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CHALLENGES FOR PHYSIOTEHRAPY IN ANISOMELIA AFTER HIP ARTHROPLASTY

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Abstract: *This report examines the problem of anisomelia of the lower extremities after total hip arthroplasty and the problems to be solved by the physiotherapist. Diagnostic methods are briefly described. An analysis of the changes in posture and gait is made and the main tasks of postoperative physiotherapy are outlined, as well as means for solving them. The aim of this paper is to introduce what tasks physical therapists may face when working with patients with anisomelia after hip replacement and what tools can be used.*

Keywords: *anisomelia, physiotherapy, total hip arthroplasty.*

INTRODUCTION

Leg length discrepancy, or anisomelia, is defined as a condition in which the lower limbs are noticeably unequal in length. Restoration of hip biomechanics and leg length are desired goals when performing total hip arthroplasty. Minor leg length discrepancies of less than a centimeter are common after total hip arthroplasty and are usually well tolerated. More significant discrepancies can be a risk factor for nerve damage, muscle imbalance, spinal curvatures, and overall kinematic chain disorder (Maloney, W. J., Keeney, J. A., 2004). Ways to influence functional anisomelia after endoprosthesis are mainly orthopedic insoles combined with physical therapy such as stretching, massage, gymnastic exercises and others in accordance with the contraindications following hip arthroplasty (Dobroski, C., 2018).

The aim of this paper is to introduce what tasks physical therapists may face when working with patients with anisomelia after hip replacement and what tools can be used.

EXPOSITION

The hip joint is one of the largest in the human musculoskeletal system. It is the basis of the kinetic chain of the lower limb and is the most mobile in it. The articular surfaces of the hip joint are formed by the acetabulum and the cartilage-covered head of the femur. The bone configuration of the femur and the acetabulum decisively determine its normal function. During walking, compressive forces in hip joint range from 13% of weight in the double-support phase, to 300% of weight in the single-support phase. The function of the hip joint is highly dependent on the correct structural interposition and orientation of the femur relative to the acetabulum. The

correct orientation of the bone structures provides the least and efficient load on the joint surfaces (Popov, N., 2020).

There are a number of reasons and diseases disrupting the proper functioning of the hip joint. The most common reasons for endoprosthetics are osteoarthritis and fractures in the hip joint area. It is estimated that about 15% of the world's population suffers from osteoarthritis (Yashar, A. et al., 2020). With the increase in the average life expectancy in recent years worldwide, the number of elderly and old people is also growing, with which this percentage is increasing (Stefanova, I. et al., 2016).

According to the data of the Bulgarian National health insurance fund (NHIF), for a period of one year (2022), 1,372 operations "Alloplasty of the hip and knee joints" were performed in Bulgaria, of which 147 were performed in the UMHAT “Kaneff “ and the UMHAT “MEDICA” in the city of Ruse (NHIF, 2022)

Coxofemoral arthroplasty is considered one of the most successful surgical/orthopedic procedures due to the good functional results, pain relief, restoration and improvement of mobility and the resulting improved quality of life. The beginning of hip joint prosthetics as a treatment for coxarthrosis dates back to the early years of the 19th century. Since then, prosthetics has undergone rapid development due to detailed studies on the anatomy and biomechanics of the hip joint (Mihov, K., 2017).

Restoration of hip joint biomechanics and leg length are desired goals when performing a total coxofemoral joint arthroplasty. Minor leg length discrepancies of less than a centimeter are common after total hip arthroplasty and are generally well tolerated. More significant discrepancies can be a risk factor for nerve damage, muscle imbalance, spinal distortions, disruption of the entire kinetic chain (Maloney, W.J., Keeney, J.A., 2004).

Anisomelia is diagnosed by limb centimeter, Allis test, X-ray, computed tomography (Dombroski C., 2018).

