitude towards religion,
- › forms of coexistence between people (in the family, social groups, neighborhood, etc.) moreover, distinguished by A. Siciński as "psychosocial nature",
- › value systems (felt and recognized) and
- › human self-identification¹⁸.

The above-mentioned catalog of indicators could thus be a good starting point for formulating research assumptions and analyzing possible relationships between the lifestyles of people from different social backgrounds and shaping or not, pro-health attitudes.

3. The study of these relationships would also require factors such as the level and type of education, economic status, type of work performed, the nature of the environment of origin and the environment of living¹⁹.

4. The dependency model should finally take into account the humanistic vision of man²⁰.

It assumes that a person formed his or her attitude towards health by making various choices. These choices are an expression of his free will. The problem is how the free-will factor can be defined in an appropriate form for the research. This is the main problem of adopting the concept of *homo eligens* as a methodological thesis.

In conclusion, it follows from the above that the formulation a framework for research on the role of pro or anti-health lifestyles in maintaining good health or not is a difficult and risky task regard to the result. It assumes the construction of generalizing schemes that simplify the essence. They lose individual factors, unique, but often decisive for the effect. However, it is an impossible task to capture a detailed, complex map of individual, partial relationships and interactions. Although a consequence of this has to be a difficult methodological compromise, resulting in some schematization and simplification of research results, there is no other way of proceeding at the present stage of methodology development.

It follows that it is necessary to decide on the necessity of simplification by taking into account the possibility of applying the concept of *homo eligens* to a model of research into factors determining pro or anti – health lifestyle. It concerns concentrating on the operational definition of the decision. In this view, it can be assumed that they are indicators of a specific human will. They become its behavioral determinant. They determine the intensity of healthy behavior.

Defining for the needs of the proposed model, it is worth noting the definition of the concept of these behaviors by H. Sękowa. According to her, these are reactions to the situation, as well as the habits and purposeful activities, i.e., behav-

¹⁶ T. Siciński (eds.) *Styl życia. Koncepcje i propozycje*, Warszawa 1976, p. 25.

¹⁷ T. Siciński (eds.) *Styl życia. Przemiany we współczesnej Polsce*, Warszawa 1978, p. 155

¹⁸ T. Siciński (eds.) *Styl życia. Przemiany...*, p. 156.

¹⁹ The following works by this author should be indicated: *Od naturalizmu do humanizmu w kryminologii*. Katowice 1991 and *Kryminogeneza w ujęciu kryminologii humanistycznej*. Katowice 1997.

²⁰ The pioneer of this trend in Polish science is L. Tyszkiewicz. Cf. this author: *Od naturalizmu do humanizmu...*

iors that remain within a certain objective or subjective knowledge, in relation to health. These behaviors may favor balancing of the burden and the action of pathological factors, they may interfere with this process and cause a violation of immune resources²¹. Therefore, it is important in health behaviors to have subjective knowledge, associated with subjective beliefs and so-called objective knowledge connected with possessing medical and socio-philosophical information²².

Therefore, if the above remarks refer to the issue of choices about pro or anti-healthy lifestyle, then the conclusion is that having this knowledge depends on many factors. However, the result of the so-called primary socialization can be decisive. It is made in the family. As a result, an adolescent learns some health habits and also acquires some knowledge about health and its value. However, environmental diversity causes that habits and knowledge in this area aren't uniform, determined by many factors (e.g., parent education, family financial conditions, etc.). Good material conditions are conducive to good health and vice versa. Poverty is negatively related to health and is associated with illness and high mortality. These facts are traditionally indicated.

Assigning great importance to individual decisions and behaviors, it should be noted that they are determined by the syndrome of cultural, environmental and socioeconomic factors. They define what is termed lifestyle.

In this context, it is therefore possible to raise the question of the ability to make the right choices in the protection of one's own health by persons whose socialization was disturbed, e.g., in pathological families. Analyzing the factors that affect it, it is important to mention two of them in particular. The first is their living environment, so the factor for which the growing man doesn't have too much influence. The second, however, is individual decision making in terms of own health. It can be assumed that in the pathological environment this possibility is severely limited.

²¹ H. Sęk, Subiektywne koncepcje zdrowia, świadomość zdrowotna a zachowania zdrowotne i promocja zdrowia (in:) Promocja zdrowia. Psychologiczne podstawy zdrowia (eds.) Z. Ratajczak i H. Heszen –Niejodek, Katowice 1997, p. 45.

²² K. Puchalski, Zachowania związane ze zdrowiem jako przedmiot nauk socjologicznych (in:) Zachowania zdrowotne (eds.) W.A. Gniazdowskiego, Łódź 1990, p. 177.

This is due to the limitation of human independence from other people living in these environments with him. The extent of his autonomy in terms of health choices is limited by factors that could be described as their antecedents.

Antecedents pro or anti-health, because this name could be supplemented with this adjective, also include factors and situations in which homo elogens have no influence. In other words, they are independent of his will. The result of a given life situation, e.g., a birth in the family from the margins of society. It is shaped objectively and is difficult to predict, so nothing is the rule. In this form, antecedents health choices, related to this and other lifestyles, are quite elusive syndrome of conditioning attributes. At this point, only some of them can be given as an example. These are:

- › Starting factors, e.g., temperament, intelligence, psychological mood, sex, education, negative family environment, place in the stratified structure of society, social status, the character of the neighborhood environment.
- › Generalized needs, such as sex, friendship, excitement.
- › Earlier health experience and knowledge about health, perceived solutions in terms of meeting the health needs (legal and illegal, such as taking drugs that alleviate pain or stress).
- › Evaluation of the available solutions, taking into account the effort required, speed and facility of achieving the effect, as well as the cost.
- › Factors of social exclusion, i.e., alcoholism, drug addiction, vagabonding, long-term stay without meaningful occupation, especially without work, learned helplessness towards their own health problems, or their disregard.

We get a multi-element model of conditioning attributes, including risk factors by entering the above antecedents into the process of developing pro or anti-healthy lifestyle of people from different social backgrounds (including pathological). On the one hand, it includes exogenous factors, including in particular environmental and social factors and situational factors. On the other hand, it includes endogenous factors, including somatic (genetic) and personality factors.

As we can see, the system of the antecedents is highly complex and it is multi-causal. As a result, the methodological concept of the man

who choose, formulated by T. Siciński, based on this system, can only be a certain vision. I use the word *vision* with full awareness. In the form presented in this article, it is an intellectual construct with a relatively low degree of finish.

Nevertheless, it may be an interesting, attractive starting point for analyzing the effects of non-medical factors, including lifestyles, on health. The daily experiences of people, patients, and medical staff confirm this. Modern medicine therefore should not distract from them. Recognition of the patient's freedom of choice is also consistent with the latest trends in behavioral sciences. According to it, the acceptance of the humanistic paradigm in the medical sciences gives it the highest possible rank in the sphere of existence.

Acknowledgements

Conflict of interest statement

The authors declare no conflict of interest.

Funding sources

There are no sources of funding to declare.

References

1. Callahan D. The WHO definition of health, Hastings Century Studies. 1973;3.
2. Domaradzki J. O definicjach zdrowia i choroby. Folia Medica Lodziensia. 2013;40.
3. Fatyga B. Rzeczy i ich miejsce w konsumpcyjnym stylu życia. Antropologia współczesności. Animacja działań lokalnych, Uniwersytet Warszawski; retrieved from: <http://www.antropologia.isns.uw.edu.pl>; access: 30.10.2017.
4. Gil R, Dziedziczko A. Pojęcie świadomości zdrowotnej, zdrowia i choroby. Zdrowie Publiczne. 2004;2.
5. Lipski A. Styl życia jako problem zdrowia społecznego, Ruch Prawniczy, Ekonomiczny i Socjologiczny. 1998;1.
6. Ostrowska A. Prozdrowotne style życia. In: Ostrowska A. (ed.). Styl życia a zdrowie, z zagadnień promocji zdrowia. Warszawa 1999.
7. Ponczek D, Olszowy I. Styl życia młodzieży i jego wpływ na zdrowie. Problemy Higieny i Epidemiologii. 2012;2.
8. Puchalski K. Zachowania związane ze zdrowiem jako przedmiot nauk socjologicznych. In: Gniazdowski WA (ed.). Zachowania zdrowotne. Łódź 1990.
9. Sęk H. Subiektywne koncepcje zdrowia, świadomość zdrowotna a zachowania zdrowotne i promocja zdrowia. In: Ratajczak Z, Heszen-Niejodek H (eds.). Promocja zdrowia. Psychologiczne podstawy zdrowia. Katowice 1997.
10. Siciński T (ed.). Styl życia w miastach polskich. Wrocław 1988; Siciński A, Wyki A (eds.). Badania „rozumiejące” style życia: narzędzia. Praca zbiorowa. Warszawa 1988.
11. Siciński T (ed.). Styl życia. Koncepcje i propozycje. Warszawa 1976.
12. Siciński T (ed.). Styl życia. Przemiany we współczesnej Polsce. Warszawa 1978.
13. Siciński A. Styl życia, kultura, wybór. Warszawa 2002.
14. Siciński A. Styl życia w miastach polskich (u progu kryzysu). In: Siciński A (ed.). Styl życia. Koncepcje, propozycje, odniesienia. Warszawa 1998.
15. Tyszka A. Uczestnictwo w kulturze. O różnorodności stylów życia. Warszawa 1971.
16. Tyszkiewicz L. Od naturalizmu do humanizmu w kryminologii. Katowice 1991.
17. Wardle J, Steptoe A. The European Health and Behaviour Survey: rationale, methods and initial results from the United Kingdom, Social Science and Medicine. 1991;8.

Acceptance for editing: 2018-03-12
Acceptance for publication: 2018-03-27

Correspondence address:

Piotr Stępnik
Department of Medical Law
Poznan University of Medical Sciences, Poland
11 Smoluchowskiego Street, 60-179 Poznań, Poland
email: pstepniak@ump.edu.pl



CASE STUDY

DOI: <https://doi.org/10.20883/jms.2018.296>

Minimally invasive facial skin revitalization treatment – a case study

Teresa Matthews-Brzozowska¹, Monika Łacka², Weronika Kawałkiewicz³, Ewa Mojs⁴, Leszek Kubisz³

¹ Chair and Clinic of Maxillofacial Orthopaedics and Orthodontics, Poznan University of Medical Sciences, Poland

² Facial Aesthetics Laboratory, Chair of Maxillofacial Orthopaedics and Orthodontics, Poznan University of Medical Sciences, Poland

³ Chair and Department of Biophysics, Poznan University of Medical Sciences, Poland

⁴ Chair and Department of Clinical Psychology, Poznan University of Medical Sciences, Poland

ABSTRACT

The increasing longevity of today's societies has created a considerable need for the revitalization of facial skin undergoing the ageing processes. It is important to undertake preventive measures and start therapy when the first signs of ageing appear. This makes it possible to achieve a satisfactory effect while using minimally invasive procedures. Among them, treatments based on autologous preparations occupy a significant place, such as those using stem cells and concentrated growth factors (CGF), which have recently been introduced on the Polish market. Such a procedure was used on the patient described in this paper. In a series of instrumental studies, after three administrations of CGF-Harmony, improved values for the measurements reflecting skin elasticity were obtained, which was confirmed by instrumental examination of the skin using a Cutometer Dual MPA 580. Instrumental analysis of the mechanical parameters of facial skin makes it possible to demonstrate the effectiveness of treatment in the field of facial aesthetic medicine.

