

Danish surgeons allow the most athletic activities after total hip and knee replacement

Mia K. Laursen · Jakob B. Andersen ·
Mikkel M. Andersen · Ole H. Simonsen ·
Mogens B. Laursen

Received: 13 September 2013 / Accepted: 7 March 2014 / Published online: 25 March 2014
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Abstract

Background and purpose Counselling patients for or against athletic activities after well performed total hip arthroplasty (THA) and total knee arthroplasty (TKA). Level of evidence is low, and the current international guidelines are based on North American expert opinions in 2001 and 2008. Could technical and operative development and social or cultural differences apply for different counselling?

Methods All Danish experts in head of departments performing more than 100 THAs or TKAs per year, were invited to fill in a questionnaire regarding the most popular sport activities in the Danish 60–69 years old population

Results Response rate was 74 and 89 % for the TKA and THA departments, respectively. A pronounced variation between the departments was observed and compared to the latest published US recommendations in 2007, the present Danish recommendations are significantly more liberal. Athletic activities are now allowed by 87 % of the Danish arthroplasty departments. Of these 55 % allow for high-impact activities after THA compared to 21 % in US in 2007 ($p < 0.0001$). Recommendations for TKA patients are less liberal. Only 38 % of the departments allow for high-impact activities after TKA compared to the 55 % after THA ($p < 0.0001$).

Interpretation Based on the pronounced variation between departments and the fact that a highly significant trend was observed over 5 years on an undocumented basis it was concluded that there is an imminent need for a higher scientific level on this issue—which hopefully can develop in a few years using PROMs in large scale follow-up studies.

Keywords Total hip arthroplasty · Total knee arthroplasty · Athletics after joint replacement · Physical activities

Introduction

Physical activity has been proven to prevent several chronic diseases, improve fitness, and decrease mortality [1, 2]. Regular exercise producing cardiovascular fitness, more over has been shown to stimulate weight loss, reduce anxiety as well as depression, and improve bone density and muscle coordination [3–6].

For older adults, staying physically active is of utmost importance, which is also true for the increasing number of patients having total knee or hip replacement.

Because of the beneficial effects of physical activity, international guidelines have been developed for levels of health-enhancing physical activity. These guidelines recommend 30 min or more of moderate-intensity aerobic (endurance) physical activity at least 5 days/week or vigorous-intensity aerobic physical activity for a minimum of 20 min at least 3 days/week [7, 8]. However, the current question of most interest always will be: How much loading will an artificial knee or hip tolerate? What kind of physical activity should be recommended to those patients? As the design and quality of the prostheses are currently

M. K. Laursen · J. B. Andersen · O. H. Simonsen ·
M. B. Laursen (✉)
Orthopaedic Department, Aalborg University Hospital,
Hobrovej 18-22, 9000 Aalborg, Denmark
e-mail: mogens.berg.laursen@rn.dk

M. M. Andersen
Department of Mathematical Sciences, Aalborg University,
Aalborg, Denmark

improved, the optimal answer will have to be altered, which was illustrated by surveys among American hip and knee surgeons in 2001, 2007 and 2008 [9–11]. From these surveys, the then current specialist's recommendations were derived. Aside from those; no recommendations have been published to our knowledge, and national or international guidelines have not been developed. Hence, updated specialist recommendations are currently warranted. In the present study, we have investigated the current Danish specialist's recommendations.

Methods

From the Danish National Hip Register (DHR) and the Danish National Knee Register (DKR) 2010 reports, we selected all departments, both public and private, performing at least 100 THAs or TKAs. The leading surgeon in each department was asked to fill in a questionnaire about which athletic activities patients in his/her department were allowed to take part in after uneventful recovery from surgery. In Denmark, most arthroplasties are performed in specialised elective units manned with 2–6 surgeons who perform between 80 and 300 arthroplasties each per year. Furthermore, all Danish hospitals (private and public) have been accredited according to The Danish Healthcare Quality Programme [12], a public accreditation programme working by the same principles as The Joint Commission and ISQua. Accreditation is achieved only if the control panel detects full consistency between treatment descriptions on the hospital's website, in the written instructions given to the patients, and in daily practice at the clinic. Regardless of whether the latter is provided by the department head or the youngest specialist.

