Original Article

Arthroscopic Fractional Lengthening After Total Hip Arthroplasty Results in Improved Patient-Reported Outcomes and Low Rates of Revision Total Hip Arthroplasty

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Purpose: To report the clinical outcomes and reoperation rates of arthroscopic and endoscopic iliopsoas release at short-term follow-up after ipsilateral total hip arthroplasty (THA) at 2 separate medical institutions and to evaluate whether demographic and radiographic parameters are associated with postoperative patient-reported outcomes (PROs). **Methods:** Patients with iliopsoas tendinitis in the setting of prior THA who underwent arthroscopic iliopsoas fractional lengthening from 1988 to 2023 at 2 academic institutions were reviewed. Patients were included if they had 12 months of follow-up and underwent evaluation of preoperative anterior acetabular component overhang, surgery satisfaction, postoperative subjective hip flexion strength and anterior groin pain improvement, modified Harris Hip Score, Single Assessment Numeric Evaluation score, Tegner activity scale score, visual analog scale (VAS) score, and revision hip arthroplasty. **Results:** Sixty hips in 58 patients (19 male and 39 female patients) were followed up for a mean of 39.3 months (range, 12.0-105.9 months) postoperatively. Of the patients, 77% reported feeling "much better" or "slightly better," 75% reported improved anterior groin pain, and 60% reported improved subjective hip flexion strength. The surgery satisfaction rating was 7.2 ± 3.3 (scale of 0 to 10). The mean postoperative modified Harris Hip Score, VAS score for pain at rest, VAS score for pain with use, and Single Assessment Numeric Evaluation score were 73.9 ± 19.4, 1.3 ± 2.4, 3.8 ± 2.9, and 71.9 ± 21.9, respectively. Preoperative anterior acetabular component overhang was 3.3 ± 6.5 mm and did not significantly correlate with postoperative PROs ($P \geq .45$). The Tegner score improved from 2.5 ± 1.7 preoperatively to 2.9 ± 1.4 postoperatively ($P = .0253$). Three patients underwent revision arthroplasty at a mean of 25.3 months (range, 11.6-40.4 months) postoperatively, with an acetabular component revision rate of 3.3%. **Conclusions:** Satisfactory outcomes and low revision arthroplasty rates were observed in patients undergoing arthroscopic iliopsoas lengthening after THA. There was no statistically significant relation between anterior acetabular component overhang and final PROs. **Level of Evidence:** Level IV, therapeutic case series.

Iliopsoas tendon impingement with associated symptomatic tendinitis has been reported to exist in up to 8.3% of patients after total hip arthroplasty (THA) and most often manifests as persistent anterior groin pain.[1-4] Although iliopsoas tendon impingement can occur anywhere along the tendon's course, it most often takes place where the tendon runs adjacent to the anterior acetabular rim.[5] There are anatomic, technical, and prosthetic causes of impingement, with malpositioned or oversized acetabular components being a common culprit owing to mechanical irritation from the proud acetabular component and adjacent tendon. Initial treatment consists of oral anti-inflammatories, stretching exercises, and ultrasound-guided iliopsoas bursal injections.[6-15] When conservative treatment fails, surgical treatment options include acetabular component revision and iliopsoas lengthening or release. Both open and arthroscopic interventions have proved to be successful operative treatment options to reduce pain while increasing hip function with positive

