

Bikini versus Traditional Incision in DAA THA: Patient Satisfaction, Surgeon Observation, and LFCN Damage

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Background: The bikini incision (BI) used in direct anterior approach total hip arthroplasty (DAA THA) theoretically improves scar aesthetics by utilizing the inguinal crease; however, current literature suggests its transverse orientation increases the risk of injury to the lateral femoral cutaneous nerve (LFCN). This study examines (1) patient and surgeon satisfaction with scar appearance and (2) differences in post-operative LFCN sensation between the vertical, traditional incision (TI) and the BI.

Questions/Purposes: In this pilot study, the following questions were investigated: (1) Do BI patients experience increased scar satisfaction compared to TI patients? (2) Does the surgeon report greater satisfaction with BI scars compared to TI scars? (3) Do BI patients have a reduced incidence of LFCN sensory disturbance compared to TI patients?.

Patients and Methods: Fifty-five patients (32 TI and 23 BI), at least 6 months post-DAA THA, were recruited from a high-volume, fellowship-trained reconstruction surgeon. 91% of the BI group was female, compared to 50% of the TI group. The Patient and Observer Scar Assessment Scale (POSAS) allowed patients to describe scar appearance and complications (eg, pain and itchiness) and enabled the surgeon to assess vascularity, pigmentation, thickness, relief, pliability, and surface area. Monofilament testing at superomedial, superolateral, inferomedial, and inferolateral quadrants of the anterior thigh assessed LFCN hypoesthesia.

Results: POSAS analysis demonstrated that (1) BI patients were significantly more satisfied with scar appearance than TI patients ($p < 0.05$), and (2) the surgeon was significantly more satisfied with BI scars than TI scars ($p < 0.05$). (3) Monofilament testing showed significantly more LFCN impairment in the inferomedial quadrant of the TI group ($p < 0.0125$).

Conclusion: This study demonstrates improved patient and surgeon satisfaction with the BI. Contrary to current beliefs, the BI better preserves LFCN innervation relative to the TI.

Keywords: cosmesis, function, novel, sensation

Introduction

Background

Total hip arthroplasty (THA) has become the standard treatment modality for severe hip osteoarthritis due to excellent outcomes, pain mitigation, and cost effectiveness compared to non-surgical care.¹ The direct anterior approach (DAA) for THA has become increasingly popular due to quicker recovery periods,² decreased hospital stays,³ and decreased institutional costs.⁴ There are two different types of incisions – traditional or bikini – that can be made during a DAA THA.⁵ The traditional incision is made just distal and lateral to the ASIS and extends towards the superolateral border of the patella. The bikini incision is an obliquely placed incision at the inguinal flexion crease that follows Langer's line (Figure 1).⁶ It is placed approximately three fingerbreadths distal to the anterior superior iliac spine (ASIS), with one-third of the incision being medial to the ASIS and two-thirds of the incision being lateral to the ASIS.⁷ Both incisions establish the intermuscular plane between the sartorius and tensor fascia lata (TFL) used in DAA THA. However,



Figure 1 Location of bikini incision marked in blue at the right inguinal flexion crease of a volunteer.

compared to the traditional vertical incision, the bikini incision results in greater difficulty in visualisation of the surgical field.⁸ The main benefit of the bikini incision is that it may be more cosmetically appealing, as it theoretically has improved healing and decreased visibility of the surgical scar.^{5,9}

Damage to the lateral femoral cutaneous nerve (LFCN) during DAA THA can result in sensory deficits such as anterolateral thigh numbness, dysesthesia, or pain.^{10,11} In turn, this negatively impacts patient quality of life and activities involving kneeling, squatting, and walking.^{10,12,13} These sensory disturbances can lead to post-operative discomfort and dissatisfaction, making LFCN preservation an important consideration in surgical approach. Hence, this pilot study explores differences in scar satisfaction and LFCN sensory impairment between the bikini and traditional incisions in DAA THA. Given the preliminary nature of this work, the sample size is limited, aiming to inform larger future studies.

Rationale

While some studies suggest that the bikini incision's transverse orientation increases the risk of LFCN injury and subsequent sensory disturbances,^{10,11} others report comparable or even reduced LFCN impairment relative to the traditional longitudinal incision.^{13,14} This inconsistency in findings emphasizes the importance for conducting further research to determine the impact of each incision on LFCN preservation. What truly differentiates this study from current literature is the subjective and objective investigation of anterolateral thigh numbness, specifically in the distribution of the LFCN. It is also the first study directly comparing patient satisfaction to surgeon satisfaction with the post-operative scar. Currently, the traditional incision is the more popular choice for DAA THAs due to increased visualisation; however, it is crucial to understand if one is superior to the other. In this pilot study, the following questions are investigated: (1) Do bikini incision patients experience increased scar satisfaction compared to traditional incision patients? (2) Does the surgeon experience increased scar satisfaction with bikini incision scars compared to traditional

incision scars? (3) Do bikini incision patients experience less LFCN sensation impairment compared to traditional incision patients?

