

# PROBLEMS OF NORMS IN A LOCOMOTOR SYSTEM DISORDER

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A question is whether we may talk about normalisation in case of pathology, being locomotor system disorder pathology; i.e. being out of norm.

We can talk about it when pathologic process is fixed, or is developing slowly, like the process of ageing. Any locomotor system disorder is reflexively compensated (Fig.1). Compensation of a locomotor system disorder

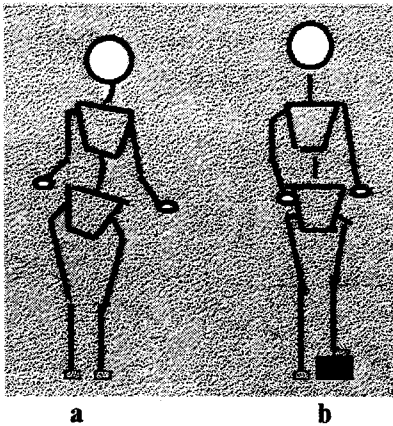


Fig. 1. Compensation of the locomotor's system disorder, a – reflexively compensation, b – controlled compensation.

overstrains other areas located below or above the place of disorder. Selecting the proper method of compensating is a main goal of rehabilitation, thus kind of norm. In case of a lower limb amputee one may not evaluate the patient's hobbling, but his gait with prosthesis or walk on crutches. Selecting the proper method of compensating pathologies is conditioned by subject's personal features, as in case of sport classification and the decision of what discipline is proper for a given person. For example the knee joint stiffness may be compensated in walking in three ways (Fig. 2). The first one overstrains hip joint and vertebral column. The second one requires bigger expenditure of energy. The third one is the most efficient, but not aesthetical. Detailed analysis of compensation allows not only to evaluate its efficiency, but also to direct it. Such aimed tests are especially important in case of fixed

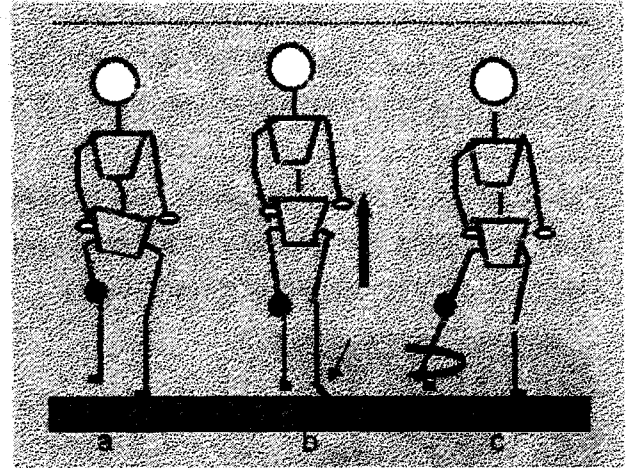


Fig. 2. Knee Joint stiffness may be compensated in walking in three ways.

disorder, as they enable decreasing overstrain in other areas of locomotor system. Coxarthrosis, degenerative disease of hip joint, chronic disorder leads in its final stage to hip joint stiffness. Typical functional reflection of such disease is the limb position in external rotation, with various levels of flexion contracture.

Analysis of compensation. There are eight hip joint external rotators.(Fig. 3+3a). Why? External rotation in

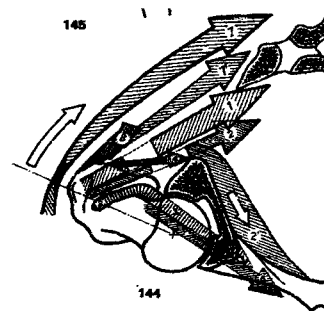


Fig. 3. External rotators of hip joint.

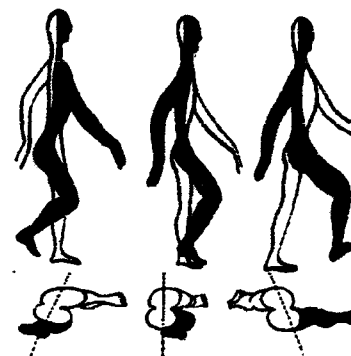


Fig. 3a. Rotation movement of hip joint.

walking manner takes place while the strain is off, during the phase of limb flight; weight of lower leg is putting the limb in external rotation before it is load again. The external rotators damp the rotary motion of pelvis in the phase of support. In cases of pathology the muscles lying directly on an articular capsule getting overstrained and derivatively contracted. Passive limit of rotation causes exerting strong pressure on femoral head while walking.

