The Journal of Arthroplasty 30 (2015) 980–986

Contents lists available at ScienceDirect

The Journal of Arthroplasty

journal homepage: www.arthroplastyjournal.org

No Superiority of High-Flexion vs Standard Total Knee Arthroplasty: An Update Meta-Analysis of Randomized Controlled Trials

Yong Jiang, MD [a], Jian Feng Yao, MD [b], Yong Min Xiong, PhD [c], Jian Bing Ma, MD [b], Hui Kang, MD [a], Peng Xu, PhD [b]

[a] Department of Sports Medicine, Hong Hui Hospital, Xi'an Jiaotong University College of Medicine, Xi'an, Shaanxi, P.R. China
[b] Department of joint surgery, Hong Hui Hospital, Xi'an Jiaotong University College of Medicine, Xi'an, Shaanxi, P.R. China
[c] Institute of Endemic Diseases, Key Laboratory of Environment and Genes Related to Diseases of Education Ministry, Xi'an Jiaotong University Health Science Center, Xi'an, Shaanxi, P.R. China

ARTICLE INFO

Article history:
Received 19 October 2014
Accepted 23 January 2015

Keywords:
meta-analysis
total knee arthroplasty
high flexion
ramdomized controlled trial
treatment outcome

ABSTRACT

This meta-analysis was performed using a Cochrane systematic review approach to examine published data with an aim to clarify whether standard or high flexion prostheses increase the range of knee motion and clinical outcomes. 1778 patients from 17 randomized controlled trials were identified. No significant differences in the range of motion, weight-bearing flexion and hip functions scores were found between treatment groups. We also found no significant differences in complications with regard to revision, component loosening, deep infection, anterior knee pain, stiffness, post-operative bone fracture and post-operative patella clunk syndrome, but the high flexion prostheses group had a higher incidence of deep venous thrombosis. The results do not support the proposition that high flexion knee prostheses provide substantial clinical advantages over standard knee prostheses.

Total knee arthroplasty (TKA) is one of the most successful surgical procedures in medicine. It is an effective and safe surgical treatment for the end-stage degenerative arthritis of knee [1]. The aim of the procedure is to achieve pain relief, to acquire stability, and to improve the range of motion (ROM) after surgery. High flexion of the knee is essential for a successful overall functional outcome [2]. Certain religious and ethnic groups require 111° to 165° of knee flexion to perform actions such as squatting and cross-legged sitting and getting in and out a bath tub [3]. Patients have increased the demands for deeper knee flexion, particularly for the purpose of participating in various sports activities in western societies [4]. However, patients with traditional implants rarely exceed 120° after surgery and many patients are unable to return to more demanding activities. The high-flexion total knee arthroplasty (HF-TKA) system was designed to imitate the natural function of the knee, and was theoretically introduced to increase the knee flexion motion, increase contact area, and improve clinical outcomes [5]. However, in clinical literature, there are conflicting reports concerning the high flexion total knee prosthesis [6–9]. Furthermore, there are several published systematic reviews and meta-analyses that compare the flexion capability and clinical outcomes of conventional and HF-TKA implants. However, those studies included non-randomized trials and may exaggerate the inherent bias and confounding in design [10–13].

In this study, we systematically review data from randomized controlled trials (RCTs) of high flexion total knee arthroplasty. This study used a Cochrane systematic review of the published data to assess if a high flexion knee prosthesis allows a greater range of motion and provides a superior clinical outcome than a standard knee prosthesis. We predicted that a high flexion knee prosthesis is superior to a standard knee prosthesis.

Methods

Literature Search

We considered that RCTs can decrease the bias and confounding in design. We performed a search of Cochrane Library (Issue 3, 2014), PubMed (January 1990 to June 2014), Ovid (January 1990 to Iune 2014), ScienceDirect Online (January 1990 to June 2014), ISI Web of Knowledge (January 1990 to June 2014) and clinicaltrial.gov (1990 to June 2014), several orthopedic journals, and conference proceedings. The following key words were used in the literature search: "knee arthroplasty, knee replacement" AND "flexion OR range of motion OR ROM" AND "treatment outcome" AND "randomized controlled trials".

Inclusion and Exclusion Criteria

We retrieved all RCTs that compared the HF-TKA with the S-TKA. Inclusion criteria were:

No author associated with this paper has disclosed any potential or pertinent conflicts which may be perceived to have impending conflict with this work. For full disclosure statements refer to http://dx.doi.org/10.1016/j.arth.2015.01.047.

Reprint requests: Peng Xu, PhD, Department of Joint Surgery, Xi'an Hong Hui Hospital College of Medicine, Xi'an Jiaotong University, Xi'an, Shaanxi 710054, PR. China.

http://dx.doi.org/10.1016/j.arth.2015.01.047
0883-5403/

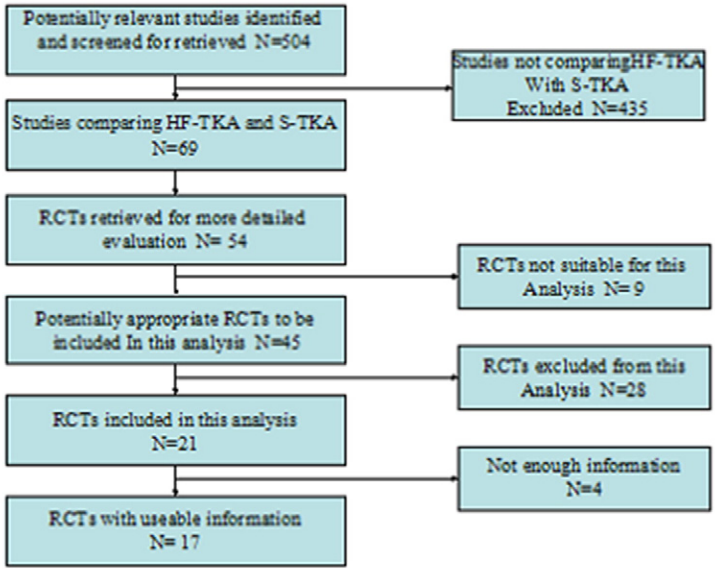

Fig. 1. Study identification, selection, and exclusions.