The selection of activities in the questionnaire is based on the 2005 survey from the Danish Institute of Governmental Research [13], from which we selected the 31 most popular sports activities in the age-group 60–69. For each activity, the surgeon should decide whether the fully recovered patient was advised to: 1—take part regardless of previous experience with the activity; 2—take part if the patient had experience with the activity before surgery; or 3—not take part in the activity. If the questionnaire was not returned within 2 months, we sent a reminder email, and if necessary a complimentary phone call was used to heighten the response rate.

Statistical method

We compared the percentage of surgeons allowing each activity based on our questionnaires to those of Klein (2007). Similarly, we compared the 'allowed with experience' and 'not allowed' categories.

In the following, assume that a certain allowance category ('allowed', 'allowed with experience', or 'not allowed') and an impact ('high', 'intermediate', and 'low') or a combination of these impacts ('all' and 'high or intermediate') are considered for statistical analysis.

Let m be the number of responding surgeons in Klein (2007) and n the number of responding surgeons in DK (2012). For activity number j (for example alphabetic order), let x_j/m be the percentage of Klein (2007) surgeons recommending 'Yes' and y_j/n the percentage of DK (2012) surgeons recommending 'Yes'. As we assume that the surgeons are independent and also that the activity recommendations within a surgeon are independent, we can analyse the percentage using a logistic regression model with activity and source [Klein (2007) or DK (2012)] as explanatory variables. If we only had one activity, this would correspond to comparing two binomial proportions.

If the source variable is statistical significant ($p < 0.05$), this can be interpreted as an overall difference between Klein (2007) and DK (2012). This difference between sources can be converted into an odds ratio that can be interpreted as the increase in recommendation percentage (averaged over all activities) if surgeons from DK (2012) were to make a recommendation instead of surgeons from Klein (2007).

We only included the activities where both sources [Klein (2007) or DK (2012)] had a recommendation. Later, when comparing THA with TKA as sources, the same type of analysis was conducted.

Results

Twenty seven departments for TKA and 28 for THA met the inclusion criteria, and 20 respective 25 filled in the questionnaire. This gives us a response rate of 74 % for TKA and 89 % for THA. Calculated from the number of procedures performed at each department, the response rates are 78 % for TKA and 91 % for THA.

Over the years 1999–2007, there was a tendency for the US recommendations to be more liberal, and for instance, single tennis was not allowed before 2007 for THA (Table 1) and bicycling and canoeing was not allowed after TKA before 2005 (Table 2). Compared with the US recommendation in 2007, the Danish recommendations in 2012 are significantly more liberal. A total of 87 % allowed any athletic activity in 2012 compared to 77 % in 2007 ($p < 0.0001$, Table 3). Even high-impact activities were allowed by 48 % in 2012, compared to 21 % in 2007. Of these 48 %, 13 % allowed high-impact activities only to experienced patients. In 2012, still 13 % of surgeons did not allow athletic activity to THA patients, compared to 21 % in 2007.

Compared with THA (Table 1), the recommendations for TKA (Table 2) were significantly more restrictive