Keywords: face, revitalization, CD34+ stem cells, concentrated growth factors (CGF).

Introduction

When planning facial skin rejuvenating or revitalizing therapy (Latin re-vita: restoring to life, reviving) practitioners in facial aesthetic medicine base their knowledge on the current canons of beauty and anthropometric measurements. The individual predispositions of patients mean that there is no universal way of maintaining the good condition of facial skin. In addition to correctly diagnosing the specific needs of each patient, the physician should be familiar with the anatomy and morphology of the face, take into account the principles of biophysics, and possess a unique sense of aesthetics [1, 2]. However, taking into account the existing norms and canons of beauty

is not enough. When planning a course of treatment, the practitioner should also focus on the psycho-aesthetic aspect, i.e. looking at the face through the prism of the patient's expectations. Everyone has their own subjective way of perceiving attractiveness, which is determined by such factors as individual preferences, sensitivity to and subjective perception of beauty, cultural aspects as well as pressure from the media or society, especially peer groups; and these factors may be different for the doctor and the patient [3]. One of the first signs of ageing is the thinning of the skin around the eyes, especially in the area of the lower eyelid [4, 5]. The rate of these changes depends on the natural predispositions of the

body, e.g. a decrease in the number of fibroblasts or in hormone levels, but also on external factors such as smoking, exposure to the sun and artificial UV sources, and many others [1, 3].

CD34+ stem cells and concentrated growth factors (CGF)

A recent development on the market of facial aesthetic medicine services is a treatment based on the application of natural stem cells and growth factors in the form of a gel. The procedure begins with obtaining the patient's venous blood, to which low molecular weight heparin is then added and the mixture undergoes centrifugation in a special blood cell separator. The separator is a highly technologically advanced device because it has electrostatic and electromagnetic shielding and a range of different centrifugation speeds programmed, which makes it possible to obtain stem cells while at the same time protecting the delicate morphotic elements from damage. As a result, 3 plasma layers are obtained: the upper layer – platelet poor plasma (PPP), which will be heated to 75 degrees Celsius, producing the aggregation of albumins and forming an APAG gel (Activated Plasma Albumin Gel); the middle layer – platelet rich plasma (PRP); and the deep layer – between the erythrocytes and PRP (approximately 0.4 ml), containing CD34 + stem cells.

During the process of obtaining CGF, the growth factors in the blood platelets and stem cells are concentrated 16 times in relation to the initial quantity contained in peripheral blood [6]. From above the erythrocyte layer the concentrated growth factors fraction, together with the stem cells, are obtained and combined with the APAG gel, which after application significantly extends the duration of the preparation's therapeutic action (up to 7 days). This is especially important in cases requiring more effective stimulation. Stem cells have a regenerative effect; among other things, they stimulate angiogenesis, they can differentiate into fibroblasts and keratinocytes, as well as stimulating the stem cells present in the epidermis and dermis for immediate regeneration of the skin through the released growth factors. Therefore, the prolonged release of growth factors using the CGF-Harmony procedure is more beneficial than using other autologous preparations [7].

The predictability of treatment results and a successful final outcome depend on the correct diagnosis of the patient and determining realistic treatment goals after a comprehensive analysis of their facial skin. There is a wide variety of skin revitalization methods. Some treatments offered by facial aesthetic medicine give almost immediate effects; others, such as the application of stem cells and growth factors, more gradually, but quite quickly and noticeably improve the appearance and structure of the skin. Aesthetic medicine procedures are increasingly popular among women, especially those that produce a relatively quick desired aesthetic effect, involve few potential complications and ensure patient satisfaction. Such treatments, which include the use of autologous preparations, enable women to lead a "race against time" and "improve nature" without the need for hospitalization or even temporarily withdrawing from their working lives [8].

The aim of this study was to show the effect of the changing values in the mechanical parameters of facial skin after three applications of stem cells and growth factors (CGF Harmony).

Case study

A 40-year-old female patient came to the Facial Aesthetics Laboratory/Centre in the Chair of Maxillofacial Orthopaedics and Orthodontics at the Poznań University of Medical Sciences in order to improve the appearance of her skin and enhance the contour of her face. According to her medical history, the patient had not had any cosmetic procedures before, except for an irregular use of face creams, mainly moisturizers of various brands. As regards facial medicine procedures, the woman had undergone a treatment based on an autogenic preparation (PRP) preceded by a Nomelan Cofeico chemical peel. One year later, the patient decided to again try a facial aesthetic medicine treatment, and the CGF Harmony procedure was recommended to her. The mechanical parameters of the facial skin were examined using a Cutometer Dual MPA 580, assessing parameters R0 to R9 at fixed measurement sites (**Figure 1**) four times: before the three applications of CGF Harmony; after six months between the 1st and 2nd treatment; two months later; and finally after another 2 months (**Table 1**). After the first application, the patient reported a persistent



Figure 1. Measurement sites

and long-lasting (about two weeks), though difficult to specify, discomfort of the facial skin with minor bruising and swelling, hence she decided to have the second treatment after 6 months. After the second application the patient did not experi-

ence such long-lasting discomfort, it passed after a few days, and there was just slight bruising and swelling. After the final application the reaction was decidedly milder, with only very slight bruising and no swelling.

Justification for the proposed medical procedure

CGF Harmony was recommended because of the proven regenerative properties of stem cells and concentrated growth factors; their synergistic actions stimulating skin repair processes, including angiogenesis, which are adapted to the skin's needs and the body's capabilities; as well as anti-inflammatory properties which accelerate healing, preventing scarring or keloids. The treatment guaranteed obtaining improvement in the facial contour as well as skin firmness, elasticity and tone, and, consequently, reducing fine lines and restructuring the facial skin in the most natural and physiological way.

All the tests were carried out under the same conditions, at a temperature of 21° C and with air

Table 1. Values for the mechanical parameters of the patient's facial skin in a series of tests

EYE BOTTOM												
Visit	1			2			3			4		
Parameter	LEFT	RIGHT	MEAN	LEFT	RIGHT	MEAN	LEFT	RIGHT	MEAN	LEFT	RIGHT	MEAN
R0 [mm]	0.16	0.18	0.17	0.26	0.27	0.27	0.29	0.34	0.32	0.31	0.27	0.29
R1 [a.u.]	0.05	0.7	0.38	0.1	0.11	0.11	0.09	0.11	0.10	0.1	0	0.05
R2 [a.u.]	0.69	0.59	0.64	0.62	0.61	0.62	0.7	0.67	0.69	0.67	1	0.84
R3 [mm]	0.2	0.24	0.22	0.31	0.32	0.32	0.35	0.42	0.39	0.39	0.58	0.49
R4 [mm]	0.08	0.11	0.10	0.13	0.11	0.12	0.1	0.19	0.15	0.16	0.2	0.18
R5 [a.u.]	0.85	0.63	0.74	0.53	0.44	0.49	0.62	0.66	0.64	0.59	0.78	0.69
R6 [a.u.]	1.22	0.97	1.10	0.74	0.5	0.62	0.7	1.05	0.88	1.05	0.6	0.83
R7 [a.u.]	0.38	0.32	0.35	0.3	0.29	0.30	0.36	0.32	0.34	0.29	0.49	0.39
R8 [mm]	0.11	0.11	0.11	0.16	0.17	0.17	0.21	0.23	0.22	0.21	0.27	0.24
R9 [mm]	0.04	0.06	0.05	0.05	0.05	0.05	0.05	0.08	0.07	0.09	0.31	0.20
R8/R0 [%]	68.75	61.11	64.93	61.54	62.96	62.25	72.41	67.65	70.03	67.74	100.00	83.87
EYE TOP												
Visit	1			2			3			4		
Parameter	LEFT	RIGHT	MEAN	LEFT	RIGHT	MEAN	LEFT	RIGHT	MEAN	LEFT	RIGHT	MEAN
R0 [mm]	0.23	0.24	0.24	0.36	0.35	0.36	0.37	0.38	0.38	0.42	0.42	0.42
R1 [a.u.]	0.07	0.02	0.05	0.13	0.12	0.13	0.16	0.09	0.13	0.18	0.02	0.10
R2 [a.u.]	0.71	0.94	0.83	0.66	0.65	0.66	0.56	0.76	0.66	0.57	0.96	0.77
R3 [mm]	0.29	0.33	0.31	0.42	0.4	0.41	0.44	0.43	0.44	0.51	0.35	0.43
R4 [mm]	0.08	0.02	0.05	0.21	0.17	0.19	0.21	0.1	0.16	0.26	0	0.13
R5 [a.u.]	0.68	1.03	0.86	0.44	0.5	0.47	0.41	0.61	0.51	0.43	0.59	0.51
R6 [a.u.]	0.99	1.12	1.06	0.53	0.45	0.49	0.58	0.69	0.64	0.77	0.86	0.82
R7 [a.u.]	0.34	0.49	0.42	0.29	0.35	0.32	0.26	0.36	0.31	0.24	0.32	0.28
R8 [mm]	0.16	0.22	0.19	0.24	0.23	0.24	0.2	0.29	0.25	0.24	0.4	0.32
R9 [mm]	0.06	0.1	0.08	0.05	0.05	0.05	0.07	0.05	0.06	0.08	-0.06	0.01
R8/R0 [%]	69.57	91.67	80.62	66.67	65.71	66.19	54.05	76.32	65.18	57.14	95.24	76.19

