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FIMS Position Statement

Physical activity after total joint replacement

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Introduction

The number of artificial joints implanted worldwide has increased dramatically over the last 20 years. In the majority of cases quality of life, as well as overall postoperative mobility, has increased as a result of joint replacement. Furthermore, improved quality of implants, optimised implantation techniques and growing experience among surgeons have led to an improved durability of prosthesis, faster rehabilitation following surgery, and a broader range of indications for treatment.

As a result, the indications for treatment with joint replacement have expanded and even younger patients are now being provided with an endoprosthesis, especially for the replacement of hip and knee joints, as well as shoulder and ankle joints. The patients' growing demand for improved quality of life and enhanced functionality during work or recreational activities after having received a total joint replacement requires a thorough reevaluation of the patient's ability to cope with physical stress, especially while performing athletic activities. In the past, the main focus rested on restoring activities of daily living (ADL). Today, that focus has shifted towards resuming previously played sports, as well as taking on new forms of exercise¹⁶.

Basics of physical activity after arthroplasties

A reasonable amount of physical activity after total joint replacement is generally recommended⁸. In this context, the majority

of scientific studies focus on physical endurance after implantation of knee- and hip prostheses^{2,3,11,18}. However, there is little evidence-based data available regarding the question of physical activity after alloarthroplasties of the upper extremities or the ankle joints. To evaluate the durability of the prosthesis, several factors have to be considered: on the one hand, there are the different types of artificial joints implanted (i.e. cemented, cementless, hybrid) stability of the prosthesis (i.e. press-fit), the extent of wear (e.g. periprosthetic osteolysis), and, on the other hand, the amount of stress applied externally. Recently the above mentioned factors have been the topic of controversy. Studies showed that increased physical activity resulted in optimised osteointegration as well as improved muscular performance and a decrease of loosening rates^{4,18,19}. Dubs, Widhalm and von Strempel observed fewer cases of loosening in patients who were physically more active, than in those who were less or not active at all^{6,19,20}. Further, von Ritter (hip) Lavernia and Jones (knee) showed that especially low-impact sports (swimming, cycling) resulted in an improved clinical outcome, as well as lower revision rates^{9,12,14}. However, higher loosening rates have been reported especially in younger patients with increased levels of physical activity^{9,14}.

Due to a lack of in vivo data, the limits of tolerance and the actual force which is internally applied to the prosthesis and its anchorage can only be estimated. Therefore secondary evaluation criteria, such as the patient's conditions, revision statistics and



model calculations, are used. One of the few available in vivo analysis using a so-called measuring-prosthesis during running and cycling exercises, shows that the stress applied to the hip joint while riding an ergometer did not increase by more than 1-1,5 times the body weight¹. The stress during treadmill exercise was significantly higher (2-3 times body weight while walking, 5-7 times body weight while running). Although not scientifically proven, assumptions and recommendations have been made in the past that the choice of footwear and other external factors should be taken into consideration. Ultimately it was proven, that the stabilising forces of the adjoining muscles are primarily responsible for the amount of stress applied to the joint¹.

Basic recommendations for physical activity

Physical exercise recommendations after implantation of a hip prosthesis have been addressed by several scientific societies. With respect to knee endoprosthesis, the type of the implanted joint (differences between surface replacement, partially stabilised and stabilised prosthesis) has to be considered, since the amount of force transmitted on the implant/bone increases with mounting passive implant stability rendering surgical revisions riskier or only partially feasible. Thus the assessments of the ability to cope with physical strain are generally conservative even though the positive effects of activity are scientifically proven. Concerning the shoulder joint, sports with little risk of falls, low tensional strain and low rotational stress are recommended rather than sports with higher risks of injury. Data concerning physical strain after endoprosthetic replacement of the ankle is even less adequate than that of the shoulder. In general, physical activities during which the patient's weight is not directly transmitted to the endoprosthetic joint are recommended (swimming, cycling¹⁷).