Patients/Methods

This is a prospective cross-sectional evaluation of patients who underwent a DAA THA for hip osteoarthritis. After receiving approval from the appropriate Research Ethics Board, patients who underwent a DAA THA were identified, and it was recorded whether they received a bikini incision or a traditional incision. All patients were informed about the purpose of the study, in accordance with the Declaration of Helsinki. This study included patients over the age of 40 who were a minimum of 6 months post-DAA THA. This study excluded any patient who required a revision to the THA, was below the age of 40, was less than 6 months post-DAA THA, or was reported to have other complications (eg, hip dislocation or femoral fracture). For the primary continuous outcome of patient satisfaction, a sample size of 348 was required for a superiority study. However, due to resource limitation (eg, research personnel, time, etc), this sample size was not met. As variations in dissection and wound closure techniques can significantly influence scar healing, patients of only one surgeon were considered in this study. The surgeon used both incision techniques (ie, bikini and traditional) regularly in his practice.

To evaluate patient satisfaction, patients were asked to fill out the Patient and Observer Scar Assessment Scale – Patient Form (Figure 2). This questionnaire included seven questions pertaining to how the patient perceives their scar. Each question was answered on a scale of 1 to 10. The answers from the first six questions were added, and a mean value was determined for the traditional incision and bikini incision groups (ie, POSAS Patient Total/PPT). A higher PPT value indicates increased scar complications (ie, pain, itchiness, impaired scar healing) compared to a lower value. A similar method of evaluating the POSAS – Patient Form was completed by Ho et al.¹⁵ Another mean value representing the patient's overall opinion of the scar was also determined for each group via the seventh question (ie, POSAS Patient Overall/PPO). A higher PPO value indicates decreased scar satisfaction compared to a lower value. The questionnaire also included a diagram upon which patients were asked to mark the location of their scar.

To compare patient satisfaction with surgeon satisfaction, the surgeon was asked to fill out the Patient and Observer Scar Assessment Scale – Observer Form (Figure 3). This questionnaire included seven questions and required the surgeon to evaluate the patient's scar with respect to various scar characteristics. Each question was answered on a scale of 1 to 10. The answers from the first six questions were added, and a mean value was determined for the traditional incision cohort and bikini incision cohort (ie, POSAS Surgeon Total/PST). A higher PST value indicates impaired scar healing compared to a lower value. Another mean value representing the surgeon's overall opinion of the scar was also determined for each group via the seventh question (ie, POSAS Surgeon Overall/PSO). A higher PSO value indicates decreased scar satisfaction compared to a lower value. The questionnaire also included a diagram upon which the surgeon was asked to mark the location of the patient's scar. The POSAS measurement tool has been shown to be reliable, with good internal consistency and agreement.¹⁶

Lateral femoral cutaneous nerve damage and subsequent anterolateral thigh numbness was examined both subjectively and objectively. To assess this subjectively, patients were asked to complete a questionnaire about numbness, discomfort, and impact on activities of daily living (eg, kneeling, squatting, and deep flexion) (Figure 4). However, only answers from the first question of this survey, “do you have any numbness around the surgical scar or down your thigh?”, were analyzed and included in this study. To assess this objectively, a novel method was implemented. A template was created to evaluate the distribution of the LFCN in four quadrants (Figure 5). At the follow-up clinic appointment, sensory testing was conducted under the most standardized conditions feasible. The patient was asked to lie supine on a flat examination table and draped appropriately in a quiet, well-lit room. To ensure consistency in template placement, a flexible measuring tape was used to locate a reference point at one-third of the distance between the anterior superior iliac spine (ASIS) and the most superolateral point of the ipsilateral patella. The central point of the template was placed at this reference point. There were three points of measurement, at one-inch intervals, extending from this central point into each of the four quadrants. Therefore, once placed parallel to the vector spanning from the ASIS to the most superolateral point of the patella, the template would equally cover the distribution of the LFCN (Figure 6). All measurements were performed by two trained examiners to reduce variability and ensure consistent reproducibility in testing. Care was taken