A non-structural (functional) length difference is unilateral lower extremity asymmetry without shortening of the bony components of the lower extremity. Functional anisomelia can be caused by a change in lower limb mechanics, such as joint contracture, static or dynamic mechanical axis malposition, muscle weakness or shortening. It is impossible to detect these faulty mechanics using a non-functional assessment such as radiography. Functional anisomelia can develop due to abnormal movement of the hip, knee, ankle, or foot in any of the three planes of motion (Khamis, S., Carmeli, E., 2017).

The structural difference in limb length is a physical (bony) shortening of a lower limb. Congenital conditions include mild developmental abnormalities detected at birth or childhood, while acquired conditions include trauma, fractures, orthopedic degenerative diseases, and surgical disorders such as joint replacement (Khamis, S., Carmeli, E., 2017). Functional anisomelia can be found in approximately 70% to 90% of the population. (Gurney, B., 2002). Passive structural changes - pelvic torsion, mild lumbar scoliosis, changes in muscle length—seem capable of anatomically compensating for anisomelia up to 20 mm. After the ~20 mm point, passive structural changes give way to active muscular compensatory measures (Knutson, G.A., 2005).

Anisomelia affects the lumbar spine, at least in part, creating lumbar scoliosis. Anisomelia has been shown to lead to pelvic distortion in the frontal plane, causing scoliosis (Gurney, B., 2002). Lumbosacral facet joint angles appear smaller on the short side, suggesting that asymmetry of joint angles predisposes patients to osteoarthritic changes in the lumbosacral joints. Patients with this type of pathology mainly complain of back pain (Fig. 1).

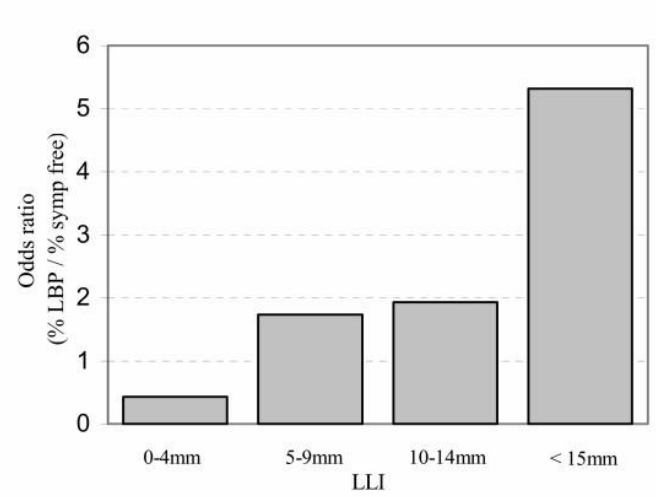

Fig. 1. "Incidence" of chronic low back pain in structural lower limb length difference (Knutson, G. A. 2005)

Postural changes in anisomelia

Patients use different specific compensatory mechanisms in anisomelia. (Table 1).

Table 1. Compensatory changes in the joints of the lower limbs

	Long leg	***Short leg***
Foot	Pronation	Supination
Ankle	Dorsiflexion	Plantar flexion
Knee	Flexion	Extension
Hip joint	Flexion + internal rotation	Extension + external rotation
Pelvic bones	Back rotation	Front rotation

Patients may have only some or all of the listed compensatory joint positions shown in Table 1. If the leg is left uncompensated, the anterior and posterior iliac spines on the side of the short leg may be lower, which may result in sacral malalignment base and/or scoliosis (Resende, R.A., 2016).

Gait changes in anisomelia

There is a cranial shift of the center of gravity, which leads to an increased load during walking. Compensatory mechanisms for this include eversion of the subtalar joint, extension at the knee joint, tiptoe walking, scything gait, flexion of the hip or knee joint (stepping gait). Stance phase and stride length of the shorter leg are reduced, resulting in reduced walking speed. Movement is done in small step.

