



## Barbed Versus Traditional Sutures: Closure Time, Cost, and Wound Related Outcomes in Total Joint Arthroplasty

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### ABSTRACT

The purpose of this study was to compare barbed sutures to traditional sutures in three domains: time, cost, and wound related outcomes in total knee arthroplasty (TKA) and total hip arthroplasty (THA). A total of 34 patients were enrolled in a prospective randomized controlled trial to assess time to wound closure and cost. In addition, a retrospective chart review of an additional 100 patients was conducted to further assess wound-related outcomes. On average, barbed sutures decreased time to wound closure by 9.72 min ( $P < 0.05$ ) after controlling for length of incision, patient's BMI and number of physicians closing. Further, using barbed sutures saved an average of \$549.59 per case. However, increased frequency and severity of wound complications were associated with barbed sutures.

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Suturing has essentially remained unchanged for decades. One innovation involving traditional methods of suturing was the invention of barbed sutures, first described by R.A. McKenzie in 1967 [1]. Within the last decade, barbed sutures became commercially available and have recently begun to gain popularity due to ease and speed of placement. However, scientific literature exploring their benefits and drawbacks is sparse, particularly in the field of orthopaedics.

In humans, barbed sutures have been investigated in a variety of procedures, yet such studies have displayed mixed results. Their use in robotic prostatectomy exhibited a decrease in suturing time [5]. In the realm of facial rejuvenation surgery, different findings exist specifically related to long term efficacy, patient satisfaction and morbidity [6–8]. Murtha et al demonstrated similar cosmetic outcomes, rates of infection, dehiscence and closure time comparing barbed sutures and traditional sutures when used in closing the dermal layer in non-emergent cesarean delivery surgeries [9]. In abdominoplasty, barbed sutures were shown to be safe and were associated with both a faster total surgery time [10] and a faster closing time [12]. Past work completed in animal models demonstrates equivalent efficacy, safety and strength when comparing barbed sutures to traditional sutures [2,3].

Within orthopaedics, one particular area in which barbed sutures have been extensively studied is flexor tendon repair. Many studies clearly show similar or greater strength achieved with barbed sutures compared to traditional suturing for this particular purpose [4,17–21]. One early observational study evaluating barbed sutures in knee and hip arthroplasties notes a faster time of placement and a theoretical cost reduction when using barbed sutures, but lacks standardization of suturing technique and lacks data describing exactly how much time or money is saved [14]. They report no change in complication or wound healing rates, but again provide no data to support this claim [14]. Another retrospective study evaluating barbed sutures in total knee arthroplasty showed a decrease in total surgical time when using barbed sutures, but comments solely on the suturing time [13]. It makes no comparison of cost between barbed and traditional suturing methods [13]. Lastly, a recent case report details three extensor mechanism failures after TKA using bidirectional barbed sutures to close the medial parapatellar arthrotomy [22]. Well designed studies providing prospective data evaluating barbed sutures are lacking in the current literature.

The purpose of this study was to prospectively investigate barbed sutures by comparing them to traditional sutures on three different levels; time to wound closure, cost, and rates of wound complications when used to close primary total knee arthroplasties (TKA) and primary total hip arthroplasties (THA). We hypothesized that using barbed sutures, specifically, the Quill Self-Retaining System (SRS; Angiotech Pharmaceuticals, Inc. Vancouver, Canada), would expedite the time to wound closure resulting in a decreased amount of time spent in the operating room. Further, we

The Conflict of Interest statement associated with this article can be found at <http://dx.doi.org/10.1016/j.arth.2013.05.031>.

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**Table 1**  
Characteristics of the Study Population.

Procedure		Quill		Traditional	
		TKA	THA	TKA	THA
Total Number		10	8	8	8
Gender	Male	5	4	3	3
	Female	5	4	5	5
Age (Years)	Average	59.2	59.6	70.6	57.9
	Range	37–82	43–85	58–86	24–80
Length of Incision (cm)	Average	19.0	18.3	17.7	15.6
	Range	15–23	13–25	15–20	13–21
BMI	Average	33.7	33.8	30.1	30.1
	Range	25.5–42.7	21.3–48.9	22.7–44.4	24.4–39

Epidemiology of the two arms of the study.

hypothesized that there may be a cost reduction associated with barbed sutures secondary to their time saving capability. Lastly, we hypothesized that the rate of wound complications would be equivalent in the two groups.

