



BRIEF REPORT

DOI: <https://doi.org/10.20883/jms.2017.122>

Harmful results of improper fitted wheelchair – case study

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ABSTRACT

Wheelchair is perceived basic orthopaedic equipment, both for permanent and temporary use. Proper wheelchair fitting, and correct education of both medical staff, patients, and their families/caregivers may influence increased awareness of threats, limitations, and results of incorrect patient's positioning in wheelchair. Basic knowledge and experience may significantly reduce consequences in aforementioned area, and influence to shorter and more effective therapeutic process. Aim of this paper is to discuss possible problems resulting from improper wheelchair fitting on the basis of presented case study, explore the relationship between improper wheelchair fitting and limitations of wheelchair users independence, mobility, and life quality based on own experience and propose solutions and directions of further research.

Keywords: rehabilitation; disabled people; elderly people; wheelchair users; wheelchair fitting; wheelchair safety.

Introduction

Wheelchair is perceived basic orthopaedic equipment, both for permanent use (usually in disabled people) and temporary use (in weakened patients during recovery or in elderly patient for increased mobility purposes). Moreover temporary wheelchair use may be useful in patients with fractures, amputations, or neurological diseases, where neurorehabilitation may provide further recovery and possibility of increased mobility without wheelchair. Particular area of wheelchair application are perceived disorders of central nervous system (CNS), where may be observed movement/mobility limitations associated with disturbed sensation. Thus there is need to pay particular attention to a proper wheelchair fitting in patients with neurological deficits. The topic of the wheelchair fitting has been studied in the scientific literature (Steenbekers & Molenbroek, 1990; Chih-Chin Hsieh et al., 2011).

No doubt proper wheelchair fit is essential to promote community participation, and to prevent harm. Improper wheelchair fitting (including basic dimensions and features of the wheelchair) may cause significant harmful secondary changes. Basic pathological secondary changes are perceived bedsores, resulting mainly from too narrow seat (bedsores in the area of great trochanters of lower limbs) or too short footrests (particularly with association of too big seat angle – what provide increased pressure, and even bedsores, in the area of sacral bone). Too wide seat may cause spine deformities, spine pain and hips pain. Moreover too wide seat associated with too long footrests may cause improper (inclined) position of lower limbs, and scoliosis. Rare cases are shortening of the Achilles tendon resulting from too long footrests and associated improper feet position. Thus improper wheelchair

Table 1. The most common results of the improperly fitted wheelchairs

Source	Observed changes in user's health status	Remarks
Mikołajewska [1]	various pathologic changes depends on problem in wheelchair fitting	results for Poland – there were observed: unproper seat width in 62.5% of cases, unproper seat depth in 62.5% of cases, unproper footrest length in 87.5% of casus
Amos & Winter 2006 [2]	bedsores	results for Tanzania
Park & Jang 2011 [3]	bedsores	buttock pressure depends on backrest inclination in patients with spine cord injuries (SCI)
Giesbrecht et al. 2012 [4]	discomfort, poor positioning and mobility, bedsores	prevalence rate of inappropriate seating in elderly patients was 58.6% (ranging from 30.4 to 81.8%)
Bourbonniere et al. [5]	decreased mobility	prevalence rate of inappropriate seating in elderly patients was 22%

fitting may be perceived the global problem and need for common approaches to resolve it.

Wheelchairs need to be fitted with the consideration of the current user's health status, size, age, goals of the therapy, functional limitations, requirements, and possibilities (including style of living), among other factors. Despite efforts both medical staff and engineers improper wheelchair fitting still happens both in disabled (Mikołajewska, 2012; Park & Jang, 2011; Amos & Winter, 2006) and elderly people (Giesbrecht et al., 2012). It may result in harmful changes in users health status (**Table 1**). Unfortunately there is lack of studies including bigger amount of patients providing more reliable data.

Aim of this paper is to discuss possible problems resulting from improper wheelchair fitting on the basis of presented case study, explore the relationship between improper wheelchair fitting and limitations of wheelchair users independence, mobility, and life quality based on own experience and propose solutiopna and direstions of further research.