Table 1 continued

CHEEK												
Visit	1			2			3			4		
Parameter	LEFT	RIGHT	MEAN	LEFT	RIGHT	MEAN	LEFT	RIGHT	MEAN	LEFT	RIGHT	MEAN
R0 [mm]	0.28	0.26	0.27	0.36	0.35	0.36	0.31	0.31	0.31	0.24	0.27	0.26
R1 [a.u.]	0.05	0.03	0.04	0	0	0.00	0	0	0	0	0	0.00
R2 [a.u.]	0.82	0.88	0.85	1	1	1.00	1	1	1	1	1	1.00
R3 [mm]	0.33	0.31	0.32	0.41	0.39	0.40	0.36	0.36	0.36	0.29	0.31	0.30
R4 [mm]	0.09	0.04	0.07	0.07	0.06	0.07	0	0	0	0	0.05	0.03
R5 [a.u.]	0.67	0.96	0.82	0.68	0.63	0.66	0.96	0.96	0.96	1.88	0.61	1.25
R6 [a.u.]	0.78	0.83	0.81	0.54	0.53	0.54	0.72	0.72	0.72	1.6	0.58	1.09
R7 [a.u.]	0.38	0.52	0.45	0.44	0.41	0.43	0.56	0.56	0.56	0.72	0.38	0.55
R8 [mm]	0.23	0.22	0.23	0.36	0.35	0.36	0.31	0.31	0.31	0.24	0.27	0.26
R9 [mm]	0.06	0.05	3.03	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.04	0.05
R8/R0 [%]	82.14	84.62	83.38	100.00	100.00	100.00	100.00	100.00	100	100.00	100.00	100.00
LIPS BOTTOM												
Visit	1			2			3			4		
Parameter	LEFT	RIGHT	MEAN	LEFT	RIGHT	MEAN	LEFT	RIGHT	MEAN	LEFT	RIGHT	MEAN
R0 [mm]	0.27	0.24	0.26	0.32	0.42	0.37	0.36	0.37	0.37	0.28	0.43	0.36
R1 [a.u.]	0.04	0.03	0.04	0	0.05	0.03	0	0	0.00	0.07	0.01	0.04
R2 [jau.]	0.85	0.86	0.86	1	0.87	0.94	1	1	1.00	0.74	0.99	0.87
R3 [mm]	0.33	0.3	0.32	0.37	0.47	0.42	0.41	0.43	0.42	0.32	0.44	0.38
R4 [mm]	0.06	0.04	0.05	0	0.06	0.03	0	0	0.00	0.1	0.05	0.08
R5 [a.u.]	1.01	1.14	1.08	0.8	0.72	0.76	1.32	1.02	1.17	0.54	0.5	0.52
R6 [a.u.]	0.92	0.9	0.91	0.5	0.49	0.50	0.62	0.81	0.72	0.47	0.29	0.38
R7 [a.u.]	0.52	0.6	0.56	0.53	0.49	0.51	0.81	0.56	0.69	0.37	0.39	0.38
R8 [mm]	0.23	0.2	0.22	0.32	0.37	0.35	0.36	0.37	0.37	0.21	0.42	0.32
R9 [mm]	0.06	0.06	0.06	0.05	0.05	0.05	0.05	0.06	0.06	0.04	0.01	0.03
R8/R0 [%]	85.19	83.33	84.26	100.00	88.10	94.05	100.00	100.00	100.00	75.00	97.67	86.34
LIPS TOP												
Visit	1			2			3			4		
Parameter	LEFT	RIGHT	MEAN	LEFT	RIGHT	MEAN	LEFT	RIGHT	MEAN	LEFT	RIGHT	MEAN
R0 [mm]	0.27	0.29	0.28	0.41	0.26	0.34	0.3	0.33	0.32	0.32	0.39	0.36
R1 [a.u.]	0.04	0.09	0.07	0.05	0	0.03	0	0	0.00	0.06	0.08	0.07
R2 [a.u.]	0.86	0.7	0.78	0.88	1	0.94	1	1	1.00	0.82	0.8	0.81
R3 [mm]	0.32	0.34	0.33	0.46	0.3	0.38	0.34	0.39	0.37	0.33	0.42	0.38
R4 [mm]	0.06	0.11	0.09	0.1	0	0.05	0	0	0.00	0.1	0.11	0.11
R5 [a.u.]	1	0.68	0.84	0.68	0.94	0.81	1.02	1.26	1.14	0.58	0.52	0.55
R6 [a.u.]	0.73	0.52	0.63	0.48	0.72	0.60	0.63	0.88	0.76	0.55	0.28	0.42
R7 [a.u.]	0.58	0.44	0.51	0.46	0.55	0.51	0.63	0.67	0.65	0.38	0.4	0.39
R8 [mm]	0.23	0.2	0.22	0.36	0.26	0.31	0.3	0.33	0.32	0.26	0.31	0.29
R9 [mm]	0.05	0.05	0.05	0.06	0.04	0.05	0.04	0.07	0.06	0.01	0.03	0.02
R8/R0 [%]	85.19	68.97	77.08	87.80	100.00	93.90	100.00	100.00	100.00	81.25	79.49	80.37

humidity in the range of 40–60%. Before each examination, the facial skin was wiped with micellar water and then the patient underwent a 20-minute adaptation to the conditions specified above. The mean values from the 6 measurements obtained at the measurement sites, each no larger than 1 cm², on both sides of the face, were analysed.

The mechanical parameters of the patient's skin were similar on both sides of the face, so the condition of the facial skin was considered on the basis of mean values in the measuring

cycle. The Cutometer Dual MPA 580 parameters which are responsible for elasticity are R2, R5 and R7 [9]. Favourable changes were observed in the values of these parameters, i.e. skin elasticity in measurements which were distant in time (visit 3 and 4) underwent the expected changes, which was not the case during the second visit. Thus, one can speak of a temporary deterioration in skin elasticity in the case of the six-month interval between the first application of stem cells and concentrated growth factors, and the conducted measurements, as shown by the val-

ues obtained for visits 1 and 2 in the eye area. The R8/R0 parameter ratio also indicates a deterioration in the skin's ability to return to the original shape, as shown by the measurements made between the 1st and 2nd administration of stem cells and concentrated growth factors. The values of all the parameters assessing elasticity on both cheeks indicate improved skin elasticity in the whole series of measurements made after the first CGF-Harmony application. Parameter R9 from the measurements performed on both the right and left cheek, shows a decrease in skin fatigue. Also, the R8/R0 parameter ratio indicates improvement in the skin's ability to return to its original shape. Measurements made around the lips also indicate improved skin elasticity, although in this case the results are not completely definite. The values of parameters R2 and R6 are favourable, whereas the measurements of parameters R5 and R7 show unfavourable values above and below the corners of the mouth. The R8/R0 ratio shows an improvement in the skin's ability to return to the original shape for the measurements made above and below the corners of the lips on both sides of the face. A decrease in skin fatigue, represented by parameter R9, can be observed for the measurements made above and below the corners of the lips on both sides of the face. Thus, a general improvement in the condition of facial skin was obtained, which was measured by means of an objective instrumental method through assessing the mechanical parameters of facial skin.

Discussion

Facial aesthetic medicine is a field undergoing intensive development. However, numerous authors emphasize that there is still a shortage of guidelines; not enough precise instrumental preliminary skin tests for determining the number, duration and series of treatments [10]; as well as inadequate standardization of administration procedures and specification of methods for dealing with complications that may arise. This, even in peeling, platelet rich plasma or mesotherapy treatments, may be connected with some risk, also associated with a lack of expected results [11–15]. The skin of a woman over 40 years of age requires care which involves both cosmetic and aesthetic medicine treatments because the

symptoms of skin ageing are clearly visible at this stage [16–18]. In the case described in this paper the patient did not take systematic care of her facial skin. In any specialist therapy, including the field of aesthetic medicine, medical photographic documentation is created as a standard [19, 20]; however, instrumental measurements of mechanical skin parameters are rarely made [21, 22]. It is also possible to measure other physical parameters such as TEWL (transepidermal water loss), skin redness and hydration [3]. The R0-R9 parameters analysed in this study refer to the elasticity and firmness of facial skin. The closer the R2, R5 and R7 parameters are to 1 (100%), the higher the skin's elasticity. The R5 parameter is the only one that can have a value above 1, which indicates skin that is very elastic and hydrated or very thin. The values of these three parameters at the measuring sites in the presented case improved. In the case of parameter R6 the lower its value, the greater is the elasticity of the skin. Parameters R3, R4 and R9 relate to "skin fatigue". The ratio of parameter R8 to parameter R0, which represents the skin's ability to return to its original shape, was also calculated (as a %) and a very favourable result was obtained. However, in the examined patient the reaction of the skin to the treatments was quite unusual: there was a hyper-reaction which could still be observed 6 months after the first CGF Harmony application, and perhaps this was why it was impossible to definitively identify any favourable trends in the mechanical parameters of the skin in the two subsequent tests (3 and 4). Environmental factors such as exposure to the sun (variable throughout the year); influence of the seasons and related temperature and diet changes; a change of cosmetics; as well as the circumstances of the measurement itself (e.g. humidity and air pressure, the experimenter's experience in taking measurements, the way of holding the probe or the pressure of the instrument on the skin) play a significant role. It is crucial that all the measurements should be performed by one person [10, 22]. In the case described in this paper, all the conditions, namely the correct preparation of the face, the required adaptation time and one person performing the measurements, were fulfilled.

The case described in this paper shows that with an accurate assessment of the condition of the skin before and after the procedure based on

an instrumental examination, the application of CGF Harmony can, in the long term, improve the facial skin condition of a woman over the age of 40 whose skin problems were not very advanced. It remains to be considered how many and at what intervals CGF Harmony treatments should be performed. However, it seems that in the presented case the Nomelan Cafeico peel treatment (which is a series of three peels applied in layers over each other) administered about a year before the application of CGF Harmony as well as a single application of PRP played a certain role. The choice of the CGF-Harmony procedure in the case of the described patient seems to be appropriate because it helped to achieve skin revitalization and wrinkle reduction, and also because it made it possible for the patient to quickly return to her daily activities, which was important from the point of view of her professional commitments. After her previous treatments, the patient was particularly interested in effective, medically well-documented and at the same time minimally invasive procedures that could slow down the natural progress of the ageing processes. Such procedures can be expected to be particularly effective when the initial parameters related to skin firmness, elasticity and hydration differ only slightly from the ideal values, and the skin is properly nurtured and preserved in good condition. The desired effect of improving the structure of the facial skin was obtained in the most natural and physiological way possible, which was confirmed by an improvement in the values of the assessed parameters, especially considering the differences between the first and fourth measurements.

Evidence can be found in the literature that aesthetic medicine treatments are an important factor in improving a person's mood. However, internalizing the perfect body image can often mean that the desire to meet excessive beauty standards becomes the most important goal in one's life. It may encourage people to engage in activities aimed at achieving the ideal appearance, which may result in excessive use of aesthetic medicine treatments [23]. This, however, was not true in the case described here as the patient saw the treatment only as a preventive measure.

It is often pointed out in the literature that facial appearance is influenced by many factors,

including correctly performed dental procedures [24]. Frequently, the effects of aesthetic treatment are lessened by an unsightly smile, with numerous missing teeth or unmatched prosthetic restorations. In such situations, despite a correctly chosen aesthetic medicine treatment, the general sense of facial aesthetics is low and the patient is not satisfied with the appearance of their profile or the proportions of their face [25]. In the case presented in this paper, the patient had harmonious and complete dental arches, thus the dental requirements related to facial aesthetics were fulfilled.

Conclusions

Instrumental analysis of the mechanical parameters of facial skin makes it possible to demonstrate the effectiveness of treatment.

The CGF-Harmony procedure can help in obtaining a better synergistic overall effect and preserving a young and fresh colour and appearance of facial skin, which naturally is one of the principal goals of facial aesthetic medicine.

Acknowledgements

Conflict of interest statement

The authors declare no conflict of interest.

Funding sources

There are no sources of funding to declare.

