ISSN 2218-5836 (online)

World Journal of *Orthopedics*

World J Orthop 2023 June 18; 14(6): 369-504

Published by Baishideng Publishing Group Inc

World Journal of Orthopedics

Contents

Monthly Volume 14 Number 6 June 18, 2023

MINIREVIEWS

ORIGINAL ARTICLE

Basic Study

Retrospective Cohort Study

Retrospective Study

Observational Study

SYSTEMATIC REVIEWS

World Journal of Orthopedics

Monthly Volume 14 Number 6 June 18, 2023

Contents

World Journal of Orthopedics

Monthly Volume 14 Number 6 June 18, 2023

Contents

NAME OF JOURNAL
World Journal of Orthopedics

ISSN
ISSN 2218-5836 (online)

LAUNCH DATE
November 18, 2010

FREQUENCY
Monthly

EDITORS-IN-CHIEF
Massimiliano Leigheb

EDITORIAL BOARD MEMBERS
http://www.wjgnet.com/2218-5836/editorialboard.htm

PUBLICATION DATE
June 18, 2023

INSTRUCTIONS TO AUTHORS
https://www.wjgnet.com/bpg/gerinfo/204

GUIDELINES FOR ETHICS DOCUMENTS
https://www.wjgnet.com/bpg/GerInfo/287

GUIDELINES FOR NON-NATIVE SPEAKERS OF ENGLISH
https://www.wjgnet.com/bpg/gerinfo/240

PUBLICATION ETHICS
https://www.wjgnet.com/bpg/GerInfo/288

PUBLICATION MISCONDUCT
https://www.wjgnet.com/bpg/gerinfo/208

ARTICLE PROCESSING CHARGE
https://www.wjgnet.com/bpg/gerinfo/242

STEPS FOR SUBMITTING MANUSCRIPTS
https://www.wjgnet.com/bpg/GerInfo/239

ONLINE SUBMISSION
https://www.f6publishing.com

E-mail: bpgoffice@wjgnet.com https://www.wjgnet.com

World Journal of Orthopedics

Submit a Manuscript: https://www.f6publishing.com

World J Orthop 2023 June 18; 14(6): 369-378

DOI: 10.5312/wjo.v14.i6.369

ISSN 2218-5836 (online)

MINIREVIEWS

Minimally invasive surgeries for insertional Achilles tendinopathy: A commentary review

Kenichiro Nakajima

Specialty type: Orthopedics

Provenance and peer review: Invited article; Externally peer reviewed.

Peer-review model: Single blind

Peer-review report's scientific quality classification
Grade A (Excellent): 0
Grade B (Very good): 0
Grade C (Good): C
Grade D (Fair): 0
Grade E (Poor): 0

P-Reviewer: Busso C, Italy

Received: December 23, 2022
Peer-review started: December 23, 2022
First decision: April 13, 2023
Revised: April 26, 2023
Accepted: May 9, 2023
Article in press: May 9, 2023
Published online: June 18, 2023

Kenichiro Nakajima, Center for Foot and Ankle Surgery, Department of Orthopedic Surgery, YashioCentral General Hospital, Yashio-shi 340-0814, Saitama, Japan

Corresponding author: Kenichiro Nakajima, MD, Chief Doctor, Center for Foot and Ankle Surgery, Department of Orthopedic Surgery, Yashio Central General Hospital, 845 Minamikawasaki, Yashio-shi 340-0814, Saitama, Japan. nakajimakenichiro@hotmail.co.jp

Abstract

Studies of minimally invasive surgery for insertional Achilles tendinopathy are limited. To establish this surgery, the following techniques must be minimally invasive: Exostosis resection at the Achilles tendon insertion, debridement of degenerated Achilles tendon, reattachment using anchors or augmentation using flexor hallucis longus (FHL) tendon transfer, and excision of the posterosuperior calcaneal prominence. Studies on these four perspectives were reviewed to establish minimally invasive surgery for insertional Achilles tendinopathy. Techniques for exostosis resection were demonstrated in one case study, where blunt dissection around the exostosis was performed, and the exostosis was resected using an abrasion burr under fluoroscopic guidance. Techniques for debridement of degenerated Achilles tendon were demonstrated in the same case study, where the space left after resection of the exostosis was used as an endoscopic working space, and the degenerated Achilles tendon and intra-tendinous calcification were debrided endoscopically. Achilles tendon reattachment techniques using suture anchors have been demonstrated in several studies. However, there are no studies on FHL tendon transfer techniques for Achilles tendon reattachment. In contrast, endoscopic posterosuperior calcaneal prominence resection is already established. Additionally, studies on ultrasound-guided surgeries and percutaneous dorsal wedge calcaneal osteotomy as minimally invasive surgery were reviewed.

