



The impact of total knee arthroplasty on golfing activity

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Background: Total knee arthroplasty (TKA) is frequently performed among individuals who golf. This study examines the effect of TKA on pre- and postoperative pain, frequency of sport participation, handicap, driving distance, use of a cart, and overall game enjoyment.

Methods: This is a survey-based retrospective review of 71 patients after primary TKA at a tertiary medical facility in upstate New York. Patients were evaluated using postoperative pain scores and asked to complete a survey that included questions about their return to sport.

Results: A total of 71 patients were included, with an average age of 70 years old. Postoperatively 85% of patients returned to play within 7.9 months, driving distance increased by 4 yards, patients' golf game improved by 1.07 strokes, and pain during and after golf was significantly decreased. Most patients did not change golf cart usage, and reported unchanged or improved performance in and enjoyment of golf.

Conclusions: We found that a majority of patients undergoing TKA returned to playing golf postoperatively. Patients were more likely to report decreased pain both before and after play and positive changes to their golf game. Our results suggest that most patients can expect to return to golf after TKA and the majority will enjoy the sport with less pain postoperatively.

Keywords: Total knee arthroplasty (TKA); golf, patient outcomes; postoperative activity

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Introduction

Total knee arthroplasty (TKA) is one of the most commonly performed orthopedic procedures at present (1). In 2010, over 600,000 TKAs were performed annually in the United States. Among older patients in the US, the per capita number of primary TKAs doubled from 1991 to 2010 (from 31 to 62 per 10,000 Medicare enrollees annually) (2). By 2030, the number of TKAs performed annually in the US is projected to increase by 673 percent to 3.48 million procedures annually (3).

The recent and projected increase in TKA procedures is due in large part to an aging Baby Boomer generation,

those born between 1946 and 1964. The 2006 U.S. Census Bureau data indicated that this generation forms over 26 percent of the United States population, approximately 78 million individuals (4). As this generation enters retirement, the expectation of maintaining an active lifestyle remains paramount, and can be facilitated by joint arthroplasty.

Candidates for TKA are also, on average, receiving arthroplasty at a younger age than in previous decades. In 2000, the average TKA patient was 69 years old, but by 2010 the average age had dropped to 66, according to data from the National Hospital Discharge Survey produced by the Centers for Disease Control (CDC) (5).

A significant amount of overlap exists between the estimated 29 million Americans who participate in golf and those who have received or are considering a TKA. A 2012 demographic study by the National Golf Foundation (NGF) reported that greater than 60% of US golfers were over the age of 50 (6). The number of golfers with TKA is expected to rise as the aging population attempts to maintain an active lifestyle. Many patients will inquire on the effects TKA may have on their golfing ability.

Our study seeks to provide further information regarding TKA and return to golf in several areas undiscussed in current literature. This study aims to thoroughly evaluate the effect of TKA on golf performance including comparing pre- and postoperative pain during and after golf utilizing a visual analog scale of pain, frequency of postoperative play, handicap, driving distance, use of a cart, and overall game enjoyment. Our goal is to address specific patient expectations with substantive data. Our hypothesis was that TKA would decrease pain experienced during and after golfing, and would improve golfers' ability to continue play. We present the following article in accordance with the STROBE reporting checklist (available at <https://aoj.amegroups.com/article/view/10.21037/aoj-20-37/rc>).

Methods

Study design

The study has been performed in accordance with the ethical standards in the Declaration of Helsinki (as revised in 2013) and has been carried out in accordance with relevant regulations of the US Health Insurance Portability and Accountability Act (HIPAA). IRB approval was obtained at the Albany Medical Center (No.: IRB#4073). All patients signed a consent form to participate in this study.

In total, two thousand consecutive patients undergoing primary TKA between January 2009 and March 2014 were mailed a 29-item survey specific to the patients' golf performance, frequency of participation, timing of return to play, presence of pain, use of a cart postoperatively, and other golf-related questions.

In order to assess for pain intensity both pre- and postoperatively, survey candidates were instructed to complete the Visual Analogue Scale (VAS) of pain intensity. The VAS pain score is the most commonly utilized instrument for the evaluation of pain intensity; its validity and reliability, especially in scoring acute pain, has been well-substantiated in previous literature (7). The VAS pain

score consists of a line with two descriptors representing extremes of pain intensity {i.e., no pain [0] and extreme pain [10]}. Patients rate their pain intensity by making a single mark on the line best representing their level of pain. Subsequently, the VAS is scored by measuring the distance from the "no pain" end of the line, ranging in value from 0 to 10.

Inclusion criteria for our study included all patients who received elective, primary TKA from one of five senior adult reconstruction specialists at our institution. Indications for TKA included osteoarthritis (OA), rheumatoid arthritis (RA), and post-traumatic arthritis. All patients who received a revision TKA or another total joint arthroplasty (TJA) were excluded from this study.