References

1. Przyłipiak A. Podstawy medycyny estetycznej. Wyd. 1, Kresowa Agencja Wydawnicza, Białystok 2013.
2. Budel E. Przegląd analiz rysów twarzy. *Academy of Aesthetic and Anti-Aging Medicine*. 2016;3:25–46.
3. Placek W. Dermatologia estetyczna. Wyd. 1, Termedia Wydawnictwa Medyczne, Poznań 2016.
4. Engländer E. Kompleksowe odmładzanie okolicy oczu. *Dermatologia Estetyczna*. 2011;13:6:386–387.
5. Augustyniak A, Rotsztejn H. Metody odmładzania skóry powiek i okolicy oczu stosowane w kosmologii i dermatologii estetycznej. 2014;16:4–5:244–248.
6. Car H. Czynniki wzrostu i komórki macierzyste w regeneracji skóry – zasadność stosowania. Concentrated Growth Factors (CGF). *Aesthetica*. 2017;23:48–52.
7. Sawicka D, Nowicka M, Kasacka I, Car H. Wybrane aspekty współdziałania komórek macierzystych i czynników wzrostu podczas regeneracji skóry. *Dermatologia Estetyczna*. 2017;19,3–4(110–111):155–166.
8. Kurczabińska-Luboń D, Nieznańska A. Czy zabiegi medycyny przeciwstarzeniowej mogą poprawić

- samopoczucie i samoocenę kobiet dojrzałych? Społeczeństwo i Edukacja. Międzynarodowe Studia Humanistyczne. 2015;2:247–254.
9. Informacje i instrukcja obsługi Cutometer® Dual MPA 580, Courage+Khazaka electronic GmbH.
 10. Ohshima H, Kinoshita S, Oyobikawa M, Futagawa M, Takiwaki H, Ishiko A, Kanto H. Use of Cutometer area parameters in evaluating age-related changes in the skin elasticity of the cheek. *Skin Res Technol*. 2013;19(1):238–242.
 11. Tilszer I, ABC mezoterapii – część I. Co o mezoterapii wiedzieć trzeba. *Academy of Aesthetic and Anti-Aging Medicine*. 2017;1:24–29.
 12. Car H, Bania A, Bienias K, Koprowicz T. Działania niepożądane mezoterapii. *Dermatol Estet*. 2012;14(4):232–239.
 13. Gołos A, Treliński J. Kliniczne zastosowanie osocza bogatopłytkowego. *Hematologia*. 2014;5(3):253–257.
 14. Kubasik P, Adamski Z. Możliwości terapii osoczem bogatopłytkowym (Platelet-Rich-Plasma) w praktyce dermatologicznej. *Dermatologia Estetyczna*. 2014;6(5):30–36.
 15. Sołdacka D, Barańska-Rybak W. Wpływ peelingów chemicznych na poziom nawilżenia skóry. *Polish Journal of Cosmetology*. 2016;19(3):223–227.
 16. Szulgenia-Próchniak J. Kosmetologia i medycyna estetyczna – synergia. *Kosmetologia Estetyczna*. 2013;1(2):35–36.
 17. Donejko M, Galicka E, Przyłipiak M, Rysiak E. Atrakcyjność twarzy kobiecej. *Pol J Cosmetol*. 2014;17(1):22–26.
 18. Artkop J, Chitryniewicz-Rostek J. Cera kobiety 40+ – charakterystyka starzenia i pielęgnacja cery dojrzałej. *Polish Journal of Cosmetology*. 2014;17(3):213–217.
 19. Jerzyk M, Lietz-Kijak D, Opalko K, Kijak E. Zastosowanie fotografii cyfrowej w praktyce stomatologicznej. *Art of Dentistry*. 2013;3:228–233.
 20. Pałczyńska D, Surdacki M, Mazurek J, Kubiak W, Cudziło D, Matthews-Brzozowski A. Fizykodiagnostyka i rehabilitacja w medycynie i stomatologii- kontynuacja. *Medyczna cyfrowa dokumentacja fotograficzna – element diagnostyki i planu leczenia w ortodoncji*. 2016;35–45.
 21. Hyo Sub Ryu, YoungHyun Joo, Sun Ok Kim, KyoungChan Park, Sang Woong Youn: Influence of age and regional differences on skin elasticity as measured by the Cutometer. *Skin Res Technol*. 2008.
 22. Carvalho PRS, Sumita JM, Soares JLM, Sanudo A, Bagatin E. Forearm skin aging: characterization by instrumental measurements. *International Journal of Cosmetic Science*. 2017;39:564–571.
 23. Gawron D. Wpływ zabiegów upiększających na ocenę własnego wyglądu i nastrój u kobiet w wieku średnim. *Psychologia Jakości Życia*. 2013;12(2):97–110.
 24. Zwolak A, Wiktor-Stoma A, Michalczewski G, et al. Nowe standardy w stomatologii estetycznej stosowane w celu poprawy estetyki twarzy i uśmiechu. *Magazyn Stomatologiczny*. 2013;12:50–54.
 25. Krakowiak-Wziątek K. Zaopatrzenie protetyczne jamy ustnej wstępem do zabiegów estetycznych twarzy. *Academy of Aesthetic and Anti-Aging Medicine*. 2016;3:76–94.

Acceptance for editing: 2018-06-30
Acceptance for publication: 2018-07-02

Correspondence address:
Teresa Matthews-Brzozowska
Chair and Clinic of Maxillofacial
Orthopaedics and Orthodontics
Poznan University of Medical Sciences, Poland
email: klinika.ortodoncji@ump.edu.pl

APPENDIX



Poznan University
of Medical Sciences
Poland

27th Bilateral Symposium Poznan-Halle

Rare diseases in clinical practice

15th–17th of December 2017

As part of long-term bilateral cooperation with Martin Luther University in Halle, the 27th Bilateral Symposium Poznań-Halle "Rare diseases in clinical practice" was held on December 16. The participants of the symposium included research workers of both partner universities. On this occasion, talks were held to set up research groups that will carry out joint activities in the field of science and research and the first Poznań-Halle groups were tentatively established. Presentation of prizes for the best oral and poster presentations is a long-standing tradition of the symposium. This award is named after two Professors: Prof. Zeige and Prof. Hasik, who initiated cooperation between our Universities over 30 years ago. In the current edition of the symposium the first prize, two second prizes and two third

prizes were given. To add, two representatives of our university were honored. The first prize went to Krzysztof Piersiała, a 6th year student of the First Medical Faculty I and the deputy chairman of the Student Scientific Club at the Clinic of Otolaryngology and Laryngological Oncology. The awarded work was written under the supervision of Prof. Małgorzata Wierzbicka, who is the Head of the Clinic and Joanna Jackowska M.D., Ph.D. The third prize went to Dr Michał Predecki, who is preparing a doctoral dissertation at PUMS Department and Clinic of Neurology (Head: Prof. Wojciech Kozubski). The work presented at the symposium was prepared in the Laboratory of Neurobiology and supervised by Prof. Jolanta Dorszewska, who tutors Dr Predecki's doctoral thesis.

ABSTRACTS

Heart amyloidosis in the clinical practice

Agnieszka Bartczak-Rutkowska,
Marta Kałużna-Oleksy, Magdalena Dudek,
Ewa Straburzyńska-Migaj

¹st Department of Cardiology, Poznan University of Medical Sciences, Poland

One of the rare conditions that cause heart hypertrophy is amyloidosis. Pathomechanism of this disease results from extracellular tissue deposition of insoluble fibrils composed of serum proteins – amyloid. There are many types of amyloid precursors: light chain immunoglobulin, transthyretin- mutant hereditary or wild-type, serum amyloid A protein. The organs typically involved are liver, kidney, gastrointestinal tract or heart. The extent of heart involvement differs with the type of amyloid. To properly manage and treat patients with heart amyloidosis it is essential to know the type of amyloid. The first step in the management of this disease is a demonstration of amyloid deposition in the tissue biopsy- fat pad, heart, mucosa and it's staining with red Congo to prove amyloid deposits. Then one needs to characterize the type of amyloid, and it is done with immunohistochemical reactions. Unfortunately, in our clinical practice, we lack proper tissue characterization. Since this step is indispensable in differential diagnosis between various types of amyloid, resulting in different ways of treatment- for example, chemotherapy in light chain amyloidosis, liver transplant in transthyretin type, it is of great importance for our cardiology department to develop cooperation with histopathological department/laboratory familiar with amyloidosis diagnostics.

The main points of collaboration:

- › Collaboration in the diagnostic procedures, especially in pathomorphological or laboratory tests
- › Collaboration in the development of the heart amyloidosis registry
- › Collaboration in the exchanging practical/clinical experience during mutual visiting possibilities.

Vitamin K status in patients after restorative proctocolectomy

Aleksandra Glapa¹, Krystian Waraczewski², Jan Krzysztof Nowak¹, Ewa Fidler-Witoń¹, Jacek Paszkowski³, Maciej Borejsza-Wysocki³, Patrycja Krzyżanowska-Jankowska¹, Tomasz Banasiewicz³, Jarosław Walkowiak¹

¹ Department of Paediatric Gastroenterology and Metabolic Diseases, Poznan University of Medical Sciences, Poland

² Chair of General and Colorectal Surgery, Poznan University of Medical Sciences, Poland

³ Chair and Department of General & Endocrine Surgery, and Gastroenterological Oncology, Poznan University of Medical Sciences, Poland

ABSTRACT

Aim. Fat-soluble vitamins such as vitamin K are inevitably associated with large intestine physiology. Surgical resection of the entire colon allows assuming significant vitamin K malabsorption in patients after restorative proctocolectomy (RPC). The objective of the study is to evaluate vitamin K status in patients after RPC.

Material and Methods. The study comprised of 49 patients operated due to ulcerative colitis (32; 17 women, 15 men) and familial adenomatous polyposis (17; 8 women 9 men). The vitamin K status has been assessed by the concentration of uncarboxylated prothrombin (PIVKA-II) measured with the use of enzyme-linked immunosorbent assay.

Results. Elevated PIVKA-II levels (≥ 2 ng/ml) occurred in 57.1% of patients studied. Spearman correlation coefficient analysis showed a moderate correlation between PIVKA-II levels and PDAI as well as chronic inflammation (respectively 0.498 and 0.491; $p < 0.05$). We observed a weak correlation between PIVKA-II levels and Moskowitz scale (0.352, $p < 0.05$), ESR (0.372, $p < 0.05$), albumin (-0.324; $p < 0.05$) and CRP levels (0.312; $p < 0.05$). No differences have been shown in PIVKA-II levels depending on the time from operative treatment, sex, the presence of adenomatous polyps in the pouch, INR value, and the hemoglobin level.

Conclusions. Vitamin K deficiency is frequent in subjects after RPC presented. However, none of the patients had its overt manifestation such as bleeding.

Oral health status in patients with mucopolysaccharidoses – exemplary cases

Damian Drążewski^{1,2}, Katarzyna Korybalska³, Zofia Orzechowska³, Janusz Witowski³, Anna Surdacka⁴

¹ Poznan University of Medical Sciences, Poland

² Private Dental Practice, Poland

³ Department of Patophysiology, Poznan University of Medical Sciences, Poland

⁴ Department of Conservative Dentistry and Endodontics, Poznan University of Medical Sciences, Poland

Introduction. Mucopolysaccharidoses (MS) is a group of inherited lysosomal storage disorders characterized by the defective activity of lysosomal enzymes. The excessive accumulation of uncleaved mucopolysaccharides results in progressive cellular damage, organ malfunction and skeletal abnormalities. Patients with MS often suffer from physical and mental disabilities, which together with poor access to professional dental care may lead to impaired oral health.

Aim. To assess the oral health status and the properties of the saliva in patients with MS.