Key Words: Achilles tendon; Endoscopy; Fluoroscopy; Osteotomy; Ultrasonography; Tendinopathy; Surgery

Core Tip: Studies of minimally invasive surgery for insertional Achilles tendinopathy are limited. Therefore, to establish this surgery, the following techniques must be minimally invasive: (1) Exostosis resection at the Achilles tendon insertion; (2) Debridement of degenerated Achilles tendon; (3) Reattachment using anchors or augmentation using flexor hallucis longus tendon transfer; and (4) Excision of the posterosuperior calcaneal prominence. This article reviewed studies from these four perspectives to establish minimally invasive surgery for insertional Achilles tendinopathy. In addition, studies on ultrasound-guided surgeries and dorsal percutaneous dorsal wedge calcaneal osteotomy as minimally invasive surgery were reviewed.

Citation: Nakajima K. Minimally invasive surgeries for insertional Achilles tendinopathy: A commentary review. *World J Orthop* 2023; 14(6): 369-378
URL: https://www.wjgnet.com/2218-5836/full/v14/i6/369.htm
DOI: https://dx.doi.org/10.5312/wjo.v14.i6.369

INTRODUCTION

Insertional Achilles tendinopathy is characterized by exostosis and intra-tendon calcification at the insertion site of the Achilles tendon into the calcaneus[1]. After failing to respond to exhaustive conservative therapy for 3-6 mo, surgery is considered[2,3]. Standard surgical procedures include posterior midline skin incision, calcaneal exostosis resection, partial or total detachment and debridement of the Achilles tendon at its insertion, resection of the posterosuperior calcaneal prominence and retrocalcaneal bursa, and reattachment using anchors or augmentation using flexor hallucis longus (FHL) tendon transfer[4,5]. The surgery's outcomes have been good[6-29]; nonetheless, the recovery was slow due to the invasiveness and the high complication rate due to the large skin incision[6,29-31]. McGarvey *et al*[6] reported a case series of 21 patients where 40% had residual pain for over two years postoperatively[6]. Hörterer *et al*[29] surveyed 118 people who underwent midline incision, partial release and debridement of the Achilles tendon, resection of the posterosuperior calcaneal prominence, and reattachment using anchors. They found that despite the high satisfaction rate, 41% had shoe limitations, and 14% had mild infections[29]. A systematic review by Highlander and Greenhagen[30] reported a 7.0% complication rate for midline incision, and another by Thompson *et al*[31] reported a significantly higher complication rate for midline incision than other incision techniques. Considering these, minimally invasive surgery is preferable. However, studies on minimally invasive surgery for insertional Achilles tendinopathy are scarce[32].

Therefore, to establish minimally invasive surgery for insertional Achilles tendinopathy, all four steps described below must be performed with minimally invasive surgery (Table 1).

This article reviewed studies on the above four techniques, including case reports, cadaver experiments, technical notes, and case series, to establish minimally invasive surgery for insertional Achilles tendinopathy. In addition, reports regarding ultrasound-guided surgeries and percutaneous dorsal wedge calcaneal osteotomy as minimally invasive surgery were also reviewed. In this article, the terms "Haglund disease" and "Haglund syndrome" were avoided because such eponymous terms are unclear[33,34].