POSAS Patient scale

The Patient and Observer Scar Assessment Scale v2.0 / EN

Date of examination: _____

Observer: _____

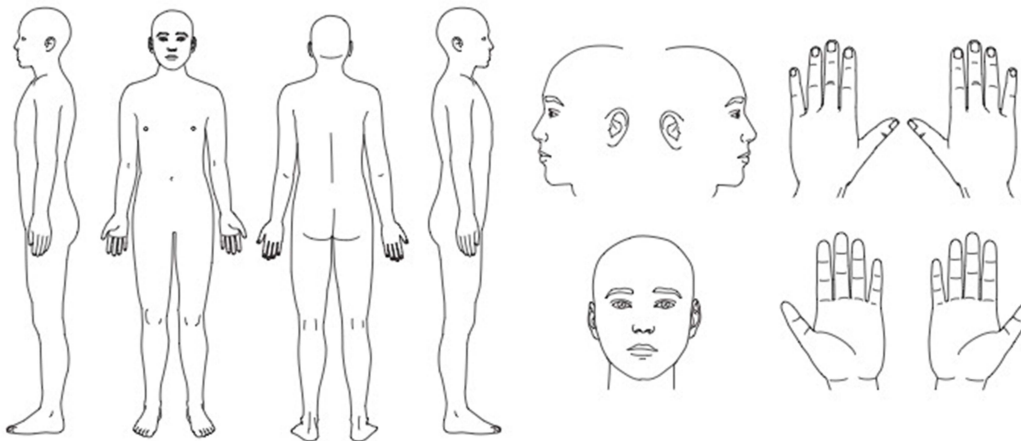
Location: _____

Research / study: _____

Name of patient: _____

Date of birth: _____

Identification number: _____



1 = no, not at all yes, very much = 10

1 2 3 4 5 6 7 8 9 10

HAS THE SCAR BEEN PAINFUL THE PAST FEW WEEKS?

HAS THE SCAR BEEN ITCHING THE PAST FEW WEEKS?

1 = no, as normal skin yes, very different = 10

1 2 3 4 5 6 7 8 9 10

IS THE SCAR COLOR DIFFERENT FROM THE COLOR OF YOUR NORMAL SKIN AT PRESENT?

IS THE STIFFNESS OF THE SCAR DIFFERENT FROM YOUR NORMAL SKIN AT PRESENT?

IS THE THICKNESS OF THE SCAR DIFFERENT FROM YOUR NORMAL SKIN AT PRESENT?

IS THE SCAR MORE IRREGULAR THAN YOUR NORMAL SKIN AT PRESENT?

1 = as normal skin very different = 10

1 2 3 4 5 6 7 8 9 10

WHAT IS YOUR OVERALL OPINION OF THE SCAR COMPARED TO NORMAL SKIN?

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Figure 2 Patient and Observer Scar Assessment Scale – Patient Form. With permission from Copyright © P.P.M. van Zuijlen, beverwijk-nl.

POSAS Observer scale

The Patient and Observer Scar Assessment Scale v2.0 / EN

Date of examination: _____

Observer: _____

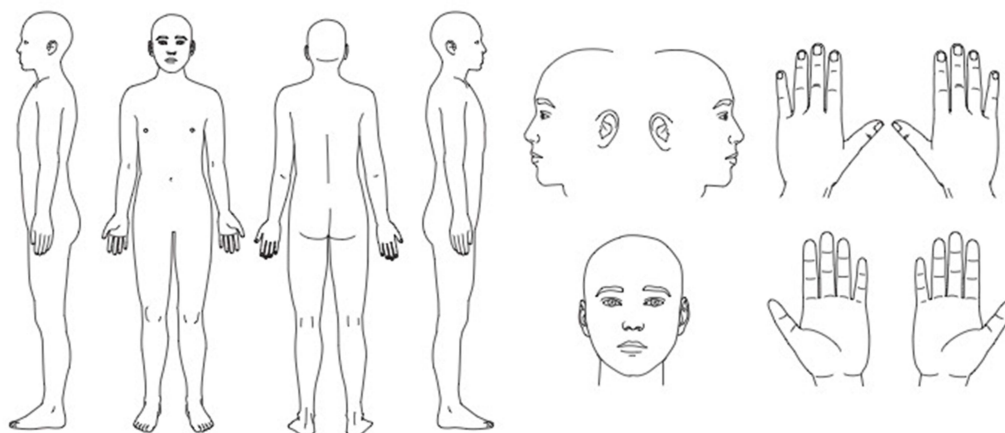
Location: _____

Research / study: _____

Name of patient: _____

Date of birth: _____

Identification number: _____



	1 = normal skin worst scar imaginable = 10										
PARAMETER	1	2	3	4	5	6	7	8	9	10	CATEGORY
VASCULARITY	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	PALE PINK RED PURPLE MIX
PIGMENTATION	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	HYPO HYPER MIX
THICKNESS	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	THICKER THINNER
RELIEF	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	MORE LESS MIX
PLIABILITY	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	SUPPLE STIFF MIX
SURFACE AREA	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	EXPANSION CONTRACTION MIX
OVERALL OPINION	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	

Explanation

The observer scale of the POSAS consists of six items (vascularity, pigmentation, thickness, relief, pliability and surface area). All items are scored on a scale ranging from 1 ('like normal skin') to 10 ('worst scar imaginable'). The sum of the six items results in a total score of the POSAS observer scale. Categories boxes are added for each item. Furthermore, an overall opinion is scored on a scale ranging from 1 to 10. All parameters should preferably be compared to normal skin on a comparable anatomic location.