Methods to overcome anisomelia

Ways to influence anisomelia after endoprosthesis are divided into surgical and conservative methods, with the conservative methods being mainly orthopedic insoles combined with physiotherapy. These orthopedic shoe insoles are either a shoe insert (up to 10-20 mm of correction) or a shoe sole overlay on the shorter leg (up to 30-60 mm of correction) (Fig. 2). This orthopedic intervention should be applied gradually in small steps.

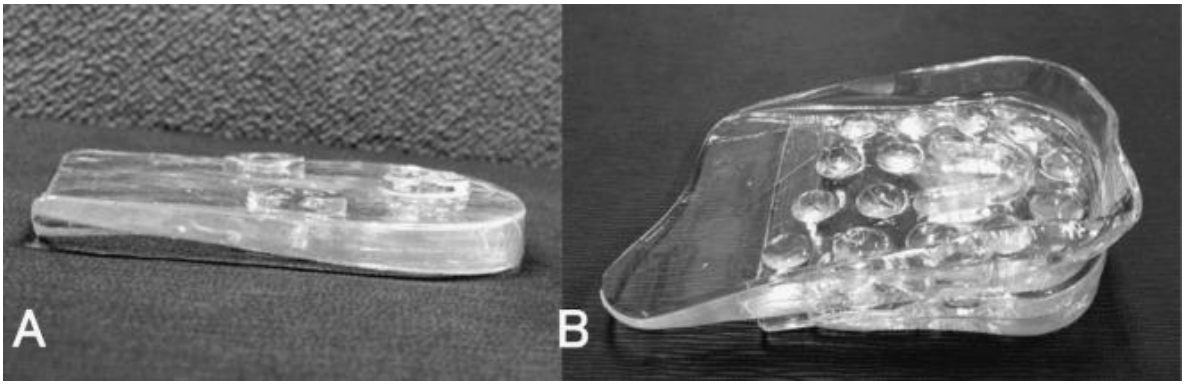

Fig. 2. (A) Single insert under the heel 5mm. (C) Three inserts under the heel 15mm. (Nakanowatari, T., Suzukamo, Y., Izumi S. I., 2016).

Physiotherapy can directly affect the clinical picture of functional anisomelia, in conditions such as soft tissue shortening, joint contractures, instability and uneven axial loading. The tasks of kinesitherapy in anisomelia are generally:

- normalization of muscle tone and length;
- increasing joint range of motion;
- strengthening of the articular muscle corset;
- reduction of postoperative edema;
- impact on scoliotic deformities;
- training in correct posture;
- destruction of pathological motor stereotypes;
- retraining in walking.

The means that can be applied are stretching, massage, muscle relaxation techniques, gymnastic exercises to strengthen muscles and joint stability, corrective gymnastics for correct posture (Dobroski, C., 2018).

When preparing a physiotherapeutic program, specialists must necessarily take into account the individual characteristics of the patient, his concomitant diseases, his rehabilitation potential and contraindications for total hip arthroplasty:

- flexion in hip joint over 90;
- adduction in hip joint;
- external and internal rotations.

For the successful elimination of the pain syndrome and the increase of the joint range of motion after hip arthroplasty, it is necessary to balance the stability, build a strong muscle corset and last but not least, line the length of the lower limbs (Kosev, P. et al., 2015).

CONCLUSION

The hip joint is at the base of the kinetic chain of the lower limb. Inconsistencies in the length of the lower limbs as a result of arthroplasty can be a risk factor for neurological damage, muscle imbalance, spinal distortions, disorders along the entire kinetic chain, affecting posture and gait. Anisomelia poses serious challenges to postoperative physiotherapy and sets a number of tasks before it, such as normalizing the tone and length of the muscles, increasing the joint range of motion, strengthening the joint muscle corset, influencing scoliotic deformities, destroying pathological motor stereotypes, retraining in walking. The ways to influence functional anisomelia after arthroplasty are mainly the application of orthopedic insoles to compensate for the differences in the length of the limb, combined with means of physiotherapy such as stretching, massage, muscle-relaxation techniques, gymnastic exercises to strengthen muscles and joint stability, corrective gymnastics for proper posture.

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