ENDOSCOPIC SURGERY FOR INSERTIONAL ACHILLES TENDINOPATHY

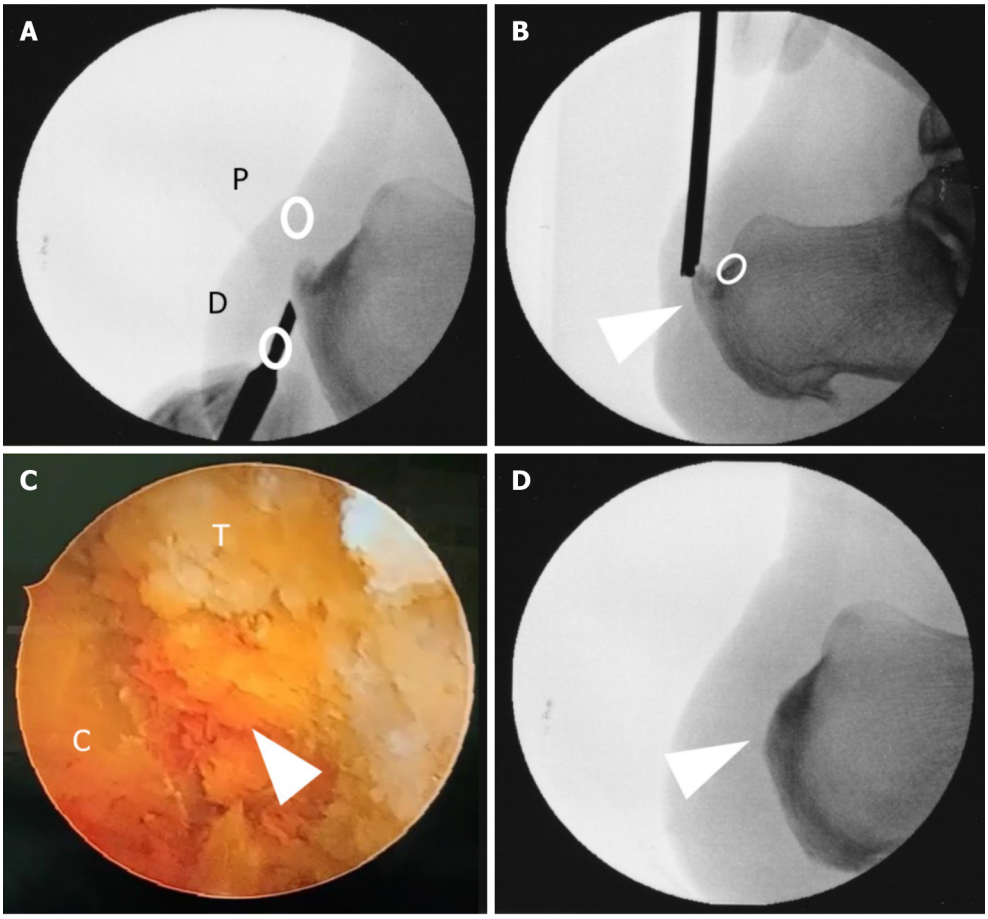
Fluoroscopic calcaneal exostosis resection and endoscopic Achilles tendon debridement

In 2022, Nakajima[32] published a case series of 44 patients who underwent minimally invasive surgeries for insertional Achilles tendinopathy involving techniques of exostosis resection at the Achilles tendon insertion and debridement of degenerated Achilles tendon (Table 1)[32]. The outline of this technique included the following: (1) Blunt dissection was performed around the exostosis with fluoroscopic guidance; (2) An abrasion bur was inserted into the space created by the dissection, and the exostosis was resected fluoroscopically; (3) The space left after resecting the exostosis was used as endoscopy working space; and (4) Debridement of the degenerated Achilles tendon was performed endoscopically (Figure 1). The outcome improved based on the median visual analog scale (VAS) and the Japanese society for surgery of the foot scores from 64.5 mm to 6.5 mm and from 67.0 points to 100 points, respectively. The median time to return to sports was 4.5 mo. Furthermore, postoperative magnetic resonance imaging (MRI) revealed that the space left after resecting the exostosis was filled with soft tissue similar to the Achilles tendon, suggesting natural repair of the attachment site (Figure 2)[32]. The novelty of this study is that it allowed exostosis resection at the Achilles tendon insertion and debridement of the degenerative Achilles tendon to be performed with minimal invasiveness. Besides,

Table 1 Techniques required in minimally invasive surgery for insertional achilles tendinopathy

No.	Techniques
1	Exostosis resection at the Achilles tendon insertion
2	Debridement of degenerated Achilles tendon
3	Reattachment using anchors or augmentation using FHL tendon transfer
4	Excision of the posterosuperior calcaneal prominence

FHL: Flexor hallucis longus.