Explanatory notes on the items:

- **VASCULARITY** Presence of vessels in scar tissue assessed by the amount of redness, tested by the amount of blood return after blanching with a piece of Plexiglas
- **PIGMENTATION** Brownish coloration of the scar by pigment (melanin); apply Plexiglas to the skin with moderate pressure to eliminate the effect of vascularity
- **THICKNESS** Average distance between the subcuticular-dermal border and the epidermal surface of the scar
- **RELIEF** The extent to which surface irregularities are present (preferably compared with adjacent normal skin)
- **PLIABILITY** Suppleness of the scar tested by wrinkling the scar between the thumb and index finger
- **SURFACE AREA** Surface area of the scar in relation to the original wound area

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Figure 3 Patient and Observer Scar Assessment Scale – Observer Form. With permission from Copyright © P.P.M. van Zuijlen, beverwijk-nl.



London Health
Sciences Centre

Study ID: _____

Date: _____

Bikini versus Traditional Incision in Direct Anterior Total Hip Arthroplasty

Age: _____

Sex: Male / Female

Date of operation: _____

Side: Right / Left

1. Do you have any numbness around the surgical scar or down your thigh? *Numbness can often be described as a lack of sensation or the feeling of "pins and needles".*

YES	NO
-----	----

1.1. If you answered "NO", you do not need to proceed. *Thank you for your time!*

2. Does this numbness cause you any discomfort?

NO	YES, but only during certain activities	YES, it is a continuous discomfort
----	---	--

3. The following questions will be relating to how this numbness affects some of your daily activities. *Please circle the most appropriate answer.*

3.1. **Kneeling**

No affect: I do not notice the numbness	Some affect: I can complete the activity with <u>mild</u> discomfort	Affects: I can complete the activity with <u>moderate</u> discomfort	Complete affect: The activity is very uncomfortable and I <u>avoid it</u>
---	--	--	---

I cannot recall doing this activity

3.2. **Squatting**

No affect: I do not notice the numbness	Some affect: I can complete the activity with <u>mild</u> discomfort	Affects: I can complete the activity with <u>moderate</u> discomfort	Complete affect: The activity is very uncomfortable and I <u>avoid it</u>
---	--	--	---

I cannot recall doing this activity

Please complete reverse side...

Version Date: 13-May-2019

Figure 4 Continued.



London Health
Sciences Centre

Study ID: _____

Date: _____

- 3.3. **Deep flexion** (i.e. bringing your knee towards your chest when stretching or when sitting on the floor with your knees drawn in)

No affect: I do not notice the numbness	Some affect: I can complete the activity with <u>mild</u> discomfort	Affects: I can complete the activity with <u>moderate</u> discomfort	Complete affect: The activity is very uncomfortable and I <u>avoid it</u>
---	--	--	---

I cannot recall doing this activity

4. Do you avoid wearing certain items of clothing or certain material due to the discomfort caused by numbness? *For example, women have reported discomfort when their skirts rub against the area of numbness.*

YES	NO
-----	----

- 4.1. If you answered "YES", can you please elaborate on the types of clothing items or materials you avoid due to discomfort from the area of numbness?

5. Are you happy with your hip replacement?

YES	NO
-----	----

- 5.1. If you answered "NO", is this due to the area of numbness?

YES	NO
-----	----

6. Please mark your level of satisfaction with the surgery on the following scale.
0 = totally dissatisfied and 10 = totally satisfied

0 — 1 — 2 — 3 — 4 — 5 — 6 — 7 — 8 — 9 — 10

Comments:

THANK YOU for your time.

Version Date: 13-May-2019

Figure 4 Patient Numbness and Activities of Daily Living Questionnaire.