Case report

Patient

The patient was a 21-years-old male, one year after road accident, at first with tetraplegia. This patient was

admitted to the neurological rehabilitation ward during the subsequent stage of the therapy with diagnosis: tetraparesis with predominance of left side hemiparesis. Clinical status of the patient is summarized in

Table 2.

Unfortunately patient was unable to participate in gait re-learning therapy as a result of improper wheelchair fitting. Despite neurorehabilitation succesful recovery of the patient with primary dignosis tetraplegia was restrained. The patient obtained possibility of gait, but main limitation during further therapy (including gait re-education) was fixed deformity in the area of ankle (i.e. improper foot positioning). Both standing and walking was painful, non-functional, and further therapy remained impossible. The patient observation and assessment provided evidence of long-term wheelchair sitting in a pathological position. Problems was increased by previous improper fitting of the wheelchair dimensions: too short seat, to narrow seat, too short footrests. Rest of the wheelchair features and accesories was perceived properly fitted, but previous training of the patients and his family was barely existent, so their consciousness of possible harmful results of improper whelchair fitting and use was rather poor. Aforementioned discomfort caused footrests non-use, and changing position into another with stright lower limbs. Long-term use of the new position, with pato-

Table 2. Clinical status of the patient

Criteria	Score / result
diagnosis	tetraparesis with predominance of left side hemiparesis
general health status	patient after treatment regained muscle strength and active movements within lower limbs allowing for introduction of gait reeducation
Ashworth Scale for grading spasticity results:	
left lower limb	4
right lower limb	3
	diagnosed tension in left lower limb resulted in improper feet position (at a 40-degree angle) without possibility of the therapy towards physiological position
other	diagnosed fixed contractures in the areas of muscles and Achilles tendon, bender of big toe, and muscle tibialis posterior of the both lower limbs

logical muscle tone, caused pathological feet positioning and limitations of further gait re-education.

Therapy

There was introduced eight-week therapeutic approach aiming at decreasing of pathologic muscle tension for physiological feet positioning purposes and increasing of range of movement within ankle. Basic components of aforementioned therapy were as follows:

1. hydrotherapy of the lower limbs – six times a week,
2. massage – five times a week,
3. parafango wrap – six times a week,
4. redression – six times a week,
5. passive exercises of ankles – five times a week,
6. orthopaedic equipment: shoe with enlarged opening (to improve the shoe wearing), gimp with metal insert (to avoiding the show deformation) – there was lack of acceptance to use orthopaedic shoes due to psychological issues (**Figure 1**),
7. botulinum toxin type A injections into: muscle plantaris, bender of big toe, muscle triceps surae, and muscle tibialis posterior.

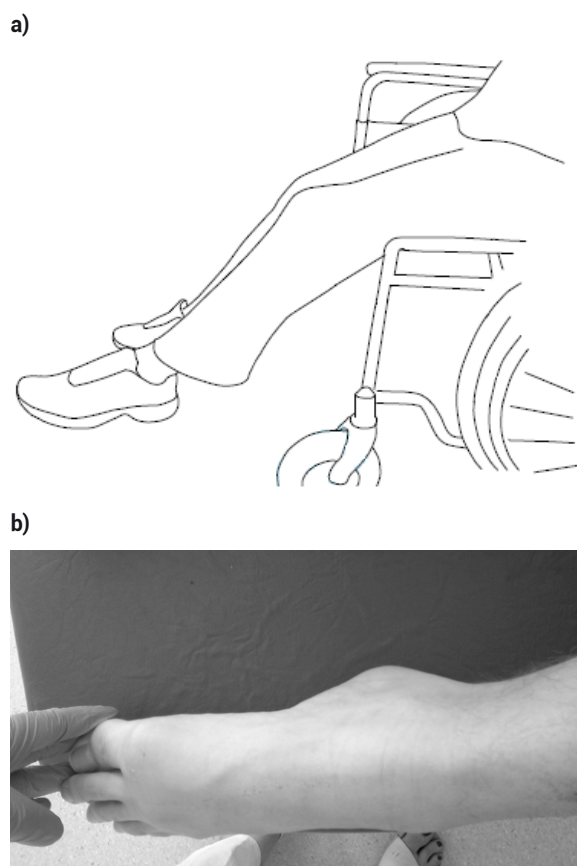


Figure 1. Patient's foot deformation: a) improper wheelchair use influencing increased pathology, b) pathologic foot deformation as a result of improper wheelchair use

Results

Aforementioned therapy, despite efforts of the patient and interdisciplinary therapeutic team, resulted in a lack of recovery. Supplementary diagnosis provided suggestion of surgical intervention for deformation correction purposes, which next proved effective. But this way whole therapy of the patient was significantly prolonged.