DOI: 10.5312/wjo.v14.i6.369

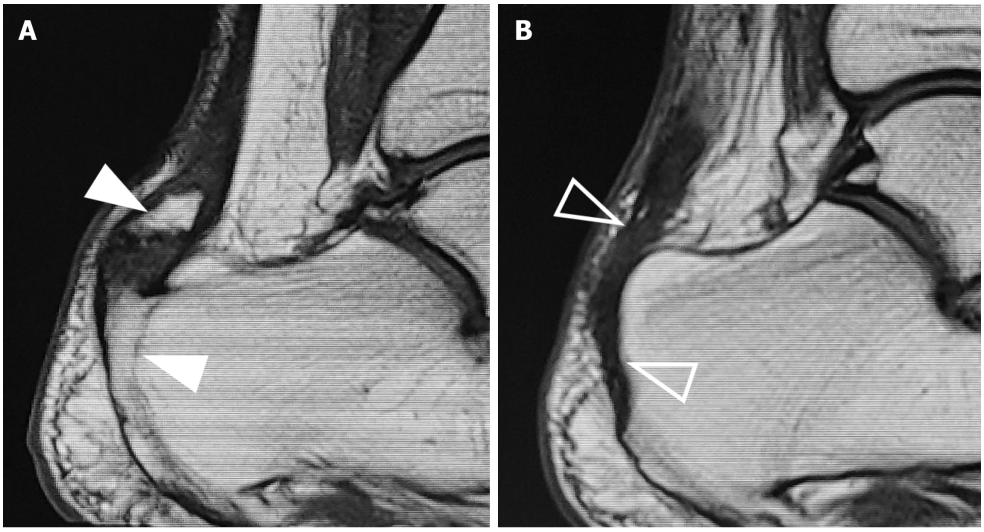
Figure 1 Fluoroscopic and endoscopic calcaneal exostosis resection and Achilles tendon debridement for insertional achilles tendinopathy[32]. A: Blunt dissection around the exostosis. Two portals were created 1 cm proximal and distal from the exostosis (circles), and blunt dissection around the exostosis was performed using a raspatorium; B: Exostosis resection using an abrasion burr under fluoroscopic guidance (arrowhead). Care was taken not to damage the normal insertion of the achilles tendon (circle). The space left after resection of the exostosis was a working space for endoscopy; C: Endoscopic view from the distal portal. The portion of the achilles tendon that had attached to the exostosis was visible as a free end (T). The unresected exostosis was attached to the tendon (arrowhead). The degenerated Achilles tendon was debrided endoscopically; D: Postoperative fluoroscopic view. The exostosis was totally resected (arrowhead). P: Proximal portal; D: Distal portal; C: The calcaneus; T: Free end.

this case series did not require reattachment or augmentation of the Achilles tendon, as natural repair of the Achilles tendon insertion site was observed. In addition, since there was no preoperative retrocalcaneal bursitis in the cases, resection of the posterior superior eminence was not performed.

Endoscopic Achilles tendon reattachment

Several studies have reported techniques for endoscopic reattachment of the Achilles tendon insertion.

Xu *et al*[35] published a case series that described a technique for endoscopically repairing partial Achilles tendon tear at the Achilles tendon insertion caused by endoscopic posterosuperior calcaneal prominence resection[35]. A suture anchor was placed at the center of the bone-resected surface after the posterosuperior prominence resection, and two stab wounds were made on the medial and lateral



DOI: 10.5312/wjo.v14.i6.369

Figure 2 Pre- and postoperative magnetic resonance imaging of the left calcaneus of a patient with insertional achilles tendinopathy who underwent Fluoroscopic and endoscopic calcaneal exostosis resection and achilles tendon debridement[32]. A: Preoperative magnetic resonance imaging (MRI). Exostosis and intra-tendon ossification were visible (white arrows); B: Postoperative MRI at 9 mo postoperatively. The void space left after resection of the exostosis and intra-tendon ossification was filled with soft tissue providing the same signal as the Achilles tendon, suggesting a natural repair.

margins of the Achilles tendon, respectively. Afterward, the Achilles tendon was sutured using the modified Bunnel technique through these four stab wounds. They performed this procedure in seven patients with insertional Achilles tendinopathy; five reported excellent results [American orthopedic foot and ankle society (AOFAS) score, 90-100], and two reported good results (AOFAS score, 80-89).

Vega *et al*[36] also reported a technique similar to that of Xu *et al*[35] in their case series[36]. An anchor with two sutures (four limbs) was placed at the center of the bone-resected surface after the endoscopic resection of the posterosuperior calcaneal prominence. Two limbs were passed through the medial portion of the Achilles tendon and sutured subcutaneously at the medial portal. The remaining two limbs were similarly sutured at the lateral portal. Twelve patients underwent this surgery, improving their AOFAS score from 70 to 92 and their Victorian institute of sports assessment-Achilles (VISA-A) score from 34 to 92.