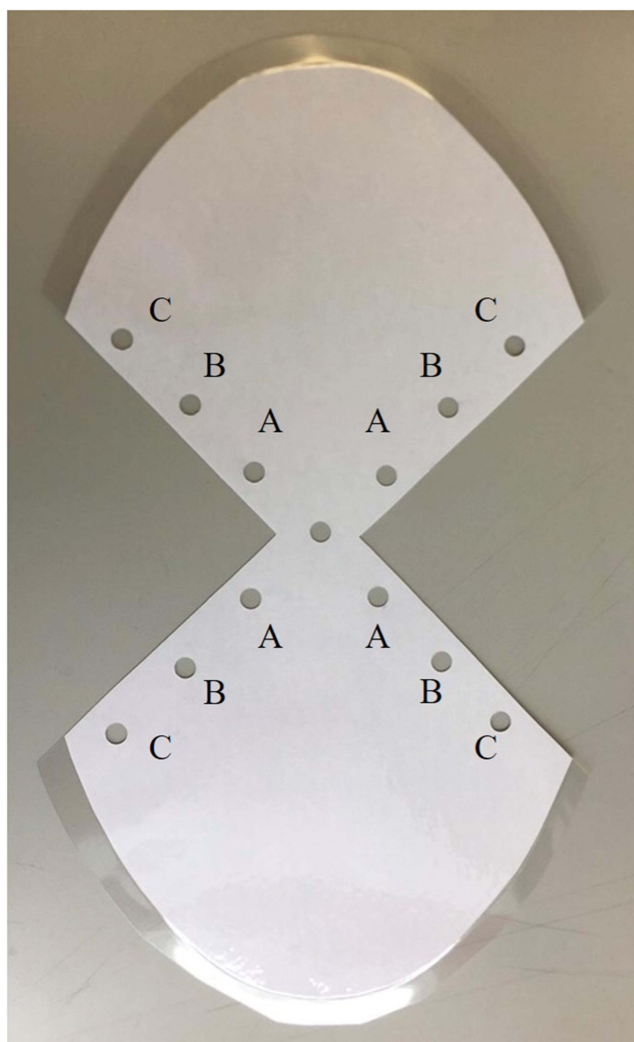


Figure 5 LFCN objective testing template with labelled testing points.

to palpate bony landmarks appropriately to ensure adequate replication of template positioning across patients. Blinding of the patient to specific testing points was maintained throughout the evaluation process.

To reliably combine data from incisions on the left and right lower extremity, quadrant 1 was labelled as the superomedial quadrant, with quadrants 2 (ie, inferomedial quadrant), 3 (ie, inferolateral quadrant), and 4 (ie, superolateral quadrant) moving clockwise on the right lower extremity and counterclockwise on the left lower extremity (Figure 6). In each quadrant, the three points of measurement were marked using a non-toxic surgical skin marker. Point A was located one inch from the center, point B was located two inches from the center, and point C was located three inches from the center (Figure 6). The template was then removed to commence LFCN sensation testing.

About 10g, 4g, and 2g Semmes-Weinstein monofilaments were used to assess the sensitivity of the skin quadrants. Prior to testing, each monofilament was shown to the patient, and the procedure was explained. Following verbal consent, the monofilaments were applied to the patient's hand to demonstrate that the test would not cause discomfort. The patient was then instructed to close their eyes and respond with "yes" upon perceiving the monofilament stimulus at the testing location. During the evaluation, each monofilament was held perpendicular to the skin and applied to the designated site with gentle pressure until it just began to bend. The filament was maintained in contact with the skin for 1 to 3 seconds before being lifted straight off, taking care to avoid contact with surrounding areas. The monofilaments were applied at each of the marked points, in order of decreasing magnitude, and perception of the stimulus was noted (ie, perceived or not). A score of 3, representing full sensation, was given if the 10g, 4g, and 2g monofilaments were perceived. A score of

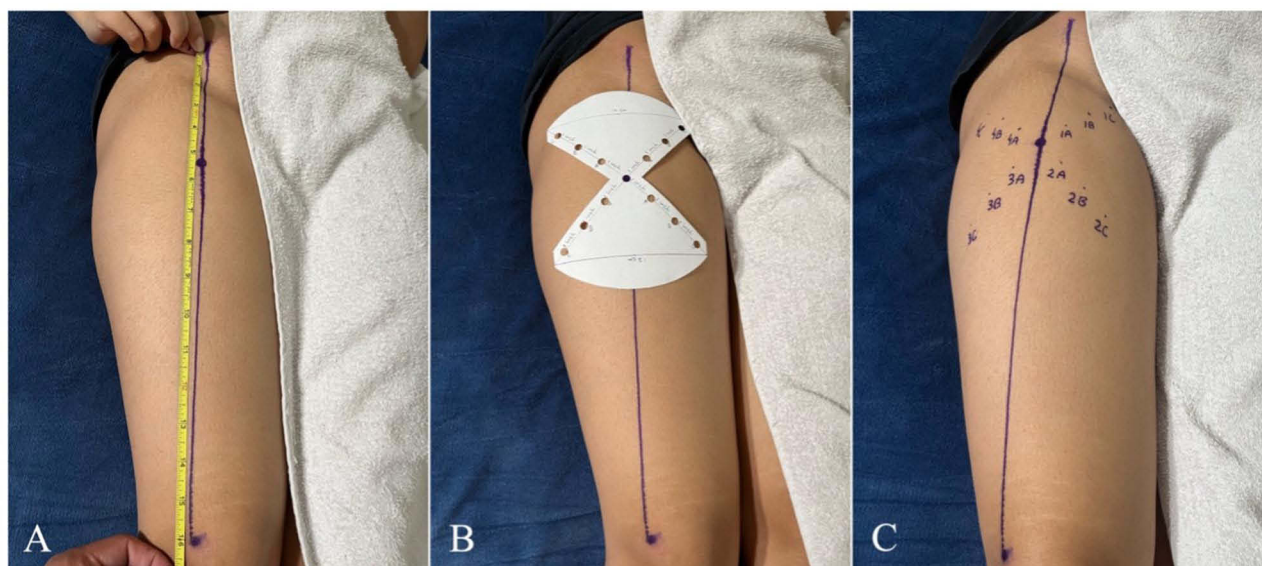


Figure 6 In (A), the blue vector is developed by measuring the ASIS to the most superolateral point of the patella. A blue dot is placed one-third of the distance from the ASIS to the most superolateral point of the patella. In (B), the center point of the template is placed on this blue dot, while ensuring the template is parallel to the blue vector. In (C), quadrants 1, 2, 3, and 4, and the corresponding points A, B, and C, are developed by the template for objective LFCN testing. This example is marked on the right lower extremity of a volunteer.