## Materials and Methods

### Participant Recruitment

We performed a prospective, randomized controlled trial at our institution between August and October of 2010. The study design was approved by our institutional review board on July 21, 2010. A power analysis was performed to determine the number of participants necessary to detect a five minute difference between the two types of sutures. It was calculated that 34 patients would be necessary to establish significance, and therefore we recruited 34 patients for our prospective cohort. Recruitment occurred during preoperative visits with the one attending orthopaedic surgeon involved in the study. Patients meeting inclusion criteria were asked if they would like to be involved in the study and those who were interested signed a detailed informed consent form. Inclusion criteria included being scheduled to undergo a primary TKA or THA at our medical center with the attending surgeon involved in this study. Exclusion criteria included patients scheduled to undergo hip and knee revision arthroplasty. We did not exclude patients on the basis of age, race, gender, BMI or other comorbid conditions. In other words, the first consecutive 34 primary TKA and THA patients agreeable to be included in the study were included and no one was subsequently excluded for any reason. Details of the study population can be seen in Table 1.

Sealed envelopes in a random order were used to place study participants in either the barbed suture arm or in the traditional suture arm of the study. Patients were randomized in a one to one ratio. At the commencement of each arthroplasty, a random envelope was drawn which dictated the type of suture to be used, thus blinding the patients to the type of suture they received.

**Table 2**  
Suture Type and Method of Placement THA.

Layer	Traditional Suture	Barbed Suture
Fascia	Distal interrupted and proximal running #1 Ethibond	Running #2 Quill
Fat	Running 0-Vicryl	Running #1 Quill
Subcutaneous	Interrupted 2.0 Vicryl	Running #0 Quill
Subcuticular	Running 3-0 Monocryl	Running 2-0 Quill Monoderm

Details of the suture type and method of placement for all THA.

**Table 3**  
Suture Type and Method of Placement TKA.

Layer	Traditional Suture	Barbed Suture
Arthrotomy	Interrupted #1 Ethibond	Running #2 Quill
Fat	Running 0-Vicryl	Running #1 Quill
Subcutaneous	Interrupted 2.0 Vicryl	Running #0 Quill
Subcuticular	Running 3-0 Monocryl	Running 2-0 Quill Monoderm

Details of the suture type and method of placement for all TKA.

### Surgical Methods

The surgical methods were consistent throughout the entire study. We used the posterolateral approach for each THA and a median parapatellar approach for each TKA, regardless of suture type used during closure. Following all procedures, ABD's were used to cover the incision and soft dressings were applied. No acrylate glue or steri strips were used during this study. Details of the exact type of suture used and the method of placement can be found in Tables 2 and 3.

### Suturing Methods

Traditional sutures were placed in the usual fashion throughout the study. Interrupted sutures were placed, tied and cut before moving on to the next knot. If space allowed, the attending and the resident surgeons would suture simultaneously when placing interrupted sutures. Running sutures were placed by first securing the suture to one end of the wound and running the suture in the usual fashion before securing it at the opposite end of the wound.

During closure with barbed suture, the suture was introduced in the center of the wound and the surgeons ran the suture towards opposite ends of the wound simultaneously. Each time barbed suture was used the attending and resident surgeons were suturing simultaneously. Upon reaching the end of the wound a few redundant throws were inserted back toward the center of the wound to secure the suture in place and the ends were cut. All suturing was completed by the same attending orthopaedic surgeon and the same fourth year resident surgeon throughout the entire study. Both had used the Quill suture for three months prior to the study to become comfortable using it and to correct for any learning curve that was necessary to overcome. A fat layer was used at the attending surgeon's discretion if the adipose layer was sufficiently thick requiring an additional suture layer to achieve tissue approximation.

### Data Collection

At the conclusion of each arthroplasty the time from placement of the first stitch to the completion of wound closure was recorded using a stop watch. In addition, the time to close each individual layer of the wound was also recorded. Specifically, we recorded the time necessary to close the fascia, fat layer, subcutaneous layer, and subcuticular layers. The length of incision was measured after closure was completed and was used as a control during statistical analysis. The patient's height and weight were also recorded in order to calculate BMI, which was also used as a control during statistical analysis. Further, the quantity of each suture used was also recorded and used during the cost analysis. All data were recorded by a medical student or a nurse present in the operating room during closure.



**Fig. 1.** Magnified barbed suture showing the helical arrangement of the barbs. Source: [http://trusted.md/feed/items/rlbates/2008/04/28/barbed\\_sutures#axzz150l6wAcX](http://trusted.md/feed/items/rlbates/2008/04/28/barbed_sutures#axzz150l6wAcX).

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