Michel *et al*[37] published a case report of a patient undergoing endoscopic posterosuperior prominence resection and endoscopic Achilles tendon repair for retrocalcaneal bursitis with partial Achilles tendon rupture[37]. First, the posterosuperior prominence was resected endoscopically, then a suture anchor with 2 limbs was placed on the bone-resected site. Next, sutures were passed through the Achilles tendon using the shuttle relay technique and sutured subcutaneously at the stab wound.

Maquirriain[38] reported in a technical note that after the posterosuperior prominence resection, the partially detached Achilles tendon insertion was reattached to the surface of bone-resected calcaneus using a percutaneous absorbable screw[38].

Hegewald *et al*[39] reported in a technical note that they made three stab wounds on the medial margin of the Achilles tendon and three stab wounds on the lateral margin, sutured the Achilles tendon using a modified Bunnell technique, and finally fixed the sutures to the calcaneus with interference screws[39].

The following three technical notes demonstrated the sequence of exostosis resection at the Achilles tendon insertion, excision of the posterosuperior calcaneal prominence, and reattachment using anchors [40-42]. Debridement of the degenerated Achilles tendon was not performed. Boniface and Vervoort[40] presented the following procedure. First, two proximal portals (medial and lateral) for posterosuperior prominence resection and three distal portals (medial, lateral, and median) for exostosis resection were created. Next, a working space was created between the skin and the Achilles tendon, and exostosis resection, detachment of the middle portion of the Achilles tendon insertion, and posterosuperior prominence resection were performed endoscopically. Finally, the detached middle portion of the Achilles tendon was then reattached to the bone-resected surface with two rows of speed bridges. When this technique was performed with 10 cadavers, it required 120 min the first time and 70 min the last time. The method presented by Miller *et al*[41] is almost identical to that of Boniface and Vervoort, except that the Achilles insertion was totally detached in the former method[41]. Lopes *et al*'s method differs from that of the two previous studies in that the sutures were placed in the tendon[42]. Six portals were created on the medial and lateral margins of the Achilles tendon. After the posterosuperior prominence was resected endoscopically, the Achilles tendon was fixed with two rows of suture anchors that placed the two sutures in the tendon in S-shapes using the six portals.

Endoscopic augmentation using FHL tendon transfer

Hunt *et al*[17] reported a prospective comparative study that revealed no difference in clinical outcomes between procedures with and without FHL tendon transfer[18]; however, FHL tendon transfer was traditionally performed in cases where more than 50% of Achilles tendon insertion was released[7,10,11,15,17,18,27,43]. The advantage of the FHL transfer for Achilles tendon augmentation is that both tendons act in the same walking cycle phase[44]. In addition, studies have reported no loss of function of the hallux due to FHL transfer. Coull *et al*[45] reported that the patients' hallux after FHL tendon transfer achieved the highest AOFAS score and that functional weakness of the hallux was not observed in daily living[45]. Hahn *et al*[46] observed that the FHL tendon was well integrated with the Achilles tendon on postoperative MRI, with ≥ 15% hypertrophy of the FHL muscle in 8 of 13 patients[46]. Other reported donors for augmentation include plantar tendon[6], sural triceps aponeurosis[47], and bone-patellar tendon[48].

A method for endoscopic FHL tendon harvest was published by Lui *et al*[49]. In this method, the FHL tendon was cut below the hallux's interphalangeal joint, the interconnection tendon between the FHL and the flexor digitorum longus was dissociated using a tendon stripper, and the tendon was pulled out through a small skin incision at the Achilles tendon.

To the best of the current author's knowledge, there are no reports of endoscopic Achilles tendon augmentation using the FHL transfer. However, if a technique to integrate the Achilles and harvested FHL tendons is developed, endoscopic FHL transfer will become possible.