2 was given if only the 10g and 4g monofilaments were perceived. A score of 1 was given if only the 10g monofilament was perceived. A score of 0 was given if none of the monofilaments were perceived. In each quadrant, the scores from points A, B, and C were added to develop a quadrant score. A lower quadrant score indicates decreased perception in that area. A similar technique has been outlined in MacDonald et al and Schaper et al.^{12,17}

Patient demographics were summarized with descriptive statistics including means, standard deviations, and proportions. Scores were averaged for both the bikini and traditional groups and compared with a non-parametric analysis (Mann Whitney *U*-Test, Chi-Square Test of Independence, Fisher's Exact Test) to determine if the distributions of the groups were different, as the assumption of normality was not met via the Shapiro–Wilk test. Age was normally distributed and compared between groups via the Independent Samples *t* Test. A *p* value of less than 0.05 was considered statistically significant for all tests. However, for the objective evaluation of numbness, a *p* value of less than 0.0125 was considered statistically significant, as the Bonferroni correction was applied for each quadrant evaluation. Lastly, 95% confidence intervals and effect sizes were calculated to better contextualize the findings. The effect size interpretation was made via the following: 0 to 0.30 = small, 0.31 to 0.50 = moderate, 0.51 to 1.0 = large.

Results

A total of 55 DAA THA patients were enrolled in this study. Thirty-two patients had received the traditional incision, while 23 patients had received the bikini incision. The age of the BI group ranged from 41 to 85, while the age of the TI group ranged from 46 to 88. The mean patient age was comparable between both cohorts ($p = 0.0835$). However, 91.3% of the bikini incision group was female, while 50% of the traditional incision group was female (Table 1). The Fisher's Exact Test demonstrated a statistically significant difference in sex between groups ($p = 0.0014$).

The mean PPT value for the traditional incision group was 15.72, while the mean PPT value for the bikini incision group was 9.17. The mean PPO value for the traditional incision group was 3.63, and 1.96 for the bikini incision group. The bikini incision group had statistically significant lower PPT and PPO scores compared to the traditional incision group (Table 2).

The mean PST value for the traditional incision group was 15.63, while the mean PST value for the bikini incision group was 10.91. The mean PSO value for the traditional incision group was 2.78, and 2.22 for the bikini incision group.

Table 1 Demographics

	Traditional (n = 32)	Bikini (n = 23)	P Value
Age	67.81 ± 10.79	62.57 ± 10.97	0.0835
Age Range	46 to 88	41 to 85	
Sex (% Female)	50%	91.3%	0.0014

Notes: The p value to determine the difference in age between groups was obtained via the Independent Samples t Test. The p value to determine the difference in sex between groups was obtained via the Fisher's Exact Test.

The bikini incision group had statistically significant lower PST and PSO scores compared to the traditional incision group (Table 2).

Fourteen (43.8%) traditional incision patients reported experiences of numbness, while only nine (39.1%) bikini incision patients reported experiences of numbness (Table 3). Although subjectively the bikini group reported less sensation of numbness, this difference was not statistically significant (p value = 0.732). Objective evaluation of numbness demonstrated significantly less loss of sensation in the bikini incision patients compared to the traditional incision patients. The proportion of patients with a quadrant score of less than 6 was greater for traditional incision patients, relative to bikini incision patients, in quadrants 2, 3, and 4 (Table 4). Furthermore, the mean quadrant score was lower for traditional incision patients, compared to bikini incision patients, in all four quadrants; this was statistically significant in quadrant 2 (Table 2).

Table 2 Perception of Scar (Patient and Surgeon Score) and Numbness Quadrant Score

	Group	Mean	Std. Deviation	95% CI	p Value	Effect Size	Interpretation
POSAS* Patient Total (PPT)	Traditional	15.72	8.963	12.615–18.825	0.004	0.39	Moderate to Large
	Bikini	9.17	5.944	6.741–11.599			
POSAS* Patient Overall (PPO)	Traditional	3.63	2.837	2.647–4.613	0.035	0.28	Small to Moderate
	Bikini	1.96	1.637	1.291–2.629			
POSAS* Surgeon Total (PST)	Traditional	15.63	3.250	14.504–16.756	< 0.001	0.44	Large
	Bikini	10.91	3.397	9.522–12.298			
POSAS* Surgeon Overall (PSO)	Traditional	2.78	0.870	2.479–3.081	0.015	0.33	Moderate
	Bikini	2.22	0.671	1.946–2.494			
Quadrant 1 Total	Traditional	7.78	1.408	7.292–8.268	0.048	0.27	Small to Moderate
	Bikini	8.30	1.295	7.771–8.829			
Quadrant 2 Total	Traditional	7.91	1.653	7.337–8.483	0.007	0.37	Moderate
	Bikini	8.83	0.491	8.629–9.031			
Quadrant 3 Total	Traditional	7.44	2.109	6.709–8.171	0.089	0.23	Small
	Bikini	8.48	0.790	8.157–8.803			
Quadrant 4 Total	Traditional	8.16	1.483	7.646–8.674	0.160	0.19	Small
	Bikini	8.61	0.839	8.267–8.953			