Functional test: in a standing position, with the fingers placed on anterior iliac spine and trochanter, the pelvis rotary movement inward shall be checked (Fig.4).



Fig.4. Functional examination of pelvis rotation movement.

Observing the foot we may find the sign of foot supination as an early-symptom of compensation of internal rotation limit. To keep the balance the tested subject may lean with his hand, tested side of the body, against something. Unloading the hip joint by support with the opposite hand on the crutch unloads the joint, what leads sometimes to restore internal rotation.(Fig. 5).

Limitation of a hip joint internal rotation while walking is apparent in results of measuring the rotation with electrogoniometric Penny & Gilles device.

Measurements made with the Kistler's platform (Fig. 6) proved that in case of limiting the internal rotation, the moment of rotation torque on femoral head increase 6 time in comparison to the normal side. The result of calculation is not rigorous, due to the fact that it is

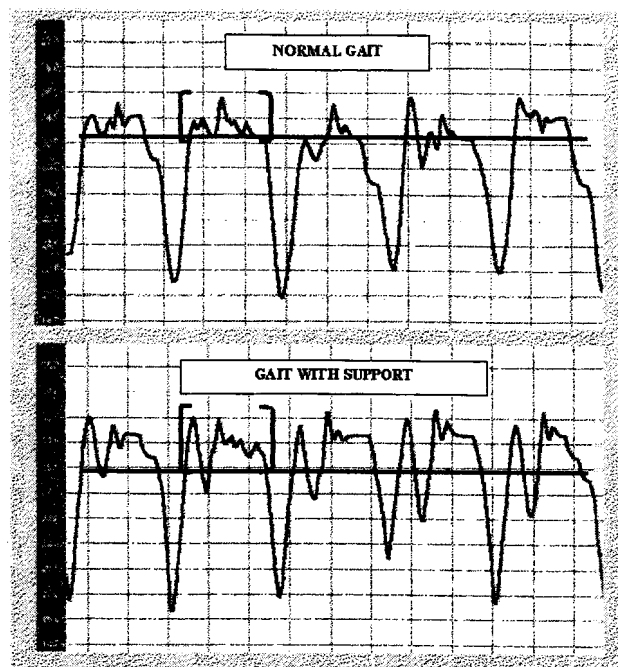


Fig. 5. Penny&Giles - range of rotation movement while walking; internal rotation above the line.

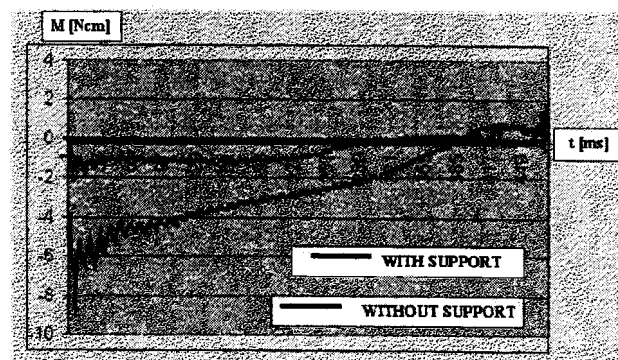


Fig. 6. The rotation torque.

difficult to measure elasticity of soft tissues, absorbing shocks, shock-absorbing value of foot achieved by supination and foot slip on the surface. Walking on crutches unloads the joint and brings the rotation back in non-advanced cases.

The course of this sort of compensation may easily be seen on a CDG diagram (Fig. 7) – the foot is loaded at its lateral side, and also at front-medial side, where, during glancing off, the foot slides and rotates on the surface. Such compensation increases hip joint load, deteriorating the joint structure and causing pain. Unloading the joint by leaning against the crutch, held in an opposite hand and moved forward, causes in many cases partial internal rotation in an unloaded hip. The crutch moved forward takes over the internal rotation braking. The effect of

compensation control shown in a functional test – change of record and of CDG test (Fig. 8) result, and change of foot loading course prove that the method of compensation is proper and that some of the gait parameters are similar to the norm.