Endoscopic posterosuperior calcaneal prominence resection

Several studies reported that posterosuperior prominence resection only for treating insertional Achilles tendinopathy had poor results[50-54]. Watson *et al*[50] reported that endoscopic posterosuperior prominence resection had a poor outcome in patients with calcaneal exostosis and recognized insertional Achilles tendinopathy and retrocalcaneal bursitis as different etiologies of posterior heel pain [50]. Leitze *et al*[51], Ortmann and McBryde[52], Jerosch[53], and Cusumano *et al*[54] excluded cases with severe insertional calcific Achilles tendinopathy for this endoscopic surgery[51-54]. Natarajan and Narayanan[55] reported that 8 out of 40 people with calcaneal exostosis who underwent endoscopic posterosuperior prominence resection would not recommend this procedure[55]. Kondreddi *et al*[56] reported that patients with Achilles tendon degeneration who underwent this surgery had lower subjective satisfaction[56]. However, Sundararajan and Wilde[57] reported that 5 of 20 patients with insertional Achilles tendinopathy presented with retrocalcaneal bursitis based on clinical and MRI findings[57]. Furthermore, a study by Rufai *et al*[58] observed that the periosteum of the posterosuperior prominence was replaced with fibrocartilage in cadavers with calcaneal exostosis[58], suggesting that insertional Achilles tendinopathy and posterior superior prominence pathology are not totally independent. Therefore, posterosuperior prominence resection should not be used alone for insertional Achilles tendinopathy but can be considered an option when needed.

Endoscopic posterosuperior prominence resection has been performed using two portals (medial and lateral)[59-62]. Wu *et al*[63] reported a case series of 27 patients whose three portals were effective. Van Sterkenburg *et al*[64] reported that the optimal endoscopic portal location varied with the shape of the posterosuperior prominence; thus, no index could be established. Lohrer *et al*[65] compared endoscopic and open osteotomy procedures using cadavers and reported similar rates of peroneal nerve injury and more bone fragments in the open osteotomy[65]. Roth *et al*[66] reported that endoscopic surgery resulted in less bone resection than open surgery, which they speculated may contribute to faster recovery[66]. Lui[67] reported that endoscopy in the supine position allowed for easier identification of anatomical structures than in the prone position[67]. Ferranti *et al*[68] reported that in 27 patients who underwent percutaneous posterosuperior prominence resection, the mean VISA-A score improved from 20 preoperatively to 75 postoperatively, and 84% experienced complete satisfaction[68].

Endoscopic gastrocnemius recession

To the best of the author's knowledge, there is only one report on endoscopic gastrocnemius recession for treating insertional Achilles tendinopathy. Tallerico *et al*[69] followed up on 11 patients who underwent endoscopic gastrocnemius recession for an average of 13.8 mo. Ten of the 11 patients were highly satisfied, and the mean postoperative AOFAS score improved from 52.0 preoperatively to 94.8 postoperatively. Six of the 11 patients had calcaneal exostosis, and their AOFAS scores improved from 51.1 preoperatively to 91.9 postoperatively[69]. Gastrocnemius recession can also be a technique for reattaching the Achilles tendon. Gould reported 49 patients with insertional Achilles tendinopathy who underwent J-shaped skin incision, complete Achilles tendon detachment and debridement, posterosuperior prominence resection, and V-Y lengthening and reattachment[70]. Staggers *et al*[71] compared 25 patients who underwent V-Y lengthening of gastrocnemius and 21 who underwent FHL transplantation during open surgery for insertional Achilles tendinopathy and reported no significant difference in subjective satisfaction, VISA-A scores, and VAS scores between both groups[71].

ULTRASOUND-GUIDED SURGERY FOR INSERTIONAL ACHILLES TENDINOPATHY

Ultrasound-guided surgery also has the potential for minimally invasive surgery. However, Khan *et al* [72] reported that although MRI is effective in diagnosing insertional Achilles tendinopathy, ultrasound does not improve diagnostic accuracy[72]; thus, this surgery may be technically demanding for insertional Achilles tendinopathy.

Chimenti *et al*[73] reviewed 34 patients who underwent ultrasound-guided posterosuperior prominence resection, debridement of the Achilles tendon insertion and intra-tendinous calcifications, and retrocalcaneal bursectomy[73]. At 6-12 wk of follow-up, baseline pain decreased from 68% preoperatively to 5% postoperatively, with a satisfaction rate of 70%. In addition, four patients who were followed up for more than 11 mo were free of pain.

Wang *et al*[74] compared outcomes in 10 patients who underwent ultrasound-guided posterosuperior prominence resection and retrocalcaneal bursectomy and 12 who underwent open surgery[74]. The AOFAS scores at two years postoperatively were 95 in the open group and 94 in the minimally invasive group, with no significant difference.