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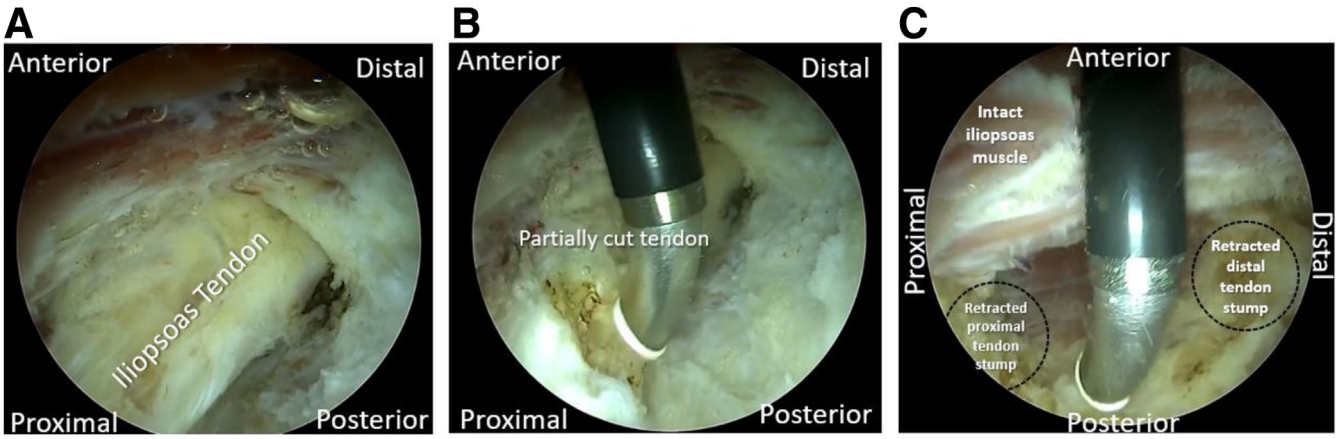

Fig 1. Arthroscopic imaging showing iliopsoas fractional lengthening with initial iliopsoas tendon visualization (A), partial release of tendon via electrocautery (B), and final lengthened tendon confirmed by visualization of retracted tendon stump (C). The patient is positioned supine, with viewing of the right hip from the anterolateral portal while instrumentation is performed from the modified anterior portal.

patient-reported outcomes (PROs) at short- to mid-term follow-up,[8-10,16-23] with some studies reporting durable outcomes at longer-term follow-up.[20,23] Iliopsoas lengthening or release, whether open or arthroscopic, is less invasive than acetabular component revision and has been documented to provide comparable or improved clinical outcomes and lower revision rates.[24]

Despite promising postoperative PROs, there is considerable debate surrounding the effects of the aforementioned procedure on functional outcomes, most notably hip flexion strength. Brandenburg et al.[19] reported an objective decrease in seated but not supine hip flexion strength. Although an objective decrease in strength is to be expected from lengthening or releasing a prominent hip flexor muscle tendon, Anderson and Keene[18] suggested that arthroscopic lengthening or release actually normalizes subjective hip strength, potentially as a result of a resultant decrease or absence of inhibitory pain with hip use.

Acetabular component prominence has been reported to be a predictive factor for the development of iliopsoas impingement.[4,5,25] Ueno et al.[4] reported that sagittal component overhang greater than 4 mm and axial component overhang greater than 12 mm were independent predictors of symptomatic iliopsoas impingement. However, Viamont-Guerra et al.[1] did not find a significant correlation between the amount of axial or sagittal acetabular component overhang and postoperative clinical outcomes after iliopsoas release, suggesting that although overhang may play a role in the prevalence of symptomatic tendinitis, it may not play a role in prognostication of treatment with iliopsoas lengthening or release. The effect of preoperative acetabular component overhang on patient outcomes continues to be a debated topic in the literature, which currently limits providers' ability to accurately counsel patients preoperatively.

The purposes of the study were to report the clinical outcomes and reoperation rates of arthroscopic and endoscopic iliopsoas release at short-term follow-up after ipsilateral THA at 2 separate medical institutions and to evaluate whether demographic and radiographic parameters are associated with postoperative PROs.

Methods

Patient Selection

After institutional review board approval (No. 08-002259), the institutional databases at 2 separate medical institutions (Mayo Clinic, Rochester, MN, and Midwest Orthopaedics at Rush, Chicago, IL) were used to identify all patients who underwent primary arthroscopic or endoscopic iliopsoas fractional lengthening from 1988 to 2023, namely iliopsoas tendon release proximal to the lesser trochanter but distal to the acetabular rim with preservation of the muscular portion of the iliopsoas at the same level to fractionally lengthen rather than release the iliopsoas tendon-muscle unit (Fig 1). A radiofrequency device was used to release the iliopsoas tendon approximately 2 cm proximal to the lesser trochanter. All patients underwent surgery after diagnostic injection confirmed symptomatic iliopsoas tendinitis if their symptoms were not controlled by nonoperative interventions (physical therapy, nonsteroidal anti-inflammatory drugs, injections, etc.). The exclusion criteria included open procedures, concomitant procedures, revision iliopsoas fractional lengthening, and less than 1 year of follow-up.