Recommendations in relation to type of sports

When assessing physical activity capacity after total joint replacement a distinction has to be made between lower impact and higher impact sports following the general recommendations of the Hip Society

Consensus, the Knee Society Consensus, and the German Society for Sports Medicine and Prevention recommendations^{5,7,8}. Physical activities that combine a cyclic performance with low rotational forces and minimal impact forces are summarised as low impact sports (e.g. cycling, swimming, walking, Nordic walking, gymnastics, low impact aerobics, weight training, and cross-country skiing) and are highly recommended for patients with endoprosthesis. Team sports and sports that require frequent jumping (e.g. soccer, handball, volleyball, basketball), as well as sports such as tennis, badminton, but also skiing, high impact aerobics and sports with higher risks of injury are rarely recommended. Nevertheless, high impact sports should not be dismissed on principle and should be evaluated for each individual case. Furthermore, forces that might likely result in luxation (in relation to surgical techniques) and sports with high risks of injury (trendy sports among others) should be avoided. The patient's prior experience in a particular sport will also play a major role in the decision to allow participation. It is recommended to evaluate running sports differentially, because duration and speed, as well as the compensational ability of the muscles, are essential assessment criteria. A primarily stable anchorage with musculo-ligamentary stability, a functional and painless walking pattern (lower extremities) and functional joint stability are general preconditions to resuming physical activity. The operation should have been performed at least 6 month previously (exceptions excluded) prior to resuming vigorous activity. A good axial alignment of the implant without signs of loosening should be confirmed via X-rays. In addition, the general assessment criteria concerning cardiovascular, pulmonary, orthopedic and neurological findings should be taken into consideration. Current contra-indications are infection, instability of the joint, or loosening of the implant. Relative contra-indications are a prior revision of the endoprosthesis, muscular insufficiency, and obesity (BMI above 30,⁵). However, those patients should not be discouraged from performing physical activities on principle, but should rather be advised to pursue alternative and less stressful movement patterns (i.e. weight training under functional joint stability, activities in the water, cyclic performance with a limited range of movement - see Table 1).



Conclusions

Physical activity after total joint replacement is recommended based on the most recent evidence-based data as outlined in Table 1. Recommendations based on the consensus statements of different societies in combination with scientific research data provide sufficient information and evaluation criteria for the prescribed exercise for recipients of knee and hip prosthesis^{2,3,11,18}. There is significantly less controlled data for the assessment of other joints. Important factors for the assessment of exercise capability and the capacity to cope with physical stress can be summarized as follows:

- (1) physical activity after joint replacement is generally recommended from the medical point of view for general health and fitness
- (2) the following factors should be taken into consideration when evaluating physical stress:
 - general risk of injury
 - risk of luxation
 - risk of damaging the implant (fracture risk, abrasion, anchorage's stability)
 - risk of loosening
 - muscular (functional) joint stability
 - patients general stamina
 - the patient's experience with the sport or activity
 - the physician's and patient's knowledge of the particular sport with respect to evaluation of its suitability and the joint's ability to cope with the expected amount of physical stress.
 - the relation between beneficial joint stabilising training stimuli and the possibility of damaging the joint by applying too much strain should be explained to the patient in a way that is suited to the patient's- particular physical activities
 - an adaptation to individual conditions and capabilities can be achieved by slightly modifying the physical activities (i.e. use of sticks during walking exercise, avoidance of competition character, limitation/modification of techniques during cross-country skiing).
 - controlled, individually paced sports are generally recommended with the objective of rehabilitative, stabilising training for the muscles adjoining the joint.

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Table 1: Recommended, recommended with limitations and less recommended types of sport after total joint replacement of hip, knee and shoulder joints^{5,7,8}

Joints	Recommended	Recommended with limitations ^{1,3}	Less recommended ^{2,3}
Hip joint	aerobics (without jumps) aquajogging ergometer training individual gymnastics bowling cycling (saddle height) horse riding rowing darts swimming dancing walking/Nordic walking hiking	aerobics (without jumps) alpine skiing golf bowling weight training running/jogging horse riding cross-country skiing tennis table tennis	basketball figure skating speed skating soccer gymnastics handball hockey inline skating martial arts/combat sport rock climbing athletics (jumps) mountain biking squash volleyball
Knee joint	aerobics (without jumps) aqua jogging ergometer training individual gymnastic bowling horse riding darts swimming dancing walking/Nordic walking hiking	alpine skiing weight training running/jogging horse riding rowing cross-country skiing tennis	basketball figure skating speed skating soccer handball hockey rock climbing squash volleyball
Shoulder ⁴	aqua jogging individual gymnastic running/jogging cycling horse riding walking/Nordic walking hiking	alpine skiing golf weight training running/jogging horse riding rowing swimming cross-country skiing	basketball figure skating speed skating soccer handball hockey martial arts/combat sports rock climbing mountain biking squash volleyball

1. generally possible depending on experience
2. evaluation for each individual case
3. sports with high risk of injury are generally less recommended
4. compared to recommendations for physical exercise after knee and hip endoprosthesis the data available for the ability to cope with physical stress after shoulder alloarthoplasties is not sufficient for evidence based evaluation. Therefore the mentioned information should be regarded as a recommendation, which should be reassessed in each individual case.

