The Journal of Arthroplasty 30 (2015) 2110–2115

Contents lists available at ScienceDirect

The Journal of Arthroplasty

journal homepage: www.arthroplastyjournal.org

Resection Technique Does Affect Resection Symmetry and Thickness of the Patella During Total Knee Arthroplasty: A Prospective Randomized Trial

Christopher L. Camp, MD, John R. Martin, MD, Aaron J. Krych, MD, Michael J. Taunton, MD, Luke Spencer-Gardner, MD, Robert T. Trousdale, MD

Department of Orthopedic Surgery, Mayo Clinic and Mayo Foundation, Rochester, Minnesota

ARTICLE INFO

Article history:
Received 27 March 2015
Accepted 21 May 2015

Keywords:
total knee arthroplasty
patellar resurfacing
patellar resection
knee arthritis
patellofemoral joint

ABSTRACT

The purpose of this study was to evaluate the accuracy and efficiency of three patellar resection techniques: cutting guide, free hand with haptic feedback, and a novel technique utilizing four quadrant measurements. Ninety patients undergoing TKA were randomized to receive patellar resurfacing by one of the three study techniques. The novel four quadrant technique resulted in least post-resection asymmetry (0.85 mm, $P = 0.001$). The most accurate methods for obtaining desired thickness were haptic feedback (0.66 mm mean discrepancy [MD]) and novel four quadrant technique (0.66 mm MD) followed by the patellar cutting guide (1.40 mm MD) ($P < 0.001$). Use of a patellar cutting guide resulted in increased patellar asymmetry and decreased accuracy in obtaining desired patellar thickness in this prospective trial.

Resurfacing of the patella during total knee arthroplasty (TKA) is a commonly performed procedure. Numerous randomized studies have attempted to determine the necessity of patellar resurfacing in the setting of a primary TKA [1–7]. These studies looked at factors believed to increase revision rates including: anterior knee pain, knee functional scores, patellar fractures, and patellar maltracking. Although a general consensus has not yet been reached on this topic, the majority of surgeons in the US routinely resurface the patella during primary TKA. Accordingly, a number of principles in patellar resection should be considered including: restoration of patellar height, performing symmetric resection, avoiding under-resection, and minimizing overstuffing of the patellofemoral joint [8].

The significance of this has been evaluated by examining complications associated with poor resection techniques such as 1) patellar fracture, 2) patellar maltracking, and 3) disruption of the extensor mechanism [8–12]. Asymmetric resurfacing may lead to increased anterior knee pain, instability, and revision rates [10]. Due to these complications, a number of techniques have been described in an effort to optimize patient outcomes. Some advocate a haptic method, in which the surgeon estimates the patellar resection thickness and symmetry by feel while referencing anatomic landmarks such as the insertion sites of the quadriceps and patellar tendons [13]. The use of patellar resection cutting guides or jigs is another popular method utilized by many surgeons [14]. Recently, a novel freehand resection technique in which the posterior surface of the patella is divided into quadrants has been described [15]. Ring tipped calipers are utilized to determine the height of the remaining patella in each quadrant and the patella can then be accurately resected to the desired level based on these measurements. At our institution all three methods are routinely used for patellar resection.

Patellar complications during TKA continue to be a problem affecting approximately 7% of patients undergoing primary TKA [16]. Although various studies have described individual results of patellar resections methods, none have attempted to compare the efficacy of various techniques in a head to head fashion. The following randomized prospective trial compares three commonly used patellar resection techniques: the use of a patellar cutting guide, haptic feedback, and the four quadrant technique. The main purpose of this study was to determine the most efficient method to symmetrically resurface the patella to the desired thickness during primary TKA. Additionally, this study assesses surgeon efficacy in patellar resection when learning a new technique as compared to their historically preferred method.

One or more of the authors of this paper have disclosed potential or pertinent conflicts of interest, which may include receipt of payment, either direct or indirect, institutional support, or association with an entity in the biomedical field which may be perceived to have potential conflict of interest with this work. For full disclosure statements refer to http://dx.doi.org/10.1016/j.arth.2015.05.038.

Source of funding: Financial support for the statistical analysis and study coordination was obtained solely from internal funding.

Level of Evidence: I. Prospective randomized controlled trial.

Reprint requests: Christopher L. Camp, M.D., Mayo Clinic, 200 First St., SW, Rochester, MN, 55905.