Material and Methods. Thirty individuals with MS were examined. They were recruited from The Society for Mucopolysaccharidoses and Rare Diseases (SMRD) registry and represented all types of MS found in Poland. The teeth were assessed as is, i.e. without prior drying and/or cleaning. When possible, unstimulated whole mixed saliva was collected and analyzed for inflammatory mediators and antioxidant status by colorimetric and immunoassays. The results were compared with those recorded in age- and sex-matched healthy controls undergoing routine dental examination.

Results. The group of MS patients displayed significant heterogeneity in terms of demographic criteria, staging of the disease, the presence of mental retardation, the degree of disability and

oral health status. It was clear, however, that on the whole, they suffered from the markedly higher prevalence of caries, inferior gingival status, and poor oral hygiene. In this respect, exemplary cases are present to highlight typical problems in oral health found in patients with MS. Moreover, the samples of saliva could be collected only from 4 less handicapped individuals and exhibited a large scatter of values. The only possible tendency observed was that of the decreased salivary concentration of VEGF (139 ± 68 vs. 313 ± 184 pg/ml).

Conclusions. Patients with MS suffer from poor dental and gingival status, and inadequate oral hygiene. The severity of these problems is generally proportional to the degree of disability associated. Thus, patients rare diseases as exemplified by MS constitute a population with special needs in terms of oral health and require a coordinated oral care.

Mutations of the *DIAPH2* gene in head and neck cancer are overrepresented in metastasizing tumors and result in a shift from "proliferation" to "migration" cellular phenotype

Ewa Byzia¹, Magdalena Kostrzewska-Poczekaj¹, Natalia Soloch¹, Małgorzata Jarmuz-Szymczak^{1,2}, Ewelina Kowal¹, Katarzyna Kiwerska¹, Kinga Bednarek¹, Małgorzata Wierzbicka³, Anna Bartochowska³, Grażyna Greczka³, Grenman^{4,5}, Krzysztof Szyfter¹, Maciej Giefing^{1,3} (presenting author)

¹ Institute of Human Genetics, Polish Academy of Sciences, Poland

² Department of Hematology, Poznan University of Medical Sciences, Poland

³ Department of Otolaryngology and Laryngological Oncology, Poznan University of Medical Sciences, Poland

⁴ Department of Otorhinolaryngology, Head and Neck Surgery, Turku University Central Hospital and Turku University, Turku, Finland

⁵ Department of Medical Biochemistry, Turku University Central Hospital and Turku University, Turku, Finland

Previously we have screened laryngeal squamous cell carcinoma (LSCC) cell lines using high reso-

lution array-CGH in order to delineate novel tumor suppressors inactivated during cancer progression. Within the identified bi-allelic-losses we found a hemizygous deletion of the X chromosome located *DIAPH2* gene. The encoded protein belongs to a highly conserved formin family sharing the FH (formin homology) domain crucial for actin polymerization. In line with this function, literature suggest an involvement of these proteins in regulation of cell movement and adhesion and therefore point to *DIAPH2* as to a novel candidate for a metastasis related gene.

Intrigued by the interesting biological function of the encoded protein, as a proof of principle, we sequenced the gene in 5 LSCC metastases-derived cell lines assuming the highest probability to identify further loss of function alterations in these samples. Indeed, we identified a hemizygous deletion targeting *DIAPH2* in 1/5 cell lines.

These preliminary findings triggered us to sequence the entire coding region of the gene in 95 primary LSCC specimens (Illumina MiSeq; paired-end sequencing, coverage: range 20–6451, median 528) that included 53 non-metastasizing (N0) and 42 metastasizing (N+) tumors. We aimed at identifying further loss-of-function mutations and their distribution in these two groups. Moreover, we combined our results with exome sequencing data from 279 head and neck tumors available in the cBioPortal. Altogether 21 mutations (5.6%) were found in the 374 studied cases that targeted functional domains of the *DIAPH2* protein, wherefrom 6/190 were N0 cases and 15/184 were N+ cases. Importantly, there was a significant overrepresentation of the mutations in the (N+) cases ($p = 0.036$; chi-squared test).

In order to analyze the biological effect of these mutations we used CRISPR/Cas9 editing to delete six amino acids from the crucial FH3 domain and to establish the *DIAPH2*^{+/-} HEK-293 cell line. Subsequent proliferation and migration assays proved that this heterozygous loss significantly alters the behavior of cells that slow down their proliferation but manifest enhanced migration.

In conclusion, these findings show the overrepresentation of *DIAPH2* mutations in metastasizing tumors. Moreover, the increased migration potential of *DIAPH2*^{+/-} cells suggest that these mutations may contribute to metastasis formation in human tumors.

Immunophenotypic assessment of Natural Killer cells in Chronic Rhinosinusitis with Nasal Polyps

Karolina Wasicka, Mariusz Kaczmarek, Małgorzata Leszczyńska

Introduction. Chronic rhinosinusitis is a chronic inflammatory process of the mucous membrane of the nasal cavity and paranasal sinuses. In the physiological state NK cells are the first line of defense against pathogens leading to cytolysis of the infected cell. However, this function may be limited under pathological conditions.

Aim. The aim of the study was to evaluate percentage and the degree of maturation of NK cells and also expression of CD314, CD336, CD337 receptors in peripheral blood and tissue from patients with chronic sinusitis with and without polyps as well as from healthy people.

Material and Methods. The research material was obtained from 49 patients with chronic sinusitis (36 with nasal polyps, 13 without polyps) undergoing endoscopic nasal and sinus surgery and also from 15 patients with nasal septum deviation and hypertrophic rhinitis as control samples. Immunophenotypic identification of NK cells was carried out with the use of flow cytometer.

Results. The results did not show any significant differences in the percentage of NK cells in the analyzed groups. Significant differences were present within the degree of maturation of NK cells between the examined groups and tissues. In the material from patients with chronic sinusitis lowered expression of the receptors has been found compared to the control group. The results indicate the involvement of NK cells in inflammation process, and the different expression of receptors in the analyzed groups may indicate the presence of a modifying agent.

Conclusions. Disorders of the maturation process and lower expression of receptors activating function of NK cells may be an important element of etiopathogenesis of chronic rhinosinusitis with and without polyps.

Systemic and oral symptoms as well as dental management in the Hyperimmunoglobulin E syndrome patients – report of two cases

Karolina Gerreth¹, Aleksandra Szczawinska-Poplonyk², Zdzisława Kycler², Anna Breborowicz²

¹ Department of Paediatric Dentistry, Poznan University of Medical Sciences, Poland

² Department of Paediatric Pneumonology, Allergology and Clinical Immunology, IIIrd Chair of Paediatrics, Poznan University of Medical Sciences, Poland

The autosomal dominant hyperimmunoglobulin E syndrome (HIES) due to a loss-of-function heterozygous transcription factor STAT3 mutation is a multisystem disease with immunological and non-immunological abnormalities. The syndrome is characterized by a classical triad of symptoms, such as eczema, recurrent respiratory tract infections and high serum concentration of IgE, which is accompanied by a variety of oral, dental, skeletal, connective tissue, vascular and dysmorphic features. As clinical manifestations of the disease often appear gradually, the clinical diagnosis of HIES in early childhood is challenging. The oral findings manifest earlier than the development of typical facial changes, hence, the expected role of oral phenotypes in early diagnosis of the disorder exist. The dermatological symptoms, oral status, other systemic health problems as well as dental management of two paediatric patients with hyperimmunoglobulin E syndrome were presented. HIES is of great importance to different health care providers because sufferers require special preventive and therapeutic management from early infancy in order to avoid complications which can even prove to be life-saving for such patients.

Identification of single nucleotide polymorphisms, rs396991 of the CD16A gene and rs1801274 of the CD32A gene, as possible factors influencing bullous pemphigoid and pemphigus phenotypes

Justyna Gornowicz-Porowska¹, Michał J. Kowalczyk², Paweł Bartkiewicz¹, Monika Bowszyc-Dmochowska¹, Ryszard Żaba², Marian Dmochowski¹, Zygmunt Adamski¹

¹ Department of Dermatology, Poznan University of Medical Sciences, Poland

² Department of Dermatology and Venereology, Poznan University of Medical Sciences, Poland

IgG Fc receptors (FcRs) may be important immunomodulatory factors participating in the pathogenesis of bullous pemphigoid (BP) and pemphigus. The aim of the study was to identify and evaluate the possible association between the expression of certain single nucleotide polymorphisms (SNP) of *CD16A* and *CD32A* genes and the disease phenotype. This study was focused on rs396991 of the *CD16A* gene and rs1801274 of the *CD32A* gene in pemphigus and BP.

The study comprised 47 patients with BP and 15 patients with pemphigus serving as mutually positive control groups. DNA was isolated from whole blood by column methods and analysed using a NanoDrop spectrophotometer. Genotyping was performed with the use of TaqMan SNP Genotyping Assays (ThermoFisher) and a Light-Cycler 2.0 real-time PCR instrument.

The frequency distribution of SNP genotypes for *CD16A* gene was as follows: (i) in BP: 21 (44.68%) homozygotes AA, 22 (46.80%) heterozygotes CA, 4 (8.52%) homozygotes CC; (ii) in pemphigus: 5 (33.33%) homozygotes AA; 8 (53.34%) heterozygotes CA, 2 (13.33%) homozygotes CC.

The frequency distribution of SNP genotypes for *CD32A* gene was as follows: (i) in BP: 9 (19.15%) homozygotes TT, 5 (53.19%) heterozygotes TC, 13 (27.66%) homozygotes CC; (ii) in pemphigus: 4 (26.66%) homozygotes TT; 8 (53.34%) heterozygotes TC, 3 (20%) homozygotes CC.

These polymorphisms may play a significant role in the pathogenesis of BP and pemphigus influencing their dynamic phenotypes.

The patient with distal arthrogyrosis and with labia minora hypertrophy-medical and ethical aspects

Grażyna Jarząbek-Bielecka¹, Karina Kapczuk¹, Radosław Słopeń², Justyna Opydo-Szymaczek³, Michalina Drejza¹, Witold Kędzia¹, Zbigniew Friebe¹, Magdalena Pisarska-Krawczyk^{4,5}

¹ Department of Perinatology and Gynecology, Gynecology Clinic, Poznan University of Medical Sciences, Poland

² Department of Gynecological Endocrinology, Poznan University of Medical Sciences, Poland

³ Department of Pediatric Dentistry, Poznan University of Medical Sciences, Poland

⁴ State Higher Vocational School in Kalisz, Poland

⁵ Faculty of Health Sciences, Poznan University of Medical Sciences, Poland

Freeman–Sheldon syndrome (FSS), also termed distal arthrogyrosis type 2A (DA2A), or Whistling-face syndrome, was originally described by EA Freeman and JH Sheldon in 1938. The symptoms of Freeman–Sheldon syndrome include drooping of the upper eyelids, strabismus, low-set ears, a long philtrum, gradual hearing loss, scoliosis, and walking difficulties. Gastroesophageal reflux has been noted during infancy, but usually improves with age. The tongue may be small, and the limited movement of the soft palate may cause nasal speech. Often there is an H- or Y-shaped dimpling of the skin over the chin. We described a case of a labioplasty in 18 years old patient with FSS and labia minora hypertrophy which is to our knowledge first reported case of coincidence of FSS with genital abnormalities. Our Patient was diagnosed with Freeman-Sheldon syndrome in an early childhood and since then she passed several reconstructive surgeries and rehabilitation. At the admission our patient reported discomfort, pain and physical activity limitation due to labia minora hypertrophy and hyperpigmentation. Patient was informed about the possibility of labioplasty procedure, accepted the proposal of surgical treatment and signed the informed consent. Labial reduction was performed by the wedge resection of labia adjusting the size to the desired one (2 cm length between

the base and the wedge). Three weeks and six months after surgery the patient reported full acceptance of her genital anatomy. She did not mention any more the hyperpigmentation of labia and reported successful sexual life with her boyfriend. Incorrect and unacceptable genital anatomy in adolescents might lead to severe sexual dysfunctions. From the ethical point of view it is fully understandable and permissible to conduct reconstruction surgery after injuries and in illnesses, or to repair deformations stemming from congenital malfunctions. In some cases it may be even considered necessary or indispensable to undergo plastic surgery. This is particularly true for children with malfunctions which may in the future stop their personal development. In such situations the burden to recognize the necessity and to take action lies with the parents.