Notes: *POSAS, or The Patient and Observer Scar Assessment Scale, allows patients to explain scar appearance and complications (ie, pain, itchiness) and allows the surgeon to evaluate scar vascularity, pigmentation, thickness, relief, pliability, and surface area. Each p value was calculated via non-parametric analysis, specifically via the Mann Whitney U-test. The effect size interpretation was made via the following: 0 to 0.30 = small, 0.31 to 0.50 = moderate, 0.51 to 1.0 = large.

Table 3 Patients' Subjective Assessment of Numbness

			Numbness	
			Yes	No
Groups	Traditional	Count	14	18
		% within Group	43.8%	56.3%
	Bikini	Count	9	14
		% within Group	39.1%	60.9%
		p value	0.732	

Notes: The p value to determine the difference in subjective numbness between groups was obtained via the Chi-Square Test of Independence.

Table 4 Proportion of Patients with Score < 6 in Quadrants 1, 2, 3, and 4

<i>Quadrant 1</i>			Score < 6	
			No	Yes
Group	Traditional	Count	30	2
		% within Group	93.8%	6.3%
	Bikini	Count	21	2
		% within Group	91.3%	8.7%
<i>Quadrant 2</i>			Score < 6	
			No	Yes
Group	Traditional	Count	29	3
		% within Group	90.6%	9.4%
	Bikini	Count	23	0
		% within Group	100.0%	0.0%
<i>Quadrant 3</i>			Score < 6	
			No	Yes
Group	Traditional	Count	26	6
		% within Group	81.3%	18.8%
	Bikini	Count	23	0
		% within Group	100.0%	0.0%
<i>Quadrant 4</i>			Score < 6	
			No	Yes
Group	Traditional	Count	31	1
		% within Group	96.9%	3.1%
	Bikini	Count	23	0
		% within Group	100.0%	0.0%

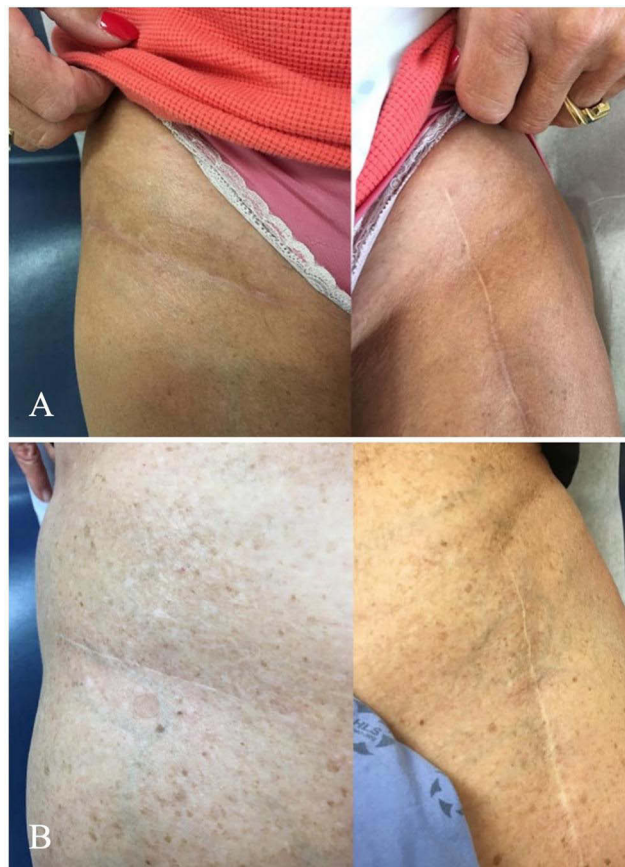


Figure 7 Scar appearance post-DAA THA in Patient (A) and Patient (B). Both patients had a history of a traditional DAA THA on the left and a bikini DAA THA on the right. The image on the left is of a healed bikini incision, while the image on the right is of a healed traditional incision. This demonstrates improved scar healing/cosmesis with a bikini DAA THA, relative to a traditional DAA THA.

