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A Review of Sport Recovery after Total Knee Replacement

Cerciello S*, Vasso M, Felici A, Corona K, Palombi A and Schiavone Panni A

Molise University, Campobasso, Italy

Abstract

The ability to come back to sport is becoming a common request among patients undergoing total knee replacement. Despite this kind of surgery may allow to fulfill this request, the potential negative effects of heavy activities on the implant are still debated. Moreover data in literature compare different populations and sports so that it is difficult to give definitive conclusions.

Light activities have positive effect on general health status both in young and old patients after knee replacement. Movement improves cardiopulmonary efficiency and bone metabolism. Local muscle strengthening and exercise increase joint flexibility optimizing implant function. No negative effects are described with this kind of light activity, thus most of surgeons recommend cycling, walking and swimming after surgery. Heavy sports such as skiing and all contact sports have less positive effects on general health while they produce stress and loads on the implant. These may be dangerous since they raise the risk of polyethylene wear and further loosening of the implant and should be allowed with caution especially in young and heavy patients.

Keywords: Total knee replacement; Sport; Heavy activity; Muscle strengthening; Aseptic loosening

Introduction

The continuous improvement of general health conditions has led to longer life expectancy. Thus the prevalence of degenerative pathologies such as osteoarthritis has increased. This issues as well as the necessity of an active lifestyle is the main reasons for the increased incidence of total joint replacement procedures in the last decades. Moreover the high success rate, which is around 90-98% at 10-20 years of Follow- up (FU) [1-3] has led the surgeons to propose this operation to younger and more active patients.

A recent study has shown that by 2016 more than half of patients requiring a Total Knee Replacement (TKR) will be younger than 65 years old (Figure 1). The trend for revision surgery will change in the same way [4].

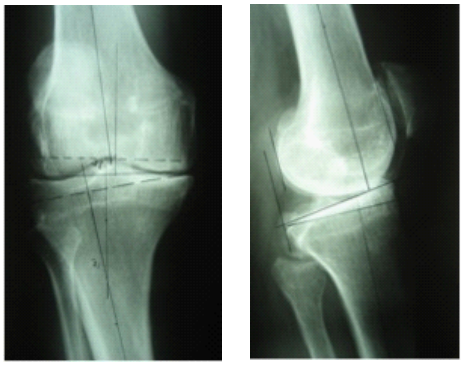
So, between 2005 and 2030, the expected demand for Total Hip Replacement (THR) and TKR will grow by 174% and 673%, respectively, [4] because of the aforementioned aspects [5].

However, beside this trend towards younger and more active patients, functional demands and expectations have changed in the same way. While in the past the main goal for a joint replacement was pain relief [6], recently most of patients look for active life and sport comeback [7].

On the other hand it is well demonstrated that healthy and active lifestyle has a positive influence on several pathologies such as depression, obesity, hypertension diabetes, and osteoporosis [8,9]. Roder et al. [10] in their study on 13000 patients undergoing THR, demonstrated in almost 40% of subjects an increase of walking time of 600%, especially in those who were particularly limited before surgery. In the same way Macnicol et al. [11] reported improvement in walking speed and oxygen demand, while Ries et al. [12] showed increase in oxygen consumption and maximum oxygen absorption. Finally, remaining physically active enhances the quality of the interface between the bone and prosthesis [7]. There is evidence that increased bone quality may improve prosthesis fixation and decrease the incidence of early loosening (Figure 2) [7-13]. According to these data several benefits are expected from moderate physical activity. However potential disadvantages are still debated.

Methods

A literature review has been performed. Pub Med database was searched without time limits using the following key words: "sport activities" and "sports", "after" or "following total knee replacement" and "total knee arthroplasty". Among the available abstracts, 42 were selected since they were strictly matching the topic. Moreover a book chapter and proceedings of international congress were analyzed. The available full text articles in English of the previously mentioned abstracts were then obtained.