http://dx.doi.org/10.1016/j.arth.2015.05.038
0883-5403/

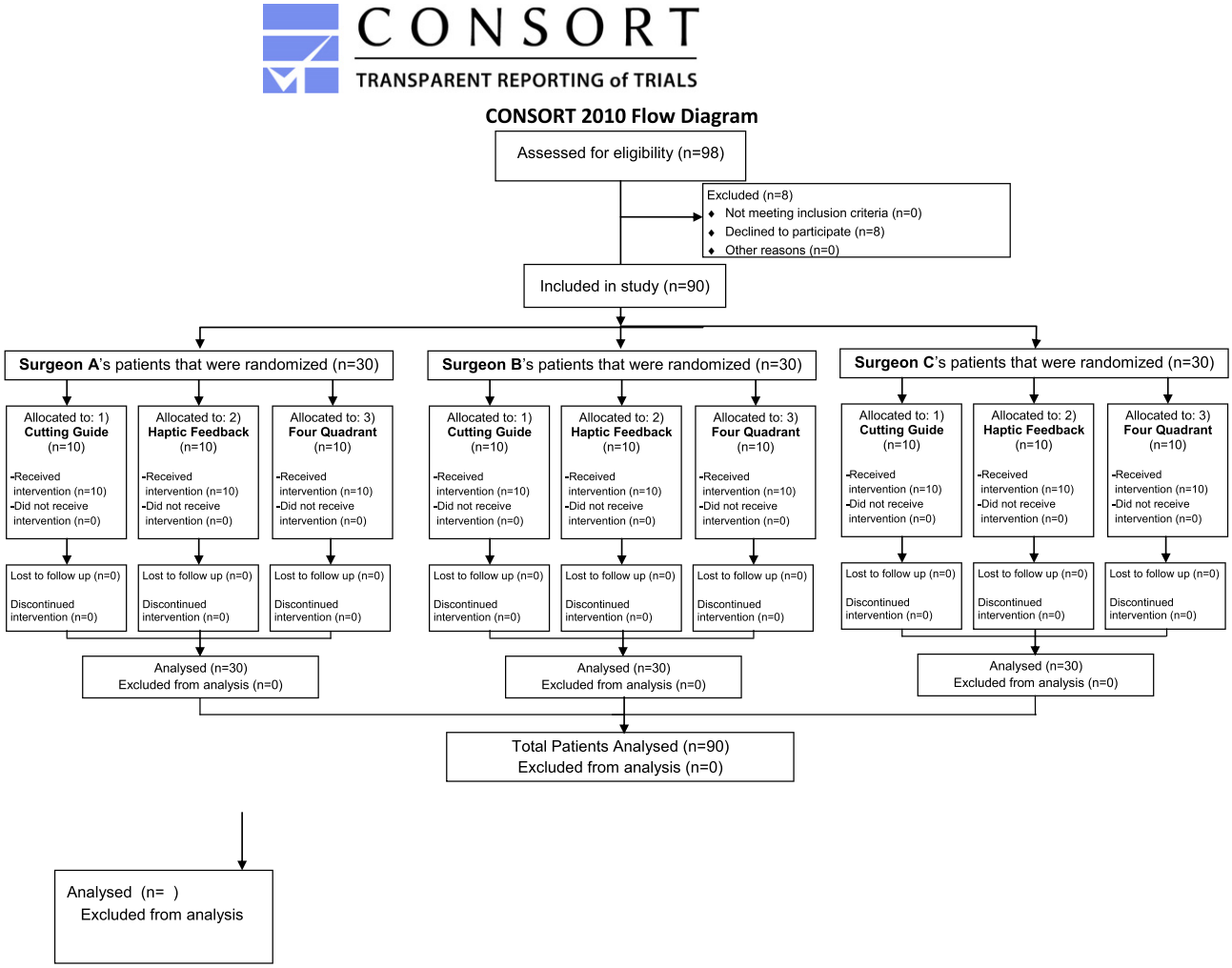

Fig. 1. Flow chart illustrating patient enrollment.

Materials and Methods

After approval from our institution's internal review board and our department's orthopedic research review committee, a total of 90 patients undergoing TKA were prospectively enrolled into this randomized controlled trial (registered at www.clinicaltrials.gov) prior to surgery (Fig. 1). To be considered for the study, patients had to meet the following inclusion criteria: undergoing elective primary TKA with patellar resurfacing, willing to participate, and able to provide informed consent. Patients were excluded if they were undergoing revision TKA, were not definitively having their patella resurfaced at the time of TKA, or were unable or unwilling to provide informed consent. All surgeries were performed by one of three experienced arthroplasty surgeons (AJK, MJT, and RTT) who each enrolled a total of 30 patients (total n = 90). Within each of these three subgroups (A, B, and C) of 30 patients, patients were equally randomized to have their patella resected by one of the following three techniques during TKA: 1) use of a standard cutting guide, 2) freehand resection with haptic feedback or 3) freehand resection guided by four quadrant measurements. A total of 10 patients per surgeon were randomized to each technique. This resulted in 30 patients randomized to each technique across all surgeons (Table 1).

Each of the three surgeons was familiar with all three resection techniques; however, they each preferred one of the techniques over the other two and historically performed the vast majority of their patellar resections in that manner. Prior to the study, no two surgeons preferred the same technique (Table 1). As a result, each surgeon was more experienced with their own preferred resection method, but they had at least used the other two techniques previously.

Informed consent was obtained from all patients in the clinical setting during their pre-surgical appointment. Randomization was completed by envelope system by an independent member of the study team that did not participate in the surgery or data collection (CLC). Each surgeon was provided with 30 sequentially numbered envelopes (1 through 30) that each contained a single data collection sheet. Surgeons were not allowed to open the envelopes until they were in the operating room. The technique to be performed was indicated on the data sheet in addition to the outcome measures. All procedures were performed entirely by the staff surgeons and they were timed from

Table 1
Patient Allocation.

	Cutting Guide	Haptic Feedback	4 Quadrant
Resections Performed by **Surgeon A**	10[a]	10	10
Resections Performed by **Surgeon B**	10	10[a]	10
Resections Performed by **Surgeon C**	10	10	10[a]

A total of ninety patients were enrolled. There were thirty patients per surgeon and thirty patients per technique.

[a] Indicates the surgeon's historically preferred technique.