Table 1 Expert opinions for THA

Activity	Allow (%)				Allow with experience (%)				Not allowed (%)			
	Healy (1999)	Healy (2005)	Klein (2007)	DK (2012)	Healy (1999)	Healy (2005)	Klein (2007)	DK 2012	Healy (1999)	Healy (2005)	Klein (2007)	DK (2012)
<i>n</i>	54	63	549	25	54	63	549	25	54	63	549	25
Soccer/contact sports			2	16			2	16	Yes	Yes	93	68
Handball				16				16				68
Baseball/softball			13				27		Yes		57	
Badminton				36				56				8
Singles tennis			16	56			28	40	Yes		52	4
Doubles tennis	Yes		64			Yes	29				6	
Racquetball/squash			11				27		Yes		60	
Golf	Yes	Yes	99	92			0	8			0	0
Bowling		Yes	90	80	Yes		8	20			1	0
Petanque				92				8				0
Billiard/shuffleboard	Yes	Yes		96				4				0
Horseback riding				60	Yes	Yes		32				8
Swimming	Yes	Yes	99	92			1	8			1	0
Jogging			6	68			5	4	Yes	Yes	87	28
Stairclimber			72				10				14	
Walking	Yes	Yes	98				1				0	
Speedwalking		Yes	81				8				9	
Treadmill			87				8				4	
Hiking		Yes	79	88	Yes		18	12			3	0
Ice or roller skating/skateboard			35	36		Yes	43	32			21	32
Bicycling (transport)				100				0				0
Road cycling		Yes	80	96	Yes		19	4			1	0
Mountain biking				60				24				16
Stationary bicycle	Yes	Yes	95	76			5	16			0	8
Low-impact aerobics			86	76			9	24			4	0
High-impact aerobics			6				7				84	
Elliptical machine			92				5				1	
Bodybuilding/weightlifting			46	64		Yes	33	24			19	12
Weight machines			60			Yes	33				5	
Athletics				32				36				28
Dancing	Yes	Yes	94	92			6	8			0	0
Yoga/pilates			58	68			24	28			10	4
Martial arts			9	20			38	20			49	60
Boxing				36				24				40
Shooting				96				4				0
Hunting				92				4				0
Fishing				96				4				0
Canoe/kayak		Yes	64	60	Yes		21	36			13	4
Rowing						Yes						

Table 1 continued

Activity	Allow (%)				Allow with experience (%)				Not allowed (%)			
	Healy (1999)	Healy (2005)	Klein (2007)	DK (2012)	Healy (1999)	Healy (2005)	Klein (2007)	DK 2012	Healy (1999)	Healy (2005)	Klein (2007)	DK (2012)
<i>n</i>	54	63	549	25	54	63	549	25	54	63	549	25
Sailing/windsurfing				36				48				16
Cross-country skiing			56	56	Yes	Yes	37	44			5	0
Downhill skiing			21	32		Yes	56	48			22	20
Stationary skiing			87			Yes	11				1	
Snowboarding			11				28				55	

In the “Healy”-columns “Yes” means that 73 % (or more) of the *n* experts agrees on the recommendation

Table 2 Expert opinions for TKA

Activity	Allow (%)			Allow with experience (%)			Not allowed (%)		
	Healy (1999)	Healy (2005)	DK (2012)	Healy (1999)	Healy (2005)	DK (2012)	Healy (1999)	Healy (2005)	DK (2012)
<i>n</i>	58	70	21	58	70	21	58	70	21
Soccer/contact sports			5			10	Yes	Yes	86
Handball			5			10	Yes		86
Football							Yes	Yes	
Lacrosse							Yes		
Hockey							Yes		
Basketball							Yes	Yes	
Volleyball							Yes		
Baseball/softball									
Badminton			43			33			24
Singles tennis			43			43	Yes		14
Doubles tennis				Yes	Yes				
Racquetball/squash							Yes		
Shuffleboard	Yes	Yes							
Golf	Yes	Yes	95			5			0
Bowling	Yes	Yes	90			5			5
Petanque/croquet	Yes		100			0			0
Horseshoes	Yes								
Billiard			100			0			0
Horseback riding	Yes		76		Yes	19			5
Swimming	Yes	Yes	100			0			0
Jogging			33			10	Yes	Yes	57
Stairclimber									
Walking	Yes	Yes							
Speedwalking		Yes		Yes					
Treadmill									
Hiking		Yes	81	Yes		14			5
Roller skating/ skateboard			33		Yes	33			33
Ice skating				Yes	Yes				
Fencing									