Figures 1a and 1b: Preoperative X-rays of a 52 years old man. There is an evidence for increasing number of young and active patients requiring total knee arthroplasty.

***Corresponding author:** Cerciello S, Molise University, Campobasso, Italy, E-mail: simo.red@tiscali.it

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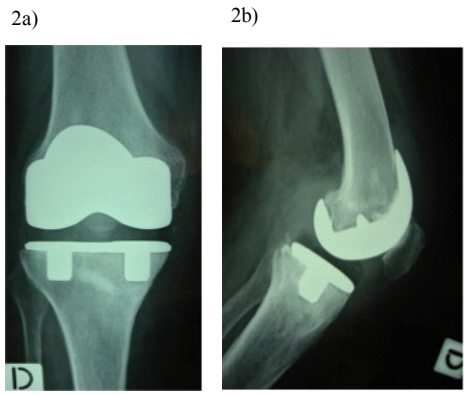

Figures 2a and 2b: 5 years follow up of a 52 years old man. Despite increased interface stresses, coming from active lifestyle, the superior bone density in young patients protects from loosening of the implant.

Literature Review and Discussion

Patient expectations

Nilsdotter et al. [14] have evaluated the outcome of TKR in terms of expectation of recovery. Knee injury and osteoarthritis outcome score (KOOS) have been administered to 88 patients (average age of 71 years, range: 51-86 yrs) before surgery, one month, 6 months, 1 year and 5 years after surgery. Expectations were completely disappointed only at 1 year FU. In general preoperative expectations were higher than postoperative results; only one third of patients who desired to keep on with golf or dancing were able to fulfill this result 5 years after surgery. At last FU 93% of patients was satisfied with the result, however only 87% was happy for the pain relief and 80% for the function recovery [14].

Thus, the more exigent the patients are the greater is the risk of dissatisfaction after surgery. Noble et al. demonstrated that satisfaction of preoperative expectations significantly conditions the subjective result [15], which is not always correlated with the objective result [16,17]. This evidence has been recently confirmed in the study by Bonnin et al. [18]. They evaluated the level of activity of 347 patients with TKR (mean age of 75, range, 28 to 94) at a mean follow-up of 44 months (range 13–71). Two hundred and thirty-seven patients (68%) reported that they felt their knee as "normal", 56% claimed that their knee limited their activities, and 66% stated that they were as active as they expected to be before the intervention. Of them, 98% were satisfied. Among the group of patients who were insufficiently active, 52% were not satisfied with their outcome. The duration of preoperative pain, the age at evaluation or the number of previous surgeries did not influence the subjective result or the degree of patient satisfaction. Among patients under 75 years, 10% regularly participated in strenuous sports but only 13% felt that this ability was important. When participation was analyzed in the motivated patients' subgroup, 63% regularly took part in at least one impact sport.

Bock et al. [19] performed a retrospective study on 138 patients (average age of 55.5 years, range: 21-65 years) undergoing TKR, focusing on physical activity at an average FU of 6 years (range 2-13 years). A trend toward low impact sports, such as cycling, walking and swimming emerged. However, the rate of patients who played sports was similar before and after surgery (80.4% and 75.4% respectively).

Age and preoperative activity level

The return to sport after TKR is strictly related to general health conditions, preoperative physical and mental status and patient's age. Healthy general status is the first aspect to analyze since it is crucial to perform any sports even at a recreational level. Preoperative fitness or focused rehabilitation program of muscle stretching and strengthening improves function recovery and sport comeback while reducing hospitalization after surgery. Bradbury et al. [20] noted that participation in athletics the year before surgery was specifically predictive of a return to athletic activity after TKA.

In a retrospective analysis on 160 patients (average age 68 years) at an average FU of 5 years (range 3-7yrs) they reported 65% of sport comeback in those who had active lifestyle before surgery. In those who where sedentary before surgery (less than 1 session per week) the rate was 32%.