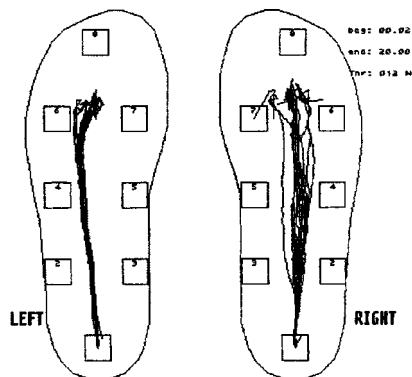


Fig. 7. CDG, coxarthrosis left – characteristic gaitline.

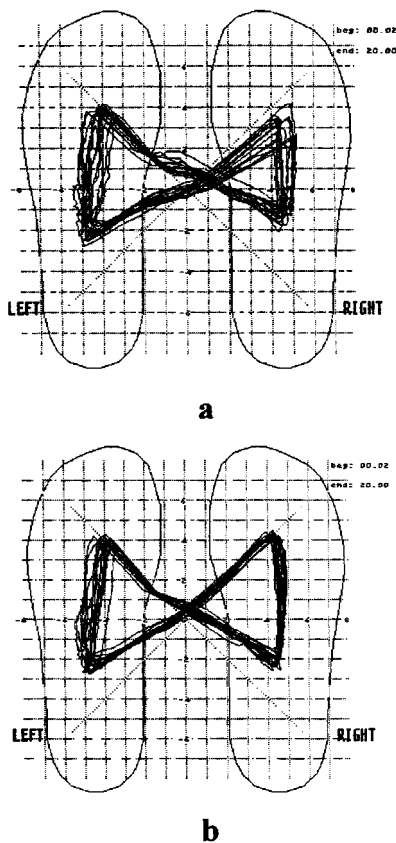


Fig. 8. CDG (cyclogram); coxarthrosis dextra, a – without support, b – with support (cruth).

Analysing other CDG (Fig. 9) records of unloaded walking manner (crutch) and the loaded one we find that the results are much better with compensation. Similar differences may be found in case of the other options: forcegraphics, histogram and cyclogram. In case of

clinical rotational stiffness unloading the joint helps to improve the records of time and the histogram.

NAME	NORM	LEFT	RIGHT	SVHM	SD_L	SD_R
Single supp. [s]	0.4-0.6	0.522	0.518	1.01	0.020	0.023
Double supp. [s]	0.1-0.2	0.000	0.187	1.12	0.010	0.014
Double swing [s]	0.0-0.5	0.000	0.000	1.01	0.000	0.000
Stance [s]	0.6-0.8	0.518	0.522	1.00	0.023	0.020
Single swing [s]	0.4-0.6	0.518	0.522	1.00	0.023	0.020
Steplength [m]	0.5-0.7	0.594	0.618	0.97	0.040	0.044

NAME	NORM	LEFT	RIGHT	SVHM	SD_L	SD_R
Single supp. [s]	0.4-0.6	0.538	0.522	1.04	0.023	0.030
Double supp. [s]	0.1-0.2	0.000	0.000	1.00	0.015	0.020
Double swing [s]	0.0-0.5	0.000	0.000	1.00	0.000	0.000
Stance [s]	0.6-0.8	0.522	0.538	1.02	0.044	0.050
Single swing [s]	0.4-0.6	0.522	0.538	0.97	0.030	0.025
Steplength [m]	0.5-0.7	0.624	0.627	1.00	0.069	0.040

Fig. 9. CDG; coxarthrosis dextra – steplenght, a – without support, b – with support (cruth).

Value of such tests depends on detailed analysis of performed clinical diagnosis and functional test. Coxarthrosis is a long-lasting disease. Characteristic swinging gait in a direction of aching hip is a symptom of compensatory hip joint unloading. Joint muscle stiffness in the phase of support decreases painful friction of wasted joint surfaces. Stiffness is permanent. Even after placing endoprosthesis and restoring the proper movability of hip, during the functional test, in many cases internal rotation is still limited while walking. This may be considered a symptom of improper gait stereotype.

Comparing the results achieved during tests performed with measuring equipment with the ones of analysis of examination allows making practical use of both techniques.