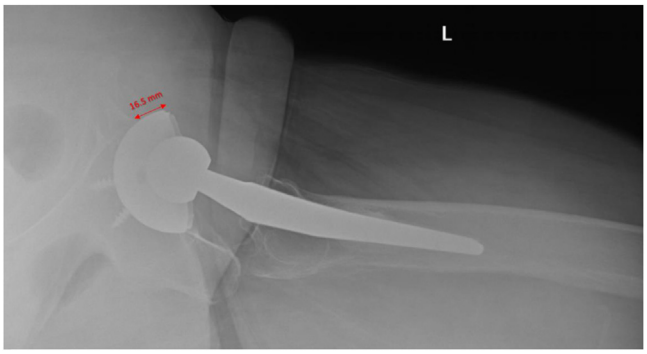

Fig 2. Cross-table lateral view of left hip joint after total hip arthroplasty with notable anterior acetabular component overhang (16.5 mm, arrow). (L, left hip.)

Table 1. Patient Demographic Characteristics and Radiographic Data

Characteristic	Data
Patients (hips), n	58 (60)
Sex	
Male	19 (32.8)
Female	39 (67.2)
Laterality	
Right	31 (51.7)
Left	29 (48.3)
Age at surgery, yr	64.1 ± 11.2
BMI	29.1 ± 5.8
Anterior acetabular overhang, mm	3.3 ± 6.5
Mean follow-up (range), mo	39.3 (12.0-105.9)

NOTE. Data are presented as mean ± standard deviation or number (percentage of total patients) unless otherwise indicated.
BMI, body mass index.

Data Collection

Anterior acetabular overhang was measured on preoperative cross-table lateral hip radiographs. This was measured as the distance from the lateral edge of the acetabulum to the lateral-most edge of the acetabular component as shown in Figure 2. Patients' medical charts were screened for subsequent ipsilateral hip operations including conversion to revision arthroplasty, and documentation was made of which hardware components were replaced. Patients were then contacted via REDCap survey or telephone to collect the following PROs: surgery satisfaction, postoperative subjective hip flexion strength and anterior groin pain improvement, modified Harris Hip Score (mHHS), Single Assessment Numeric Evaluation score, Tegner activity scale score, visual analog scale (VAS) score for pain at rest, and VAS score for pain with use. Overall hip improvement, hip strength, and anterior groin pain postoperatively were measured using a 5-point Likert system. Patients reported their overall hip improvement, strength, and groin pain as "much worse," "slightly worse," "no change," "slightly better," or "much better" when compared with before the arthroscopic iliopsoas fractional lengthening procedure. The overall outcome score completion rate was 81%.

Statistical Analysis

Patient demographic characteristics, radiographic measurements, and subsequent operations were summarized as mean and standard deviation or as number and percentage of total patients. Independent-sample *t* tests were used to compare 2 sets of continuous variables. Pearson product-moment correlation tests were used to measure the strength of linear relation between 2 groups of continuous variables, and Mann-Whitney *U* tests were used to compare continuous with categorical variables. All statistical tests were 2-sided, and $P < .05$ was considered statistically significant.

Results

Patient Demographic Characteristics and Radiographic Findings

After application of the inclusion and exclusion criteria, 60 patients were eligible for study inclusion. Two patients were lost to follow-up, leaving 60 hips in 58 patients to be included in this study, resulting in a 97% follow-up rate. The patient cohort consisted of 19 male and 39 female patients, with an average age and average body mass index of 64.1 ± 11.2 years and 29.1 ± 5.8, respectively (Table 1). Mean preoperative anterior acetabular component overhang on cross-table lateral hip radiographs was 3.3 ± 6.5 mm. An example of considerable anterior overhang on a cross-table lateral view and 3-dimensional computed tomography reconstruction is shown in Figures 2 and 3.