Labioplasty in a FSS patient with labia minora hypertrophy can help to obtain both the full acceptance of genital anatomy and successful sexual life. To our knowledge this is a first report of labia minora hypertrophy in a patient with FSS. As far no embryological connection between the labia minora overgrowth and Freeman-Sheldon syndrome was reported.

Isolated hypogonadotropic hypogonadism in clinical practice

Małgorzata Kałużna, Katarzyna Ziemnicka

Department of Endocrinology, Metabolism and Internal Medicine, Poznan University of Medical Sciences, Poland

Department of Endocrinology, Metabolism and Internal Medicine of Poznan University of Medical Science since many years conducts research on isolated hypogonadotropic hypogonadism (IHH). A result of these studies is collection of unique cohort patients presenting IHH, which also includes the familial cases. IHH is a significant cause of disorders of maturation and infertility in human. IHH is five times more common in males than in females. GnRH neuronal migration disorders and defects in the synthesis, secretion and

action of gonadotropin releasing hormone (GnRH), luteinizing hormone (LH) or follicle-stimulating hormone (FSH) underlie the background of IHH. IHH is divided into two types: a type with anosmia (lack of smell), called Kallmann syndrome and normosmic form (without disturbances of smell) – nIHH. Kallmann syndrome accounts for about 60% of IHH. IHH patients can have accompanying defects such as renal agenesis, deafness, cleft palate, mirror movements or digital anomalies etc.

To date, more than 25 genes involved in the pathogenesis of IHH have been identified. However, the genetic basis of approximately half of the IHH cases remains unidentified. The next generation sequencing (NGS) with use of platforms of high- or medium-throughput represents nowadays most advanced and efficient tool for identification of genetic background of IHH.

Reversal of IHH, observed in 10% of IHH patients, is defined as reinstatement of normal testosterone concentration in serum after short discontinuation of treatment with testosterone, gonadotropin or GnRH. Mutations in *FGFR1*, *PROKR2*, *KAL1*, *GNRHR*, *TACR3*, *TAC3* were identified in several cases of reversal.

The knowledge of genetic background of IHH helps to individualize the treatment and help to predict reversion of hypogonadism. Early appropriate clinical and genetic diagnostics and treatment are crucial for achieving optimal clinical results and effective counseling.

Oral health status and tobacco smoking as a risk factor for stroke

Katarzyna Baksalary-Iżycka, Radosław Kazimierski, Anna Kurhańska-Flisykowska, Włodzimierz Łojewski, Izabela Wojtasz

Department of Conservative Dentistry and Endodontology, Poznan University of Medical Sciences, Poland

Department of Vascular Diseases of Nervous System, Poznan University of Medical Sciences, Poland

Department of Oral Surgery and Periodontology, Poznan University of Medical Sciences, Poland

Aim. We analyzed the oral health status and periodontal status of post-stroke patients from Clin-

ic of Vascular Diseases of Nervous System to assess a possible link between stroke and severe periodontitis.

Material and Methods. Data has been provided between 2014–2017. Within 72 hours post stroke each patient has been examined by staff from Periodontology Clinic. The periodontal state of all participants was assessed according to the WHO Oral Health Data Chart and the following indices: API, BOP,CAL,PD. The control group, the same age and sex, has been taken from a group of Periodontal Clinic Patients. The group consist of 240 patients,128 women and 112 men mean age 43–92 years with chronic periodontitis (96) and gingivitis(82).About 20% was edentulous.

Results. We found significant difference in the BOP and API values between the two groups analyzed: the post stroke patients smoking and no smoking and the healthy controls. Our preliminary data suggest that periodontal disease may be a factor predisposing to stroke.

Conclusions. Emerging evidence suggest that poor oral health control influences the initiation and/or progression of atherosclerosis (including infarct and stroke). We found significant differences in the BOP and API values between patients and control subjects which confirm that periodontitis can be predisposing factor to stroke.

Analysis of genotype-phenotype risk factors in families with history of Alzheimer's disease

Michał Prendecki¹, Marta Kowalska¹, Olaf Szyszka¹, Joanna Nowakowska¹, Jolanta Florczak-Wyspiańska², Jan Ilkowski³, Wojciech Kozubski², Jolanta Dorszewska¹

¹ Laboratory of Neurobiology, Department of Neurology, Poznan University of Medical Sciences, Poland

² Chair and Department of Neurology, Poznan University of Medical Sciences, Poland

³ Department of Emergency Medicine, Poznan University of Medical Sciences, Poland

Introduction. Currently, 50% of cases of rare, familial form of Alzheimer's disease (AD), is connected with mutations in three genes associated

with amyloid β ($A\beta$) cascade: *APP*, *PSEN1* and *PSEN2*. The causative factors for remaining cases of familial AD (FAD) have not been fully elucidated. The aggregation of unfavorable variants in *APOE* – responsible for diminished $A\beta$ clearance and *TOMM40* – associated with $A\beta$ transfer to mitochondria, and increased oxidative stress, may induce development of AD in certain families. The *APOE* possesses three common variants: protective – E2, neutral – E3 and pathogenic – E4. Simultaneously, the *TOMM40* rs10524523 polymorphism comprise following alleles: short (S), long (L) and very long (VL). These variants may influence the levels of biochemical parameters, such as: the protective apolipoprotein E (apoE), antioxidants, e.g. glutathione (GSH), and other biothiols, such as vasculature damaging homocysteine (Hcy). So far, very few studies were focused on investigation of the effects of genotype-phenotype risk factors for AD in subjects with family history of AD.

Aim. The aim of the study was the analysis of the genetic variants of *APOE* and *TOMM40* genes and the apoE phenotype, as well as the level of chosen biothiols in families with history of AD.

Material and Methods. The members of two families with history of AD and no detected mutations in hotspot regions of *APP*, *PSEN1* and *PSEN2* genes were recruited to the study. The variants in *APOE* gene were analyzed by qPCR, *TOMM40* by HRM and capillary electrophoresis while *APP*, *PSEN1*, *PSEN2* by sequencing. The plasma level of apoE was analyzed by ELISA. The concentrations of Hcy and GSH were analyzed by HPLC/EC.

Results. It was shown that in the analyzed families, the disease manifested about 65 years of age. All studied persons were carriers of at least one *APOE* E4 allele. Moreover AD patients, from studied families were carriers of unfavorable variants: *TOMM40* S and L, and exhibited elevated levels of Hcy and decreased concentration of apoE. Moreover, the presence of two *APOE* E4 alleles was accompanied with decreased apoE levels, both in AD patients and family members without signs of dementia.

Conclusions. It seems that the *APOE* E4 and *TOMM40* S/L alleles leading to the altered plasma concentrations of apoE and biothiols may increase the risk of developing AD in families with history of this disease.

Is trivial otitis externa always harmless?

Joanna Napierała, Małgorzata Wierzbicka

Department of Otolaryngology, Head and Neck Surgery, Poznan University of Medical Sciences, Poland

Introduction. Otitis externa is an infection of the outer ear canal with or without eardrum involvement. It is thought to affect 10% of people at some stage. In predisposed patients, this common disease may develop into life-threatening process which invades the temporal bone and skull base.

Material and Methods. Medical records in patients with MOE hospitalized in Department of Otolaryngology and Laryngological Oncology in Poznań between 2008–2017 was retrospectively analyzed. We review latest literature using the search terms: „malignant otitis externa”, „skull base osteomyelitis”.

Results. Analysis of medical records reveals that MOE affects more often elderly person over 70 years. There is sex predilection for men. Patients with DM, immune deficiency or with other systemic conditions develop predominantly MOE. Symptoms are frequently underestimated by patients and diagnostics is delayed. Currently, attempts have been made to unify terminology, diagnostics and treatment of temporal bone destructive processes in patient with MOE.

Conclusions. *Nonetheless, we should also bear in mind* that even trivial otitis externa may develop into the life-threatening disease. Multicenter study and metaanalysis are aimed to reach the consensus for the diagnosis, treatment and nomenclature of inflammatory processes invading temporal bone. In patients with MOE, prompt diagnosis and *sufficiently long* antibiotic treatment is required to provide better outcomes and avoid surgical approach.

Recessive dystrophic epidermolysis bullosa in the dental practice – description of two cases

Justyna Opydo-Szymaczek, Natalia Wendland, Maria Borysewicz-Lewicka

Department of Pediatric Dentistry
Poznan University of Medical Sciences, Poland

Epidermolysis bullosa dystrophica or dystrophic epidermolysis bullosa (DEB) is a genetically determined (autosomal dominant or recessive) disease characterized by the appearance of severe blistering lesions affecting skin and mucous membranes. DEB is caused by genetic defects within the human COL7A1 gene encoding collagen VII. The deficiency in anchoring fibrils impairs the adherence between the epidermis and the underlying dermis.

The aim of the study was to present two patients with recessive type of DEB also known as "Hallopeau–Siemens variant of epidermolysis bullosa", who are currently patients of the Department of Pediatric Dentistry of Poznan University of Medical Sciences.

The 12-year-old girl and her 9-year-old sister were referred to the university clinic seeking advice and treatment, due to rapidly progressing dental caries. Most of the teeth in both sisters presented with advanced caries demineralization demanding urgent dental intervention.

Dental caries lesions have been treated in local anesthesia, while extractions of posterior permanent teeth have been planned to be carried out under general anesthesia. Patients with DEB present a challenge for dental care, since every manipulation in oral cavity may result in blistering. At the same time, elimination of pain and discomfort due to caries is essential in improving the quality of life of the patients.

The blue light in examination of mucosa – the role of NBI in diagnostics

Krzysztof Piersiala², Joanna Jackowska¹, Hanna Klimza¹, Małgorzata Wierzbicka¹

¹ Department of Otolaryngology, Head and Neck Surgery, Poznan University of Medical Sciences, Poland

² Student Research Group at the Department of Otolaryngology, Head and Neck Surgery, Poznan University of Medical Sciences, Poland

Introduction. The present review is focused on the use of NBI in the diagnostic and management process of patients with laryngeal cancer. Narrow band imaging (NBI) by enhancing the contrast between the mucosal epithelium and submucosal vessels facilitates diagnosis of precancerous and cancerous lesions, as well as hypertrophic lesions such as laryngeal papillomatosis. Narrow band imaging (NBI) is an optical technique based on the modification of white light by the use of special optical filters. Every change in the microvascular architecture of the mucosa is classified according to Ni's classification (2011).