1. Patients with osteoarthritis and other non-traumatic diseases who had primary condylar type TKAs performed, with standard knee prostheses or high flexion knee prostheses;
2. A minimum one-year follow-up duration;
3. Studies reporting maximum preoperative and postoperative knee flexions along with standard deviation (SD) or standard error.

Exclusion criteria were:

1. Patients who had received any ipsilateral surgeries;
2. Patients who had been diagnosed with inflammatory arthritis;
3. Patients who had a flexion contracture greater than 20°;
4. Patients who had dementia and neurological disorders that affected mobility;
5. Continuous data that showed the medians and/or ranges, and where it was not possible to obtain the original information by contacting the author.

The data were extracted by 2 reviewers independently to ensure accuracy. In cases of disagreement, a consensus was reached by discussion. Study quality was evaluated according to the method for RCTs described in the Cochrane Reviewer's Handbook 5.0 [14].

Outcome Measures

The primary outcome measures assessed in this study include the range of motion (ROM) and the weight-bearing flexion. The secondary

Table 1
Characteristics of Included Randomized Controlled Trials and Study Treatments.

Inclusion Study	Country	Mean Follow-Up (Year)	Sample (Knee)		Type of Study	
			HF-TKA	S-TKA	HF-TKA	S-TKA
Choi WC 2010 [19]	South Korea	2	85	85	PFC Sigma PS-RP-F, Depuy	PFC-Sigma PS-RP; Depuy
Dennis DA 2013[a] [20]	U.S.A	1	93 (93)	93 (93)	PFC sigma PS-RP-F, Depuy	PFC sigma PS-RP, Depuy
Guild GN 2014 [5]	U.S.A	2	138	140	NexGen LPS-Flex, Zimmer	NexGen LPS, Zimmer
Kim YH 2012[a] [23]	South Korea	10	100 (100)	100 (100)	NexGen LPS-Flex; Zimmer	NexGen LPS; Zimmer
Hamilton WG 2011 [21]	U.S.A	1	65	62	PFC sigma PS-RP-Flex, Depuy	PFC sigma PS-RP, Depuy
Seng C 2011 [9]	Singapore	5	41	35	NexGen LPS-Flex; Zimmer	PFC sigma LPS, Depuy
Singh H 2012[a] [30]	India	2.1	50 (100)	50 (100)	Gender-soecific NexGen LPS-Flex, Zimmer	NexGen LPS; Zimmer
Nutton RW 2008 [27]	Scotland	1	28	28	NexGen LPS-Flex, Zimmer	NexGen LPS; Zimmer
Radetzki F 2013 [28]	Germany	10	39	39	PFC sigma PS-RP-Flex, Depuy	PFC sigma PS-RP, Depuy
McCalden RW 2009 25]	Canada	2.7	50	50	Genisis IIPS-HF Insert, Smith & Nephew	Genisis IIPS-insert; Smith & Nephew
Fischer M 2013 [4]	Germany	1	31	29	PFC sigma CR-RF-Flex, Depuy	PFC sigma CR, Depuy
Kim YH 2009[a] [22]	South Korea	3.1	54 (54)	54 (54)	NexGen CR-Flex, Zimmer	NexGen CR; Zimmer
Lützner J 2014 [24]	Germany	1	68	48	NRG CR-HF, Stryker	NRG CR Stryker
Minoda 2009 [26]	Japan	1	87	89	NexGen CR-Flex, Zimmer	NexGen CR, Zimmer
Murphy M 2014 [31]	Australia	2	18	17	Profix CR-HF, Smith & Nephew	Profix CR, Smith & Nephew
Seon JK 2009 [29]	South Korea	2	50	50	NexGen CR-Flex, Zimmer	NexGen CR, Zimmer
Springorum HR 2014 [8]	Germany	3	28	31	PFC sigma CR-HF, Depuy	PFC sigma CR, Depuy

PFC Sigma PS-RP-F, PFC Sigma Posterior Stabilized Rotating Platform High-Flex (DePuy Orthopaedics, Warsaw, IN, USA); PFC Sigma PS-RP, PFC Sigma Posterior Stabilized Rotating Platform (DePuy Orthopaedics, Warsaw, IN, USA); Nexgen LPS, Nexgen Legacy Posterior Stabilized, Nexgen LPS-Flex, Nexgen Legacy Posterior Stabilized High Flexion (Zimmer, Warsaw, IN, USA); Genesis II PS, Genesis II Posterior Stabilized; Genesis II PS HF, Genesis II Posterior Stabilized High-Flex (Smith & Nephew, Memphis, TN, USA); NRG CR, Non-Restrictive Geometry Cruciate Retaining; NRG CR-HF, Non-Restrictive Geometry Cruciate Retaining High Flexion (Stryker Orthopaedics, Mahwah, NJ, USA); Profix CR, Profix Cruciate Retaining; Profix CR-HF, Profix Cruciate Retaining High flexion (Smith & Nephew, Memphis, TN, USA); CR, Cruciate Retaining; HF, High flexion.

[a] Bilateral total knee arthroplasty.