The surveys and a paid return envelope were sent by mail to the patients' address. All patients signed a consent form to participate in this study. In addition, guidelines set forth by the Health Information Privacy and Portability Act (HIPPA) were thoroughly reviewed and implemented.

Statistical analysis

Descriptive statistics were used to assess baseline characteristics including: age, gender, laterality of implant, and handedness. Comparisons of pre- and postoperative VAS pain scores and golf cart use were performed using sample *t*-tests. All survey outcomes were reported as arithmetic means and percentiles. When appropriate, standard deviations (SD) and ranges were also reported. Statistical analysis was conducted using Excel software (Microsoft Corporation, Richmond, Washington, USA). A *P* value of <0.05 was considered statistically significant.

Results

Baseline characteristics

Of the 2,000 surveys mailed to patients, 482 (24.1%) responses were received, of which 141 patients reported playing golf. 49 patients reported having received another TJA and were subsequently excluded from the study; patients were also excluded for revision surgery or other factors outlined above. Ultimately, 71 patient responses were included in this study with a minimal follow-up time of 1-year post-TKA. Descriptive statistics of baseline characteristics indicated that the average age and gender distribution of study participants was 70 years and roughly

Table 1 Baseline demographics and other characteristics of TKA patients who reported playing golf

Demographics and characteristics	N (% of total)
Average age [in years]	70 [56–93]
Male, avg.	70
Female, avg.	71
Gender	
Male	52 (73.2)
Female	19 (26.8)
TKA laterality	
Left	35 (49.3)
Right	36 (50.7)
Right handedness	71 (100.0)
Preoperative patient inquiry regarding golf	37 (52.1)
Surgeon provision of advice on golf game	35 (49.3)
TKA, total knee arthroplasty.	

Table 2 Patient-reported postoperative time to resume golf and subsequent golfing frequency

Patient-reported golf participation	N (% of total)
Resumed golfing	60 (84.5)
Months prior to resuming, avg.	7.9
Golf frequency postoperatively	
Never	11 (15.5)
Rarely (1/month)	17 (21.5)
Occasionally (2–7/month)	21 (30.8)
Frequently (8+/month)	22 (30.8)
Change in golfing frequency	
No change	33 (46.5)
More frequent	15 (21.1)
Less frequent	23 (32.4)

3:1 male to female (*Table 1*). There was an equal distribution of patients receiving left and right TKA. Moreover, all patients were right-hand dominant. Preoperatively, 52.1% of patients reported asking their orthopaedic surgeon about golf, and 49.3% stated that their surgeon gave advice regarding likely outcomes for their golf game before and during their recovery course.

Table 3 Patient-reported subjective impact of total knee arthroplasty on overall golf performance, game enjoyment, and pain during play

Golf performance	N (% of total)
Average change in total # of strokes	–1.07 (–10 to +18)
Average change in driving distance (yds.)	4 (–50 to +50)
Increased difficulty in strokes	11 (15.5)
Decreased difficulty in strokes	22 (31.0)
Change in golf swing	18 (30.5)
Cart usage pre- and post-TKA	
No change	39 (76.5)
Preoperative cart to postoperative walking	7 (13.7)
Preoperative walking to postoperative cart	5 (9.8)
Perceived performance after TKA	
Same	29 (49.2)
Improved	25 (42.4)
Worse	5 (8.5)
Pain during golf after TKA	
Same	3 (5.1)
Better	53 (89.8)
Worse	3 (5.1)
No response	12
TKA, total knee arthroplasty.	

Postoperative golf outcomes

In our patient population, 85% of respondents who had previously played golf returned to play within an average of 7.9 months after TKA (*Table 2*). 22% of respondents reported playing golf postoperatively less than or equal to once a month, whereas 62% of those surveyed reported playing golf two or more times a month. 11 patients stopped playing golf postoperatively for reasons ranging from increased knee pain to poor general health. Additionally, 68% of respondents indicated they played golf more frequently or the same as preoperatively, while 32% played golf less often than before.

Overall, a majority of respondents noted positive changes in their golf game postoperatively (*Table 3*). On average, respondents stated that their golf game improved by 1.07 strokes (range, –10 to +18 strokes) and their driving range increased by 4 yards (range, –50 to +50 yards). The majority (53.5%) of respondents did not report any increased or

Table 4 VAS pain scores during and after golf

	VAS score	P value
Pain during golf game		
Prior to TKA	6.62	
Following TKA	1.33	
Overall reduction in pain	77%	<0.001
Pain after golf game		
Prior to TKA	5.32	
Following TKA	1.29	
Overall reduction in pain	71%	<0.001

TKA, total knee arthroplasty; VAS, Visual Analogue Scale.

decreased difficulty with golf strokes. 31% of respondents reported decreased difficulty with golf strokes, especially when driving, while 16% of respondents endorsed increased stroke difficulty, primarily when driving or in the sand traps.