Discussion

Wheelchair use may significantly influence activity and participation both disabled, severely ill, and elderly people (Mortenson et al., 2008). Although at least several studies reported 40–80% of nursing home residents (wheelchair users) who need for some type of seating intervention for increased mobility purposes. Moreover further research indicate that use of wheelchairs and seating systems do not fitting the individual needs, a lot of problems can become evident: pressure ulcers, difficulty in propulsion, discomfort, dysphagia, falls, and decreased quality of life (Gavin-Dreschnack et al., 2005). Thus described therapy resulting from improper wheelchair fitting may be additional limitation, decreasing of patients quality of life, and cost generated by improper wheelchair fitting. It needs for additional research, especially due to limited evidences. Role of aforementioned research, particularly in long-term rehabilitation and care, may be hard to overestimate, influencing both independence, mobility, quality of life, and even, as a consequences, mortality and cost of the therapy in disable people and elderly people. Newest tools, including Seating Identification Tool (SIT), Resident Ergonomic Assessment Profile for Seating, and Wheelchair Seating Discomfort Assessment Tool, help to assess selected possible risks in a quick, easy to use, reliable and valid way (Gavin-Dreschnack et al., 2005; Miller et al., 2004; Crane et al., 2005). But no doubt outcomes of clinical trials should be involved into strategic planning for both the home therapy and care, and institutionalized therapy and care.

Apart of described foot deformation as harmful results of improper fitted wheelchair there is need for paying particular attention to subsequent possible negative result of the improper position in wheelchair: increased lumbar lordosis and risk of pain in lumbar-sacral spine. Due to importance of this issue future patient's assessment needs to be supplemented by more detailed questions concerning previous his-

tory of spine pain and influence of the angle between the thighs and trunk.

Due to poor scientific evidence it should be noted, that clinical picture of the different types of aforementioned harmful results of improper fitted wheelchair may be caused by more than one mechanism, making possible whole spectrum of disorders. Thus presented way of the therapy needs further investigation. Moreover clinical picture of disorders resulting from improper wheelchair fitting may change depends on the clinical status of the patient, place of lesion, functional possibilities, life style, age, etc. No doubt there is need to explore more varieties of treating for other cases (Mikołajewska & Mikołajewski, 2010; Gaal et al., 1997; Cooper et al., 2006). Contemporary approach in presented area may be insufficient. Knowledge in the area of basic wheelchair fitting should be common within multidisciplinary therapeutic team, to avoid mistakes and misunderstandings. Training of the patient and his/her family/caregivers should cover these issues, including response to observed changes (possibly harmful). This may require additional effort within system of medical staff education, with emphasizing the role of supervision from local medical authorities. This approach may result e.g. in significant decrease of the secondary complications. Presented case report pays particular attention both to proper diagnosis, early beginning of the rehabilitation, and moreover proper wheelchair fitting and with further control (and modification, if necessary). Well fitted wheelchair may decrease possible threats, and allow to avoid secondary complications described above. If not it may be true, that presented therapy of harmful results of improper wheelchair fitting may be useful and effective therapeutic approach, but should be as quick as possible, patient-oriented and patient-tailored.

Conclusions

Aformentioned case study shows importance of proper wheelchair fitting, and correct education of both medical staff, patients, and their families/caregivers. Increased awareness of threats, limitations, and results of incorrect patient's positioning in wheelchair resulting from improper fitting of wheelchair dimensions and features may influence decreasing harmful results as described. It seems basic knowledge and experience may significantly reduce consequences in aforementioned area, and influence to shorter and more effective therapeutic process. There is need

for common effective prevention policy in the area of wheelchair fitting.

Acknowledgements

Conflict of interest statement

The authors declare no conflict of interest.

Funding sources

There are no sources of funding to declare.

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Acceptance for editing: 2016-1-20
Acceptance for publication: 2017-03-27