Material and Methods. The use and diagnostic efficacy of different optical diagnostic methods used in detection of larynx malignancies was studied based on a combined analysis of publically accessible databases (PubMed, MEDLINE, Cochrane Library) as well as experiences of *Department of Otolaryngology - Head and Neck Surgery of Poznan University of Medical Sciences.*

Conclusions. There is a wide range of evidence in the literature and in experience of our department that optical diagnostic methods such as NBI proved to be superior to white light endoscopy for the detection of early stages of larynx malignancies and thus have the potential to revolutionize early diagnosis of the larynx cancer. In addition, the use of NBI allows more precise assessment of the surgical margins status of early stage and locally advanced laryngeal cancers managed in endoscopic laser cordectomy.

What is the significance of *Borrelia burgdorferi* infection in morphea? Case report and literature review

Weronika Pietrenko¹, Adriana Polańska²,
Monika Bowszyc-Dmochowska³,
Ryszard Żaba², Zygmunt Adamski¹,
Elżbieta Kacprzak⁴, Aleksandra
Dańczak-Pazdrowska⁵

¹ Department and Clinic of Dermatology, Poznan University of Medical Sciences, Poland

² Department of Dermatology and Venereology, Poznan University of Medical Sciences, Poland

³ Laboratory of Histopathology and Skin Immunopathology, Department and Clinic of Dermatology, Poznan University of Medical Sciences, Poland

⁴ Chair and Clinic of Tropical and Parasitic Diseases, Poznan University of Medical Sciences, Poland

⁵ Laboratory of Diagnostics of Non-Invasive Skin Diseases, Chair and Clinic of Dermatology, Poznan University of Medical Sciences, Poland

Morphea and lichen sclerosus are diseases of unknown etiology, however they are considered to have autoimmune Introduction. Their hypothetical association with *Borrelia burgdorferi* infection has been a subject to debate for a long time. 50-year-old male presented with a 5-month history of dermatosis. The patient rapidly developed multiple disseminated purple macules and pale indurations with liliac ring on the trunk and extremities. The patient has been working in the forest and reported multiple tick bites over last few years. He didn't report any skin lesions of morphology corresponding to erythema chronicum migrans. The skin biopsy was consistent with morphea diagnosis. The patient was treated with doxycycline, ceftriaxone and low doses of metyloprednisolone. Rapid, spectacular improvement of skin lesions was observed. Improvement of skin lesions after tretment with antibiotics led us to consider association between morphea and *Borrelia burgdorferi* infection.

The activity of mitochondrial respiratory system in intact peripheral blood mononuclear cells from multiple sclerosis patients

Slawomir Michalak¹, Joanna
Rybacka-Mossakowska¹, Krystyna
Osztynowicz¹, Justyna Biernacka-Łukanty¹,
Elżbieta Tokarz-Kupczyk², Wojciech
Kozubski²

¹ Department of Neurochemistry and Neuropathology, Poznan University of Medical Sciences, Poland

² Department of Neurology, Poznan University of Medical Sciences, Poland

Introduction. Neurodegeneration during the course of multiple sclerosis (MS) is associated with chronic inflammation and the production of reactive oxigen and nitrogen species, and mitochondrial injury.

Aim. The aim of this study was to evaluate the activity of mitochondrial respiratory system in peripheral blood mononuclear cells (PBMCs) from MS patients.

Material and Methods. The study included 15 multiple sclerosis patients hospitalized in Department of Neurology at Poznan University of Medical Sciences in Poznan, Poland and 23 healthy volunteers. PBMCs were isolated from EDTA blood via density gradient centrifugation (Histopaque, Sigma-Aldrich). The cell number was counted in Bürker's chamber and in YUMIZEN H500 (HORIBA, Japan) analyzer and the volume corresponding to 1×10^6 cells was applied for respirometry. The activity of mitochondrial respiratory system was analyzed in intact PBMCs using high-resolution respirometer (Oxygraph-2k; Oroboros Instruments, Innsbruck, Austria) according to the ROUTINE, LEAK, electron transfer system (ETS), and residual oxygen consumption (ROX) protocol.

Results. ROUTINE respiration in PBMCs from blood was lower in MS patients (12.66 ± 3.77 pmol $O_2/s \cdot 10^6$ cells, mean \pm standard deviation, $P = 0,0480$) than in controls (15.76 ± 4.54 pmol $O_2/s \cdot 10^6$ cells). No changes in LEAK respiration were found in MS patients (4.25 ± 2.06 pmol $O_2/s \cdot 10^6$ cells, $P = 0.1431$) compared to healthy subjects (4.52 ± 1.77 pmol $O_2/s \cdot 10^6$ cells). ETS respiration in PBMCs from MS patients (14.44 ;

10.46 – 22.94 pmol O₂/s*10⁶ cells, median; interquartile range) did not differ from controls (16.54; 11.38 – 20.68 pmol O₂/s*10⁶ cells). Downregulation of ROX respiration was observed in PBMCs from MS patients (2.90 ± 1.70 pmol O₂/s*10⁶ cells) compared to controls (4.76 ± 1.79 pmol O₂/s*10⁶ cells, P = 0.0004).

Conclusions. Basic mitochondrial respiration is down-regulated in PBMCs along with inhibition of extramitochondrial respiration in the course of multiple sclerosis.

Rheological picture of Waldenström's macroglobulinemia

Anna Marcinkowska-Gapińska¹, Piotr Kowal¹, Włodzimierz Liebert²

¹ Rheological Laboratory, Department of Neurology, Poznan University of Medical Sciences, Poland

² Department of Neurosurgery, Poznan University of Medical Sciences, Poland

Waldenström macroglobulinemia (WM) is defined by the World Health Organization as lymphoplasmacytic lymphoma (LPL). Increased concentration of IgM is one of the factors that lead to increase of blood viscosity. Blood hyperviscosity in patients with Waldenström's macroglobulinemia is serious clinical problem. The aim of this work was to observe the rheological parameters in a group of Waldenström's macroglobulinemia patients in a two year period. During this time the blood samples from each patient were collected four times. The evaluation included such factors as whole blood viscosity, plasma viscosity, hematocrit value and the tendency to aggregation and deformation of erythrocytes. The latter features were quantified using the mathematical rheological model of Quemada. Compared to the hemorheological parameters obtained for healthy objects, elevated value of plasma viscosity and an increased tendency to aggregation were observed in the studied group. Other rheological parameters values did not differ significantly from the values in healthy objects. All patients were under constant medical control.

Heart sarcoidosis – difficult diagnostic process and therapeutic management

Alicja Nowak, Magdalena Dudek, Marta Kałużna-Oleksy, Agnieszka Bartczak-Rutkowska, Ewa Straburzyńska-Migaj

^{1st} Department of Cardiology, Poznan University of Medical Sciences, Poland

Sarcoidosis is granulomatous systemic disease of unknown – probably immune-related etiology with noncaseating granulomas involving usually lungs and lymph nodes, however it may affect different tissues and organs including heart. The disease affects at least 10 of 100,000 persons each year (more often women) at the age of 25–45 years old and individuals over 50 years old, with the highest prevalence in Europe and North America. The most devastating pattern of the disease is concerned with myocardial involvement which, according to different sources, is estimated between 5 and 50% of affected patients. Although cardiac sarcoidosis has usually benign, asymptomatic course, it accounts for approximately 25% of the disease-related deaths. The main cardiac symptoms include: (a) conduction disturbances (2nd and 3rd degree heart block), (b) ventricular arrhythmias (sVT) which may result in sudden cardiac death and (c) progressive heart failure. Despite this potential life-threatening symptoms, both, the diagnosis and management of cardiac sarcoidosis arouse controversy and remain challenging. According to HRS Expert Consensus (2014) there are histological as well as clinical pathways to a diagnosis of cardiac sarcoidosis. The first one embraces endomyocardial biopsy, and the second one that applies to patient with established extra-cardiac involvement, is based on the cardiovascular imaging (echocardiography, PET, CMR). The management strategies include immunosuppressive therapy (most often corticosteroids), antiarrhythmic drugs and invasive therapy (ablation, pacemaker/ICD) when indicated.

The main points of collaboration:

- › Collaboration in the diagnostic procedures, especially in laboratory tests.
- › Collaboration in the development of the heart sarcoidosis registry.

- › Collaboration in the exchanging practical/clinical experience during mutual visiting possibilities.

Unobvious dermatological side effects of radiotherapy – report of two cases and literature review.

Barbara Olszewska¹, Adriana Polańska², Monika Bowszyc-Dmochowska³, Marian Dmochowski⁴, Ryszard Żaba², Zygmunt Adamski¹, Aleksandra Dańczak-Pazdrowska⁵

¹ Department and Clinic of Dermatology, Poznan University of Medical Sciences, Poland

² Department of Dermatology and Venereology, Poznan University of Medical Sciences, Poland

³ Laboratory of Histopathology and Skin Immunopathology, Department and Clinic of Dermatology, Poznan University of Medical Sciences, Poland

⁴ Department and Clinic of Dermatology, Poznan University of Medical Sciences, Poland

⁵ Laboratory of Diagnostics of Non-Invasive Skin Diseases, Chair and Clinic of Dermatology, Poznan University of Medical Sciences, Poland

Radiotherapy is one of the most common methods of treatment for malignant neoplasms. Typical side effects of radiotherapy include acute and chronic cutaneous reactions of varying intensity. However, rare causes of radio-induced skin diseases have also been reported.

We report two cases, in which treatment with radiotherapy have induced a localized bullous pemphigoid (BP) and a generalized morphea.

A 81-year old woman 3 months prior to hospital admission has received 33 courses of radiation therapy for an infiltrating duct carcinoma. In a day of receiving the last dose of radiation she has developed multiple tense blisters on the right breast. Direct immunofluorescence for antibase-membrane autoantibodies showed linear deposits of C3+ at the dermoepidermal junction. Multi-parametric indirect immunofluorescence ELISA assay had confirmed a high IgG antibody titer to BP230. IgG anti-BP180 antibodies were negative. The patient has been diagnosed with localized paraneoplastic radiotherapy-induced bullous pemphigoid and treated with a daily dose of 200 mg of oral doxycycline and 24 mg of oral methylprednisolone with a substantial improvement.

A 55-year old woman treated for a duct carcinoma of the left breast have presented at two years after mastectomy followed with chemoradiotherapy with skin lesions characteristic for generalized morphea. A local recurrence of breast cancer has been excluded. The patient received a topical treatment with clobetasole and oral treatment with methotrexate in a dose of 7.5 mg daily. Due to lack of satisfactory response an UVA1 therapy has been started with good results – decrease of density of preexisting plaques, lack of new lesions, a “lilac ring” hasn’t been observed.

Up to date, 37 cases of radiation-induced bullous pemphigoid and 88 cases of radiation-induced morphea have been reported in the literature. The cases described indicate the necessity of profound evaluation of skin changes in patients receiving radiotherapy.