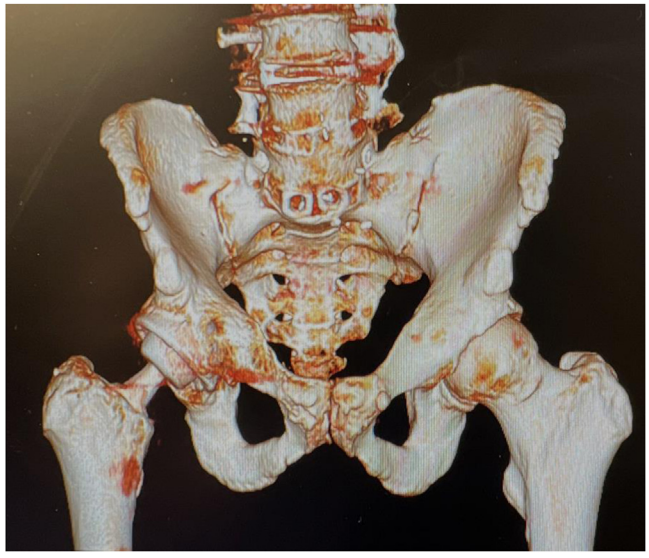

Fig 3. Three-dimensional pelvis computed tomography reconstruction after right total hip arthroplasty with substantial anterior overhang of right acetabular component.

Table 2. Reoperations and Revisions

	Data
Revision THA	
After release	3
Before release	11
Time between release and revision THA, mo	25.3 (11.6-40.4)

NOTE. Data are presented as mean (range) or number of patients.
THA, total hip arthroplasty.

No significant correlation was drawn between the degree of acetabular component overhang and PROs ($P \geq .45$). Of note, 11 of the patients included in this study (19.0%) had undergone revision THA prior to receiving the diagnosis of iliopsoas tendinitis and prior to undergoing subsequent arthroscopic iliopsoas tendon fractional lengthening (Table 2).

Patient-Reported Outcomes

Patients were followed up for a mean of 39.3 months (range, 12.0-105.9 months) after surgery. PROs were collected from 47 patients. The average surgery satisfaction rating was 7.2 ± 3.3 on a scale of 0 ("not at all satisfied") to 10 ("extremely satisfied"). The mean postoperative mHHS and Single-Assessment Numerical Evaluation score were 73.9 ± 19.4 and 71.9 ± 21.9, respectively. The mean Tegner score was 2.9 ± 1.4 postoperatively compared with 2.5 ± 1.7 preoperatively ($P = .0253$). Postoperative hip pain was reported using a VAS from 0 to 10. The average VAS pain score was 1.3 ± 2.4 at rest and 3.8 ± 2.9 with use. No significant correlation was found between postoperative mHHS and age at surgery ($P = .161$), body mass index ($P = .822$), or sex ($P = .275$).

Seventy-seven percent of patients reported that the hip was slightly better or much better after the tendon release. Seventy-five percent of patients also reported that their anterior groin pain was slightly better or much better postoperatively. Sixty percent of patients reported that their hip strength was slightly better or much better after surgery, and only 1 patient (2.1%) reported hip strength as being much worse than before the release. Figure 4 compares the distribution of anterior groin pain improvement scores against reported hip strength improvement scores. A significant positive correlation was found between anterior groin pain improvement and hip strength improvement ($R = 0.560$, $P < .0001$), with more patients reporting slightly better or much better anterior groin pain in the setting of also reporting slightly better or much better hip strength. In addition, a significant negative correlation was identified between hip strength improvement and pain with use ($R = -0.411$, $P = .0041$). A summary of all PROs can be reviewed in Table 3.