Table 2 continued

Activity	Allow (%)			Allow with experience (%)			Not allowed (%)		
	Healy (1999)	Healy (2005)	DK (2012)	Healy (1999)	Healy (2005)	DK (2012)	Healy (1999)	Healy (2005)	DK (2012)
<i>n</i>	58	70	21	58	70	21	58	70	21
Bicycling (transport)			100			0			0
Bicycling (sport)		Yes	86	Yes		14			0
Mountain biking			57			19			19
Rock climbing							Yes		
Stationary bicycle	Yes	Yes	86			5			10
Low-impact aerobics	Yes		76			14			10
High-impact aerobics							Yes		
Elliptical machine									
Bodybuilding/ weightlifting			43		Yes	14			43
Weight machines				Yes	Yes				
Athletics			24			19			57
Dancing	Yes	Yes	95			5			0
Yoga/pilates			100			0			0
Martial arts			5			19			76
Boxing			29			19			52
Shooting	Yes		100			0			0
Hunting			95			0			0
Fishing			95			5			0
Canoe/kayak/rowing		Yes	86	Yes		10			5
Sailing/windsurfing			52			29			19
Cross-country skiing			67	Yes	Yes	29			5
Downhill skiing			33		Yes	48			19
Stationary skiing				Yes	Yes				

In the “Healy”-columns “Yes” means that 73 % (or more) of the *n* experts agrees on the recommendation

(Table 3). Twenty per cent did not allow any athletic activity after TKA compared to 14 % after THA ($p < 0.0001$). Whereas 55 % allowed high-impact activities after THA only 38 % allowed this after TKA. Among these, only 22 % allowed high-impact activities if not experienced, compared to 35 % for THA. The recommendation by the departments did not depend on the number of procedures performed (Fig. 1). There was a significant difference between Klein (2007) and DK (2012).

Discussion

Our results could be biased by the chosen method; data collected are in fact the view of the heads of department in the larger arthroplasty units in Denmark, but we believe that all answers are given in the spirit of each departments fixed (and accredited) protocol for sporting activities, for all the activities covered and adhered to by all relevant

specialists in the department. It is not possible for a senior member of a Danish orthopaedic department to maintain a very specialist practice run against differing views to his/her colleagues. In fact, all arthroplasty surgeons within a unit are forced to consensus on a fixed protocol for all treatment aspects. Otherwise, accreditation will be redrawn.

The orthopaedic literature on athletic activity after THA and TKA is mostly limited to small retrospective studies with short-term follow-up [14, 15]. One longitudinal four-centre study in 2005 found that most patients with hip (97 %) and knee (94 %) OA had performed sports activities during their life, only 36 % (hip patients) and 42 % (knee patients) had maintained sports activities at the time of surgery. Five years post-operatively, the proportion of patients performing sports activities increased to 52 % among patients with THA, but further declined to 34 % among those with TKA. Accordingly, the proportion of patients with THA performing sports activities for more than 2 h a week increased from 8 to 14 %, whereas this

Table 3 Statistics: results for comparison of Klein (2007) with DK (2012) (Table 1) and THA with TKA (Tables 1, 2)

	Number of activities	2007 (549 responses) versus 2012 (25 responses)				Number of activities	THA (25 responses) versus TKA (21 responses)			
		2007 mean	2012 mean	OR	<i>p</i> value		THA mean	TKA mean	OR	<i>p</i> value
Not allowed										
Any	-18	21.2	13.3	0.35	<0.0001	31	13.7	20.3	2.16	<0.0001
H	3	76.3	52.0	0.25	<0.0001	7	44.0	61.9	2.41	0.0005
I	7	18.0	9.7	0.44	0.0027	8	9.5	19.1	2.45	0.0063
H + I	10	35.5	22.4	0.33	<0.0001	15	25.6	39.1	2.43	<0.0001
Allowed										
Any	-18	57.5	64.9	1.78	<0.0001	31	65.0	65.6	1.04	0.7821
H	3	5.7	34.7	9.66	<0.0001	7	35.4	22.6	0.47	0.0060
I	7	48.4	58.3	1.68	0.0035	8	55.5	52.4	0.87	0.5220
H + I	10	35.6	51.2	2.69	<0.0001	15	46.1	38.5	0.67	0.0231
Allowed WE										
Any	-18	19.6	21.8	1.17	0.2136	31	21.0	13.9	0.56	0.0002
H	3	15.0	13.3	0.84	0.6592	7	20.0	15.1	0.70	0.2325
I	7	32.0	32.0	1.00	0.9954	8	35.0	28.5	0.73	0.1730
H + I	10	26.9	26.4	0.97	0.8551	15	28.0	22.3	0.71	0.0705
Allowed + allowed WE										
Any	-18	77.1	86.7	3.57	<0.0001	31	86.1	79.5	0.47	<0.0001
H	3	20.7	48.0	5.29	<0.0001	7	55.4	37.7	0.42	0.0005
I	7	80.4	90.3	2.58	0.0006	8	90.5	80.9	0.41	0.0063
H + I	10	62.5	77.6	3.74	<0.0001	15	74.1	60.7	0.41	<0.0001