Journal of Medical Science (JMS) is a PEER-REVIEWED, OPEN ACCESS journal that publishes original research articles and reviews which cover all aspects of clinical and basic science research. The journal particularly encourages submissions on the latest achievements of world medicine and related disciplines. JMS is published quarterly by Poznan University of Medical Sciences.

ONLINE SUBMISSION:

Manuscripts should be submitted to the Editorial Office by an e-mail attachment: nowinylekarskie@ump.edu.pl. You do not need to mail any paper copies of your manuscript.

All submissions should be prepared with the following files:

- Cover Letter
- Manuscript
- Tables
- Figures
- Supplementary Online Material

COVER LETTER: Manuscripts must be accompanied by a cover letter from the author who will be responsible for correspondence regarding the manuscript as well as for communications among authors regarding revisions and approval of proofs. The cover letter should contain the following elements: (1) the full title of the manuscript, (2) the category of the manuscript being submitted (e.g. Original Article, Brief Report), (3) the statement that the manuscript has not been published and is not under consideration for publication in any other journal, (4) the statement that all authors approved the manuscript and its submission to the journal, and (5) a list of at least two referees.

MANUSCRIPT: Journal of Medical Science publishes Original Articles, Brief Reports, Review articles, Mini-Reviews, Images in Clinical Medicine and The Rationale and Design and Methods of New Studies. From 2014, only articles in English will be considered for publication. They should be organized as follows: Title page, Abstract, Introduction, Materials and Methods, Results, Discussion, Acknowledgments, Conflict of Interest, References and Figure Legends. All manuscripts should be typed in Arial or Times New Roman font and double spaced with a 2,5 cm (1 inch) margin on all sides. They should be saved in DOC, DOCX, ODT, RTF or TXT format. Pages should be numbered consecutively, beginning with the title page.

Ethical Guidelines

Authors should follow the principles outlined in the Declaration of Helsinki of the World Medical Association (www.wma.net). The manuscript should contain a statement that the work has been approved by the relevant institutional review boards or ethics committees and that all human participants gave informed consent to the work. This statement should appear in the Material and Methods section. Identifying information, including patients' names, initials, or hospital numbers, should not be published in written descriptions, illustrations, and pedigrees. Studies involving experiments with animals must be conducted with approval by the local animal care committee and state that their care was in accordance with institution and international guidelines.

Authorship:

According to the International Committee on Medical Journal Ethics (ICMJE), an author is defined as one who has made substantial contributions to the conception and development of a manuscript. Authorship should be based on all of the following: 1) substantial contributions to conception and design, data analysis and interpretation; 2) article drafting or critical advice for important intellectual content; and 3) final approval of the version to be published. All other contributors should be listed as acknowledgments. All submissions are expected to comply with the above definition.

Conflict of Interest

The manuscript should contain a conflict of interest statement from each author. Authors should disclose all financial and personal relationships that could influence their work or declare the absence of any conflict of interest. Author's conflict of interest should be included under Acknowledgements section.

Abbreviations

Abbreviations should be defined at first mention, by putting abbreviation between brackets after the full text. Ensure consistency of abbreviations throughout the article. Avoid using them in the title and abstract. Abbreviations may be used in tables and figures if they are defined in the table footnotes and figure legends.

Trade names

For products used in experiments or methods (particularly those referred to by a trade name), give the manufacturer's full name and location (in parentheses). When possible, use generic names of drugs.

Title page

The first page of the manuscript should contain the title of the article, authors' full names without degrees or titles, authors' institutional affiliations including city and country and a running title, not exceeding 40 letters and spaces. The first page should also include the full postal address, e-mail address, and telephone and fax numbers of the corresponding author.

Abstract

The abstract should not exceed 250 words and should be structured into separate sections: Background, Methods, Results and Conclusions. It should concisely state the significant findings without reference to the rest of the paper. The abstract should be followed by a list of 3 to 6 Key words. They should reflect the central topic of the article (avoid words already used in the title).

The following categories of articles can be proposed to the Journal of Medical Science:

ORIGINAL RESEARCH

Original articles: Manuscripts in this category describe the results of original research conducted in the broad area of life science and medicine. The manuscript should be presented in the format of Abstract (250-word limit), Keywords, Introduction, Material and Methods, Results, Discussion, Perspectives, Acknowledgments and References. In the Discussion section, statements regarding the importance and *novelty of the study* should be presented. In addition, the limitations of the study should be articulated. The abstract must be structured and include: Objectives, Material and Methods, Results and Conclusions. Manuscripts cannot exceed 3500 words in length (excluding title page, abstract and references) and contain no more than a combination of 8 tables and/or figures. The number of references should not exceed 45.

Brief Reports: Manuscripts in this category may present results of studies involving small sample sizes, introduce new methodologies, describe preliminary findings or replication studies. The manuscript must follow the same format requirements as full length manuscripts. Brief reports should be up to 2000 words (excluding title page, abstract and references) and can include up to 3 tables and/or figures. The number of references should not exceed 25.

REVIEW ARTICLES

Review articles: These articles should describe recent advances in areas within the Journal's scope. Review articles cannot exceed 5000 words length (excluding title page, abstract and references) and contain no more than a combination of 10 tables and/or figures. Authors are encouraged to restrict figures and tables to essential data that cannot be described in the text. The number of references should not exceed 80.

A THOUSAND WORDS ABOUT... is a form of Mini-Reviews. Manuscripts in this category should focus on *latest achievements of life science and medicine*. Manuscripts should be up to 1000 words in length (excluding title page, abstract and references) and contain up to 5 tables and/or figures and up to 25 most relevant references. The number of authors is limited to no more than 3.

OTHER SUBMISSIONS

Invited Editorials: Editorials are authoritative commentaries on topics of current interest or that relate to articles published in the same issue. Manuscripts should be up to 1500 words in length. The number of references should not exceed 10. The number of authors is limited to no more than 2.

Images in Clinical Medicine: Manuscripts in this category should contain one distinct image from life science or medicine. Only original and high-quality images are considered for publication. The description of the image (up to 250 words) should present relevant information like short description of the patient's history, clinical findings and course, imaging techniques or molecular biology techniques (e.g. blotting techniques or immunostaining). All labeled structures in the image should be described and explained in the legend. The number of references should not exceed 5. The number of authors is limited to no more than 5.

The Rationale, Design and Methods of New Studies: Manuscripts in this category should provide information regarding the grants awarded by different founding agencies, e.g. National Health Institute, European Union, National Science Center or National Center for Research and Development. The manuscript should be presented in the format of Research Project Objectives, Research Plan and Basic Concept, Research Methodology, Measurable Effects and Expected Results. The article should also contain general information about the grant: grant title, keywords (up to five), name of the principal investigator and co-investigators, founding source with the grant number, *Ethical Committee permission number*, code in clinical trials (if applicable). Only grant projects in the amount over 100,000 Euro can be presented. Manuscripts should be up to 2000 words in length (excluding references) and can include up to 5 tables and/or figures. The abstract should not exceed 150 words. The number of authors is limited to the Principal Investigator and Co-investigators.

Acknowledgements

Under acknowledgements please specify contributors to the article other than the authors accredited. List here those individuals who provided help during the research (e.g., providing language help, writing assistance or proof reading the article, etc.). Also acknowledge all sources of support (grants from government agencies, private foundations, etc.). The names of funding organizations should be written in full.

References

All manuscripts should use the 'Vancouver' style for references. References should be numbered consecutively in the order in which they appear in the text **and listed at the end of the paper.** References cited only in Figures/Tables should be listed in the end. Reference citations in the text should be identified by Arabic numbers in square brackets. Some examples:

This result was later contradicted by Smith and Murray [3].

Smith [8] has argued that...

Multiple clinical trials [4–6, 9] show...

List all authors if there are six or fewer; if there are seven or more, list first six followed by "et al.". Journal names should be abbreviated according to Index Medicus.

Some examples

Standard journal articles

1. Fassone E, Rahman S. Complex I deficiency: clinical features, biochemistry and molecular genetics. *J Med Genet.* 2012 Sep;49(9):578–590.
2. Pugh TJ, Morozova O, Attiyeh EF, Asgharzadeh S, Wei JS, Auclair D et al. The genetic landscape of high-risk neuroblastoma. *Nat Genet.* 2013 Mar;45(3):279–284.

Books

Personal author(s)

1. Rang HP, Dale MM, Ritter JM, Moore PK. *Pharmacology.* 5th ed. Edinburgh: Churchill Livingstone; 2003.

Editor(s) or compiler(s) as authors

2. Beers MH, Porter RS, Jones TV, Kaplan JL, Berkwitz M (editors). *The Merck manual of diagnosis and therapy.* 18th ed. Whitehouse Station (NJ): Merck Research Laboratories; 2006.

Chapter in the book

1. Phillips SJ, Whisnant JP. Hypertension and stroke. In: Laragh JH, Brenner BM, editors. *Hypertension: pathophysiology, diagnosis, and management.* 2nd ed. New York: Raven Press; 1995. p. 465–478.

TABLES: Tables should be typed on sheets separate from the text (each table on a separate sheet). They should be numbered consecutively with Arabic numerals. Tables should always be cited in text (e.g. table 2) in consecutive numerical order. Each table should include a compulsory, concise explanatory title and an explanatory legend. Footnotes to tables should be typed below the table body and referred to by superscript lowercase letters. No vertical rules should be used. Tables should not duplicate results presented elsewhere in the manuscript (e.g. in figures).

FIGURES: All illustrations, graphs, drawings, or photographs are referred to as figures and must be uploaded as separate files when submitting a manuscript. Figures should be numbered in sequence with Arabic numerals. They should always be cited in text (e.g. figure 3) in consecutive numerical order. Figures for publication must only be submitted in high-resolution TIFF or EPS format (*minimum 300 dpi resolution*). Each figure should be self-explanatory without reference to the text and have a concise but descriptive legend. All symbols and abbreviations used in the figure must be defined, unless they are common abbreviations or have already been defined in the text. Figure Legends must be included after the reference section of the Main Text.

Color figures: Figures and photographs will be reproduced in full colour in the online edition of the journal. In the paper edition, all figures and photographs will be reproduced as black-and-white.

SUPPLEMENTARY ONLINE MATERIAL: Authors may submit supplementary material for their articles to be posted in the electronic version of the journal. To be accepted for posting, supplementary materials must be essential to the scientific integrity and excellence of the paper. The supplementary material is subject to the same editorial standards and peer-review procedures as the print publication.

Review Process

All manuscripts are reviewed by the Editor-in-Chief or one of the members of the Editorial Board, who may decide to reject the paper or send it for external peer review. Manuscripts accepted for peer review will be blind reviewed by at least two experts in the field. After peer review, the Editor-in-Chief will study the paper together with reviewer comments to make one of the following decisions: accept, accept pending minor revision, accept pending major revision, or reject. Authors will receive comments on the manuscript regardless of the decision. In the event that a manuscript is accepted pending revision, the author will be responsible for completing the revision within 60 days.

Copyright

The copyright to the submitted manuscript is held by the Author, who grants the Journal of Medical Science (JMS) a nonexclusive licence to use, reproduce, and distribute the work, including for commercial purposes.