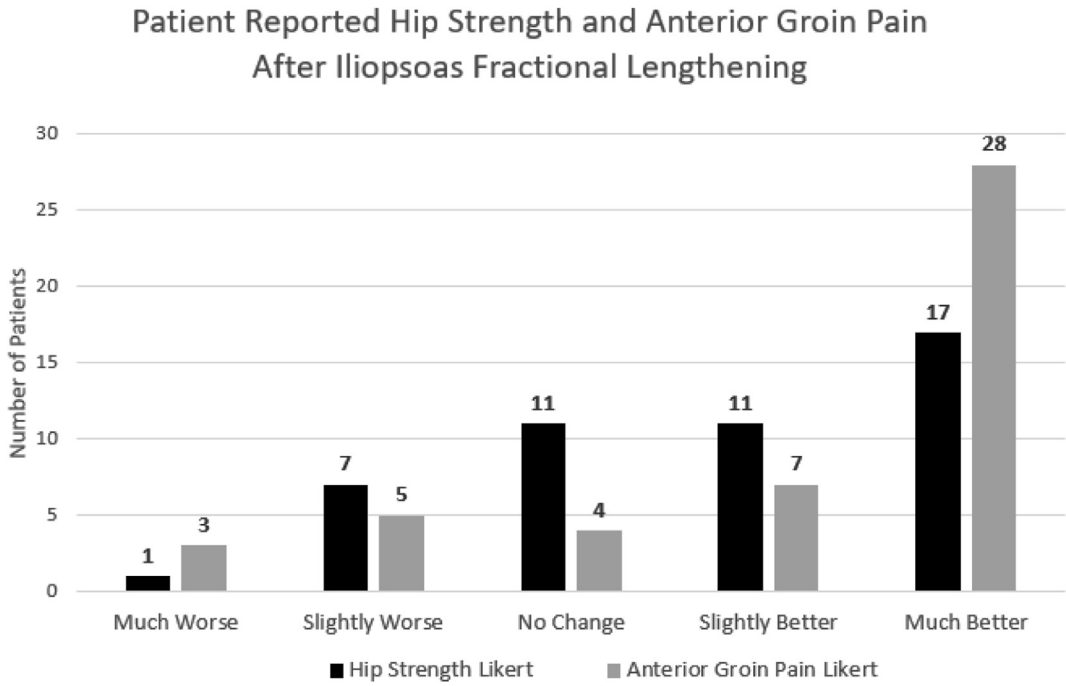

Fig 4. Bar chart of Likert scores of hip strength and anterior groin pain showing a correlation between the distribution of pain improvement and hip strength improvement postoperatively ($P < .001$).

Table 3. Patient-Reported Outcomes

Measure	Data
Surgery satisfaction rating	7.2 ± 3.3
Postoperative improvement	
Much worse	4 (8.5)
Slightly worse	2 (4.3)
No change	5 (10.6)
Slightly better	11 (23.4)
Much better	25 (53.2)
Hip strength	
Much worse	1 (2.1)
Slightly worse	7 (14.9)
No change	11 (23.4)
Slightly better	11 (23.4)
Much better	17 (36.2)
Anterior groin pain	
Much worse	3 (6.4)
Slightly worse	5 (10.6)
No change	4 (8.5)
Slightly better	7 (14.9)
Much better	28 (59.6)
SANE score	71.9 ± 21.9
Tegner score	
Preoperative	2.5 ± 1.7
Postoperative	2.9 ± 1.4 ($P = .0253$)
VAS pain score	
At rest	1.3 ± 2.4
With use	3.8 ± 2.9
mHHS	73.9 ± 19.4

NOTE. Data are presented as mean ± standard deviation or number (percentage of total patients).

mHHS, modified Harris Hip Score; SANE, Single Assessment Numeric Evaluation; VAS, visual analog scale.

Reoperations and Revisions

Revision THA was performed in 3 patients (5.2%) after arthroscopic iliopsoas fractional lengthening. Two patients underwent acetabular component revision, one patient underwent an isolated femoral component revision, one patient underwent both acetabular and femoral component revisions, and one patient underwent isolated replacement of the femoral head owing to trunnionosis (Table 4), resulting in an overall acetabular component revision rate of 3.3%. For patients undergoing acetabular component revision, mean anterior acetabular overhang was 7.3 ± 5.0 mm. No statistically significant correlation was identified between the amount of preoperative anterior acetabular overhang and whether the patient underwent acetabular component revision ($P = .241$).

Table 4. Hardware Replaced in Revision THAs After Fractional Iliopsoas Lengthening

Hardware Replaced	Patients, n	Preoperative Anterior Overhang, mm
Acetabular component*	1	12.3
Both acetabular and femoral components	1	2.3
Femoral head (owing to trunnionosis)	1	7.2

THA, total hip arthroplasty.

*The acetabular component exchange included a femoral head exchange with the femoral stem left in situ.

Discussion

In this study, patients noted satisfactory outcomes after arthroscopic iliopsoas lengthening, with 77% reporting that their overall hip improvement was much better or slightly better after surgery. This is slightly lower than the outcomes of Viamont-Guerra et al.,[1] who reported that 87% of their patients were satisfied or very satisfied with their surgical results. This study's postoperative mHHS was slightly lower, at 73.9 ± 19.4, than the scores of 86.1 and 83.2 reported by Moreta et al.[26] and Viamont-Guerra et al., respectively.