Chatterji et al. [21] evaluated the number of sports played before and after surgery. Around 12% of patients quit sports (108 out of 122) while there was 20% reduction of the average number of sports practiced. However, those patients who came back to sport referred improvement in their performances. Age and motivation are strictly related. It is well-demonstrated patients younger than 60 years have 30% higher sport activity than older ones [22]. Young and highly motivated patients are more prone come back to active lifestyle and sport [23].

Thus the ability to play a sport is really multi factorial. It is therefore important to analyze sports participation not only in the overall population but also in the population of motivated patients who wish to resume sports activities and analyze the reasons for nonparticipation.

Mont et al. [24] evaluated the results of TKR in 30 patients younger than 50 years at an average FU of 7 years. At the International Knee Society (IKS) score excellent result was achieved in 18 patients (60%) while in 11 (37%) the result was good.

Specific sports

Some authors focused on the recovery on specific sports after surgery. This is important since different solicitations on the knee joint, which are characteristics of different sports, produce different effects on the implant and bone-prosthesis interface.

For example golf and cycling have different impact on the knee; they produce progressive axial rotation and shear forces. However a normal swing produces superior forces on the knee, increasing the risk of polyethylene wear [25]. Increased internal–external rotations generated from the top of the backswing to the end of the follow-through could contribute to accelerated polyethylene wear. However, gradual rotational movements have been demonstrated during the stationary cycling. Therefore, for patients following a TKA who wish to remain physically active, stationary cycling is recommended rather than playing golf [25].

Mallon et al. [26] evaluated the recovery of 83 golf players after surgery at an average FU of 4.3 years. Around 3% of subjects were pain free during sport, however 35% claimed of pin after sport performance. He reported more pain in right-handed players who had left knee replacement because of specific movement during swing stroke.

Mont et al. [27] performed a retrospective study on 33 tennis players (average age 64 years). At an average FU of 7 years average

training was three times per week. In 21% of cases playing single was allowed, while in 45% of patients only double was permitted. All patients were satisfied with their functional outcome as well as with the level they could play again. Only 4 patients (12%) claimed of pain and stiffness during sport.

LaPorte et al. [28] reported the results of 18 TKR in 11 tennis players of an average age of 70 years. At an average FU of 3.2 years all patients were satisfied with their recovery although they played at a slightly lower level.

Sport and implant design

Implant type is another aspect that must be considered to predict postoperative result. While there is no evidence for different postoperative activity level in case of cemented or un-cemented implants [29]; some differences arise with different implants. Unicompartmental prosthesis (UNI) is becoming a common solution in wide spectrum of patients. They have less morbidity than total implants, thus less postoperative pain and faster recovery are expected. Theoretically further sport participation should be faster and easier [29]. Naal et al. [30] reported the results of 83 patients with UNI implants at an average FU of 18 months. Sport recovery was possible in 88% of patients (95% in those who played some sports before surgery). There was reduction in the number of sports played individually (from 5 to 3.1) with positive trend toward low impact sports such as cycling and swimming. Moreover older patients (average age of 73 years) had more frequent training than young subjects (average age 57.8 years). Hopper and Leach [31] evaluated the results of UNI and TKR. They found better results in term of sport recovery and level of activity as well as high satisfaction rate in the UNI group. 96.7% of patients played some sports in the UNI group compared with 63.6% in the TKA. Sport recovery was possible 3.6 and 4.1 months after surgery respectively; pain during sport was present in 24.1% of patients in the UNI group and 42% in the TKR group. Walton compared the results of 183 UNI and 142 TKR. Patients were comparable in terms of age and preoperative activity. At an average FU of 12 months no difference was found in terms of rapidity of recovery; however the rate of activity and sports were much higher in the UNI group [32].