Discussion

There were two notable findings regarding scar satisfaction in this study: (1) the bikini incision patients experienced less scar complications and more scar satisfaction than traditional incision patients, and (2) the surgeon was more satisfied with the bikini incision scars, as they healed more effectively than the traditional incision scars. These significant differences in scar complications, healing, and satisfaction may be explained by the location and orientation of the bikini incision itself. As mentioned by Lemperle et al, collagen fibers organize parallel to natural skin folds.¹⁸ When incisions perpendicular to skin folds are created, these collagen fibers are severed.¹⁸ However, when incisions parallel to skin folds are created, these collagen fibers are instead separated and spared.¹⁸ Moreover, incisions perpendicular to skin folds result in increased skin edge tension and a broader scar, while incisions parallel to skin folds result in decreased skin edge tension and a narrower scar.⁶ Hence, the perpendicularly placed traditional incision results in impaired healing and poor cosmesis relative to the bikini incision placed parallel to the inguinal flexion crease (Figure 7). This was demonstrated by both patient and surgeon score analysis.

Currently, it is believed that the bikini incision results in increased incidence of damage to the LFCN and in turn, increased incidence of numbness post-DAA THA.^{10,11} For instance, Thaler et al used cadaveric analysis and found that the bikini incision crossed the LFCN in 100% of specimens—particularly in cases with fan-like branching patterns—highlighting a consistently high anatomical risk associated with this incision type.¹¹ However, it has also been reported that the traditional incision can equally result in damage to the LFCN.^{13,14} For instance, upon objective LFCN testing, Leunig et al found no difference between traditional incision patients and bikini incision patients.¹⁴ In the present study, it was determined that the bikini incision is more protective of LFCN function than the traditional incision, especially in the inferomedial distribution of the LFCN. Hence, it is also possible that refined techniques associated with increased

surgeon familiarity may reduce the likelihood of LFCN injury. As emphasized by Corten et al and Leunig et al, with careful subcutaneous dissection, the LFCN and its function may be spared.^{7,14}

Our findings also contrast with prior studies that report a higher incidence of LFCN injury with the bikini incision. For instance, Sang et al conducted a prospective randomized study and found that 36.4% of patients in the bikini group experienced LFCN-related symptoms versus 21.9% in the traditional group, a statistically significant difference.¹⁰ Their methodology incorporated symptom self-reporting, ultrasound, and electrophysiological confirmation of nerve involvement, offering a potentially more sensitive means of detecting subclinical LFCN dysfunction. In contrast, our study used quadrant-based monofilament testing to objectively assess functional sensation. Although monofilament testing has been shown to reliably assess sensation,¹⁹ it may not detect minor subclinical deficits that tools, such as electrophysiological studies, might capture. Hence, the divergence in findings may be attributed to several contributing factors: (1) anatomical variability in LFCN branching patterns across populations; (2) differences in surgeon experience and incision technique; and (3) heterogeneity in assessment tools.

Furthermore, multiple studies have demonstrated that the bikini incision provides similar exposure and ease of access as the traditional longitudinal incision in DAA THA, especially in non-obese patients.^{5,14} However, surgeon experience and patient selection are critical, as the bikini incision may provide reduced visualization in highly muscular or obese individuals and prevent appropriate exposure.^{5,14} With proper technique and increased surgeon familiarity, however, the bikini incision remains comparable to the traditional incision.^{5,7,13}

These findings are important, as they may inform clinical decision-making by supporting the use of the bikini incision in appropriate patients. Specifically, for those who consider cosmesis and sensory outcomes a priority. Additionally, the results can be useful in preoperative counseling to set realistic expectations with respect to scar appearance and potential for anterolateral thigh numbness. In turn, this allows for more personalized surgical planning based on patient preference and individual body habitus.

Despite these results, there were certain limitations to this study. Due to COVID-19 patient restrictions and resource limitation (eg, research personnel, time, etc), a sample of convenience was obtained. Notably, as a pilot study with a small sample size of 55 participants, the statistical power was limited. This may reduce the ability to detect smaller differences. Furthermore, there was a substantial gender imbalance, with 91.3% of the bikini incision group being female. This may influence scar satisfaction ratings or perceptions of numbness and represent a potential confounding factor. Future studies should consider matching groups by gender. Moreover, patients from only one surgeon were considered in this study to control for surgical technique. Incorporating multiple surgeons in future research would enhance external validity of study results. Lastly, although subjective data on LFCN numbness was collected, the difference between groups was not statistically significant. Future studies may benefit from increasing sample size to explore the clinical impact of these findings. Correcting these limitations will allow improved characterization of the extent to which the bikini incision may be protective of LFCN function post-operatively.

Conclusion

During a DAA THA, the bikini incision is made at the inguinal crease, parallel to the body's natural skin folds. This study demonstrates that the bikini incision provides superior results with respect to scar complications (ie, pain, itchiness, and impaired scar healing), cosmesis, and satisfaction compared to the traditional vertical incision. Through objective testing, this study has shown that the bikini incision may better preserve LFCN function compared to the traditional incision. Due to these benefits, the bikini incision should be considered a promising alternative to the traditional incision when performing a DAA THA. However, it is important to conduct further investigations with larger sample sizes, multiple surgeons, and matched groups.

Ethics Approval Statement

This study has been approved by the Western University Research Ethics Board and consent has been obtained for all study participants.

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