The 'number of activities' column is the number of activities that both sources have a recommendation for and therefore are used in the comparison. The difference between '2012 mean' and 'THA mean' is caused by the activities that are included in the comparisons (refer to Table 1 to see the activities that Klein (2007) do not have a recommendation for). The *p* value is for whether the OR (odds ratio) is equal to 1 or different from 1

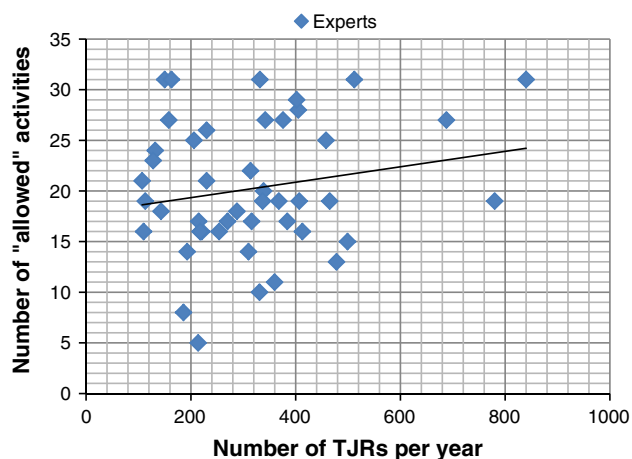


Fig. 1 Danish experts recommendations plotted against their production

proportion decreased from 12 to 5 % among patients with TKA [16]. Differences in pain 5 years after joint replacement might explain some of the differences of sports activities as persistent post-operative pain were reported by

9 % of patients with THA and by >16 % with TKA. Also, the surgeons' belief with regards to the mechanical strength of the artificial joint and its surroundings and the risks of overuse and traumatic injury, and consequently, recommendations are probably highly decisive for the patient. The present study is the first to demonstrate that the recommendations for THA patients are significantly more liberal compared with TKA, a total of 20 % of the departments did not allow any athletic activity after TKA, and this circumspection is probably only based on personal experience. To our knowledge, evidence to conclude increased soreness of TKA compared with THA has not been published. When patients who have undergone joint replacements choose to participate in athletic activity, orthopaedic surgeons should provide information with which to evaluate the risk of sports activity and recommend appropriate athletic activity. A trend among experts to allow more athletic activity and relax restrictions of sports activity after joint replacements may be based on outstanding patient outcomes, increasing surgeon confidence in surgical technique, and innovations in joint implants. This trend may also be a response to patients' demands to

participate in athletics after surgery. However, this trend in expert opinion is not evidence-based and may not be in the best interest of patients.

At this state, we still linger at the lowest possible level of evidence: “the expert opinion”. An increasing number of experts allow for increasing activity—but that will never alter the evidence level. Future research combining large patient cohorts with yearly Patient Reported Outcome Measures (PROM) regarding activities and level will give us the possibility to tell whether there are any differences in implant survival between patient groups in different sports and activity levels and possibly tell whether special implants should be preferred for patients with special demands for their future sports activities.

Discussion of statistical method

As several similar analyses have been conducted in Table 3, and some analyses of these have a subset of data in common, the reader should be cautious to interpret them jointly rather than as one single analysis at a time. Some multiple-testing correction could be invoked, but as it is not obvious how, as only a subset of data is in common, we chose not to perform such a correction.

It would be relevant to have the all the original responds from the surgeons in Klein (2007) in order to analyse if there were within-surgeon structure. We could have done this type of analysis for comparing THA with TKA as we have all the original observations, but to maintain the same interpretation of the results between the two analyses, we chose not to.

Acknowledgments We thank the responding experts, without whom this review would have been impossible.

Conflict of interest None.

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