Three-quarters of respondents did not change their use of golf carts before or after TKA, however, 13.7% surveyed reported using golf carts preoperatively but walking the course postoperatively. 10% of patients reported new use of carts postoperatively (Table 3). Overall, 91% of patients reported their perceived golf performance was the same or improved postoperatively. Moreover, 90% of respondents reported that their knee pain while playing was comparatively better following TKA than it had been preoperatively. Lastly, 95% of respondents reported enjoying golf the same or more after their primary TKA.

Patients' VAS pain scores were consistent with these overall positive outcomes (Table 4). Respondents indicated that their pain before primary TKA during and after golf averaged 6.6 and 5.3, respectively, thus demonstrating moderate to severe levels of pain. Postoperatively, VAS pain scores both during and after golf activity dropped to an average of 1.3. This decrease in VAS pain scores was statistically significant ($P < 0.001$) and represented a significant postoperative reduction in pain during and after golf activity of 77% and 71%, respectively.

Discussion

The results of our study demonstrate that a majority of patients undergoing a TKA were able to return to golfing activity post-operatively. Post-operatively patients were likely to continue playing at the same frequency as they

did preoperatively or at an increased frequency. Overall, respondents were more likely to reflect positive changes in their golf game post-operatively.

Our study indicates that most golfers (85%) in our TKA population are able to return to golfing activity at an average of 7.9 months after surgery. These results are similar to a 2009 study by Jackson *et al.*, finding that 57% of TKA patients return by 6 months with a 94% overall return rate (8). Another study by Mallon *et al.*, likewise indicated an average return to play of 5 months in 83 avid golfers (9,10). In 2004, Chatterji *et al.*, reported an average return to play time of just 3 months; however, this study included only 6 patients with more than half of the golfers surveyed reporting having ceased golfing postoperatively (11). We noted that our return of an average 7.9 months may have been influenced by geographic location and a relatively short playing season as opposed to more favorable golfing conditions found elsewhere.

An additional primary outcome measure of the current study was a significant decrease in pain, as measured on the VAS scale, both during and after golfing following TKA. Mallon *et al.*, previously showed that the majority of patients had reduced golfing pain after surgery, especially if done on the trail leg; this study did not quantify the level of pain experienced by postoperative patients (9,10). Our results, as shown above, demonstrate a dramatic decrease in VAS scores for patients engaging in golf postoperatively.

The majority of golfers in the current study reported golfing more frequently after surgery. There was also a mild increase in average driving length of 4 yards and an overall score improvement by 1.07 strokes. This improved driving distance is a contrast with a prior study showing a small loss of 12.2 yards driving distance, yet is in agreement with that study's finding of an improvement of 1 stroke per round post-operatively (9,10). However, both driving distance and strokes gained are patient reported estimates with inherent bias, and neither meet a statistically significant threshold.

The limitations of the current study include a poor response rate and inherent recall bias. Only 24% of study candidates participated, representing a low response rate compared to previous studies. A poor response rate was expected as our study targeted patients undergoing knee replacement as a whole rather than golfers in particular. Of the surveys returned, nearly 30% were golfers, whereas less than 10% of the US population over the age 50 are golfers. Therefore, it is likely that many non-golfers chose not to return the survey, leading to potential selection bias. There is inherent recall bias given the fact that respondents were

asked to remember their pre-surgery golf performance, experience, and perceptions of pain. Some respondents may not have golfed for several years leading up to their TKA given their preoperative pain, with limited ability to evaluate their pre-TKA golf experience. This bias could be reduced by ensuring that patients had attempted golfing within an established time frame prior to their TKA.

The majority of golfers in our study had neither increased nor decreased difficulty with executing their golf stroke postoperatively. Thirty one percent of patients reported improved ease of using the driver, supporting previous literature which showed similar improvement in 45% of golfers (9). This improvement in pain with driver use is expected, as this particular club has been shown to have increased flexion in the lead leg at the apex of the backswing phase, and increased stress and moments in the downswing and follow-through phase (12,13).

Our results indicate that return to golf after TKA can be expected in most patients and that the majority of patients will be able to enjoy the game with significantly less pain than before surgery. Surgeons counseling their patients on TKA should be able to instruct their patients that return to golf after TKA is possible.

Future directions of the current research include a prospective trial for golfers undergoing TKA that could include sport specific therapy regimens pre- and postoperatively.

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Footnote

Reporting Checklist: The authors have completed the STROBE reporting checklist. Available at <https://aoj.amegroups.com/article/view/10.21037/aoj-20-37/rc>

Data Sharing Statement: Available at <https://aoj.amegroups.com/article/view/10.21037/aoj-20-37/dss>

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at <https://aoj.amegroups.com/article/view/10.21037/aoj-20-37/coif>). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related

to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study has been performed in accordance with the ethical standards in the Declaration of Helsinki (as revised in 2013) and has been carried out in accordance with relevant regulations of the US Health Insurance Portability and Accountability Act (HIPAA). IRB approval was obtained at the Albany Medical Center (No.: IRB#4073). All patients signed a consent form to participate in this study. This work was performed at The Albany Medical Center, Albany, NY.

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