Loss of hip flexion strength after iliopsoas fractional lengthening continues to be debated in the literature and is clinically relevant given the substantial pain inhibition often seen preoperatively in these patients. Brandenburg et al.[19] objectively measured hip strength postoperatively and found that arthroscopic iliopsoas release resulted in atrophy of the iliopsoas muscle and significantly decreased hip flexion strength in the seated position ($P < .001$). Although strength was not objectively measured in this cohort, 60% of patients reported a subjective improvement in hip strength and 23% reported no change. Of note, only 1 patient reported strength as being much worse after surgery. This is comparable to postoperative results found by Moreta et al.,[26] who reported an average Medical Research Council strength score of 4.58 (of 5) in patients who underwent arthroscopic iliopsoas fractional lengthening. Frequently, strength can be limited by associated pain. Although tendon lengthening may decrease the maximum force a muscle can generate, this study showed that pain relief was strongly correlated with perceived hip flexion strength, with nearly 77% of patients reporting subjective improvement or no change in strength.

An important potential clinical prognostic factor evaluated by this study is acetabular component prominence. Average acetabular component overhang on cross-table lateral views was 3.3 mm, which is similar to previous findings in the literature, including the axial and sagittal component overhang reported by Viamont-Guerra et al.[1] (3.7 mm and 5.8 mm, respectively), who did not find any significant correlation between the mHHS and axial ($P = .754$) or sagittal ($P = .212$) acetabular component overhang. Chalmers et al.[2] published similar findings showing no significant correlation between acetabular prominence less than or greater than 8 mm and postoperative groin pain or Harris Hip Score ($P \geq .07$). Because radiographic measurements cannot reliably predict patient outcomes, we believe that an additional diagnostic workup prior to

iliopsoas lengthening is imperative. All patients within this cohort had an improvement in symptoms with a preoperative iliopsoas bursal injection. A positive response to local anesthetic remains the most accurate tool in predicting who may benefit from iliopsoas fractional lengthening. Furthermore, the overall positive outcomes observed suggest that iliopsoas release may play an efficacious role even for patients with substantial overhang, which is important given the substantial difference in morbidity and recovery between lengthening and revision arthroplasty.

This study showed low rates of all-cause revision THA (5.2%) and even lower rates of acetabular revision (3.3%). Acetabular component revision is often considered for patients with severe acetabular overhang (>8 mm)[5]; however, this measurement did not correlate with outcomes in this study. In a systematic review conducted by Shapira et al.,[24] iliopsoas tenotomy gave equal or better clinical outcomes and lower complication rates when compared with acetabular component revision.

Limitations

This study is not without important limitations. First, it was retrospective in its review of the data, without analysis of improvement from any preoperative PROs. Second, the 2-dimensional nature of anterior overhang on a cross-table lateral radiograph may not accurately account for the complete degree of acetabular component overhang. Additionally, no objective strength testing was obtained, and postoperative data were solely subjective PROs.

Conclusions

Satisfactory outcomes and low revision arthroplasty rates were observed in patients undergoing arthroscopic iliopsoas lengthening after THA. There was no statistically significant relation between anterior acetabular component overhang and final PROs.

Disclosures

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Support was provided by the Foderaro-Quattrone Musculoskeletal-Orthopaedic Surgery Research Innovation Fund. M.J.T. reports board membership with American Academy of Orthopaedic Surgeons, American Association of Hip and Knee Surgeons, *Journal of Arthroplasty*, Mid-America Orthopaedic Association, *Journal of Knee Surgery*, *Knee Surgery, Sports Traumatology, Arthroscopy*, and *Orthopedics Today*; reports a consulting or advisory relationship with Envois and Onkos. B.A.L. reports a consulting or advisory relationship with Arthrex and owns equity or stocks in COVR Medical. S.J.N. reports board membership with American Orthopaedic Society for Sports Medicine and Arthroscopy Association of North America; receives funding grants from Mitek, Ossur, Springer, and Stryker; and reports a consulting or advisory relationship with Stryker. M.H. reports a consulting or advisory relationship with DJO-Envois, Moximed, and Vericel; receives funding grants from Elsevier; and reports board membership with *Journal of Cartilage and Joint Preservation*. All other authors (K.N.S., K.J., M.V.) declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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