High impact sports and complications

Dahm et al. [33] reported similar data on 1206 patients (average age 67 years) at an average age of 5.7 years. 91% of patients were satisfied with their postoperative physical activity level, however 16% could keep on with heavy sports. Better results were reported in male and younger patients. Wylde et al. [34] in a postal survey on 2085 patients with knee and joint replacement evaluated the activity level obtained between one and three years after surgery. 446 (61.4%) subjects had returned to their sporting activities by one to three years after operation and 192 (26.4%) were unable to do so because of their joint replacement, with the most common reason being pain. The largest decline was in high-impact sports including badminton, tennis and dancing.

On the other hand practice in heavy sports play a negative role after this kind of surgery. Heavy activities may end up with acute injuries, such as per prosthetic fractures and dislocations, as well as problems that arise from repetitive loading of the joint, such as osteolysis, and finally aseptic loosening [35]. Moreover it was demonstrated that after TKR, joint wear is a direct function of overall use [3,13,23,36-38]. In fact longer survivorship rates were reported in older and sedentary patients [2]. For those reasons, in the past decades surgeons have prohibited high-impact activities after TKA [39,40].

However recently, Mont et al. [41] performed a prospective study on the failure rate of TKR implants in a group of patients. Two groups of 57 patients with an average age of 70 years were recruited according to the frequency and level of physical training. At an average FU of 7 years similar results emerged in terms of satisfaction, failure rate and evidence of loosening on X-ray films. The same data emerged from the study of Diduch et al. [42]. Data from principal studies are summarized in table 1 according to the review of Vogel et al. [43].

First Author	Journal	Year	Number of patiens	Sports	Finding
Ries et al. [12]	J Bone Joint Surg Am	1996	19	General, cycling	2 years after TKR:patients improve cardiovascular fitness as assessed by a cyclingthreshold test.
Nilsdotter et al. [14]	Acta Orthop	2009	102	General	5 years after TKR:patient expectations exceeded their capabilities.
Bonnin et al. [18]	Knee Surg Sports Traumatol Arthrosc	2010	347	General	10% of patients< 75 years oldregularly participated in strenuous sports after TKR.
Bradbury et al. [20]	Am J Sports Med	1998	160	General	77% of patients who participated in regular exercise the year before surgery returned to sports.
Chatterji et al. [21]	ANZ J Surg	2005	144	General	Decrease in number of active patients from 122 to 108 after surgery. Increased low-impact and decreased high-impact activities.
Hamai et al. [25]	J Orthop Res	2008	12	Golf, cycling	Stationary cycling produced gradual rotational movements in the knee. Golf swings produced significantly larger magnitude rotational motions.
Mont et al. [27]	Am J Sports Med	2002	46	Tennis	All patients were satisfied with their ability to return to sport. Only 21% of patients had surgeon approval to play tennis.
Hopper and Leach [31]	Knee Surg Sports Traumatol Arthrosc	2008	110	General	63.6% of patients after TKR returned to sportsbut with less frequent participation.
Dahm et al. [33]	J Arthroplasty	2008	1630	General	16% of patients report participating in labor/sports “not recommended” by the Knee Society survey.
Wylde et al. [34]	J Bone Joint Surg Br	2008	2085	General	61.4% of patients returned to sport 1 to 3 years after surgery.
Mont et al. [41]	Clin Orthop Relat Res	2007	72	General	Low- to moderate-impact sports did not affect clinical or radiographic outcomes after TKA at midterm follow-up.

Table 1: Analyzed data from principal studies.

Conclusions

Analyzing the return to sport after total knee arthroplasty is particularly complex. Data in literature compare non-homogeneous populations concerning different sports. Individual characteristics, lifestyle and patient preferences and motivations must be taken into account when proposing some kind of physical activity after surgery. Motivation is probably the key point to discuss since it is the major determinant for postoperative recovery. Low impact sports can be recommended in most of patients for their positive effect on general health and mental status. Current trends in clinical opinion favor a higher level of athletic activity after TKR. However the return to high impact sports must be carefully evaluated with patients for their potential negative effect on the implant [43].

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