Freed *et al*[75] performed ultrasound-guided Achilles fasciotomy and tenotomy in 26 people with insertional Achilles tendinopathy, with a mean operating time of 4 min and 32 s, a mean follow-up of 16 mo, and a success rate of 85%[75].

PERCUTANEOUS DORSAL WEDGE CALCANEAL OSTEOTOMY FOR INSERTIONAL ACHILLES TENDINOPATHY

Dorsal wedge calcaneal osteotomy for insertional Achilles tendinopathy has been frequently reported since 2010[76-85]. A closing wedge osteotomy of the calcaneus moves the Achilles tendon insertion upward and forward, loosening the Achilles tendon and widening the gap between the Achilles tendon and the posterosuperior prominence. In 1939, Zadek[86] first published a case series of three patients who underwent this osteotomy. Keck and Kelly[87] also published a 3-patient case series of similar osteotomy in 1965. Therefore, this osteotomy is sometimes called the Zadek osteotomy or the Keck and Kelly[87] osteotomy.

Good surgical results have been reported. Georgiannos *et al*[78] reviewed the outcomes of 52 athletes who underwent this osteotomy, with AOFAS scores improving from 59 to 95 and VISA-A scores improving from 65 to 90 at a minimum of three years of follow-up[78]. Maffulli *et al*[82] reported that in 25 patients who underwent this osteotomy, the median VISA-A score improved from 25 to 86, and 3 of 4 patients reported a return to the pre-injury state[82]. Cengiz and Karaoglu[85] followed up on 14 patients who underwent this surgery for more than three years. They reported that the AOFAS score improved from 56 preoperatively to 89 postoperatively, and the VAS score improved from 86 preoperatively to 41 postoperatively[85]. Ge *et al*[80] followed up on 12 patients who underwent this osteotomy for an average of 86 mo, with AOFAS scores improving from 52 to 98 and VISA-A scores improving from 37 to 98. They also reported that these postoperative scores were significantly higher than those of 32 patients who underwent posterosuperior prominence resection[80]. A description of this osteotomy technique was detailed in a review by Syed and Perera[77].

Recently, minimally invasive surgery for this osteotomy has been reported. Vernois *et al*[88] detailed this minimally invasive osteotomy technique using a 3-mm wide and 20-mm long Shannon bur[88]. Nordio *et al*[89] reported that in 26 patients who underwent percutaneous surgery, the Foot function index score improved from 65 to 8. The VAS score improved from 9 to 1, with a mean follow-up of 12 mo, and pain relief was achieved at a mean of 12 wk[89]. Choi and Suh[90] compared the outcomes of 11 patients who underwent minimally invasive osteotomy using a 2.2 mm Shannon bar and 14 patients who underwent open posterosuperior prominence resection. The VISA-A score of this osteotomy improved from 36 to 88, and the VAS score improved from 89 to 36. They also reported that minimally invasive surgery was significantly better than posterosuperior prominence resection at 6 mo postoperatively; however, the outcomes were similar at the final follow-up[90].

CONCLUSION

To establish minimally invasive surgery for insertional Achilles tendinopathy, the following four techniques must be minimally invasive: (1) Exostosis resection at the Achilles tendon insertion; (2) Debridement of degenerated Achilles tendon; (3) Reattachment using anchors or augmentation using FHL tendon transfer; and (4) Excision of the posterosuperior calcaneal prominence. This article reviewed studies from these four perspectives.

Exostosis resection at the Achilles tendon insertion was demonstrated in one case study, where blunt dissection around the exostosis was performed under fluoroscopy, an abrasion bur was introduced into the space created, and the exostosis was resected under fluoroscopic guidance.

Debridement of degenerated Achilles tendon was demonstrated in the same case study, where the space left after resection of the exostosis was an endoscopic working space, and the degenerated Achilles tendon and intra-tendinous calcification were debrided endoscopically.

Achilles tendon reattachment techniques have been demonstrated in several studies, where anchors were placed on the calcaneal surface after the posterosuperior prominence resection, and sutures were passed through the Achilles tendon using several stab wounds and fixated to the anchors.

In contrast, FHL tendon transfer techniques have not yet been published. The minimally invasive FHL harvest was reported in a technical note. Therefore, if a technique to integrate the Achilles tendon and the harvested FHL tendon is developed, endoscopic FHL transfer will become possible.

Endoscopic posterior superior prominence resection has already been established.

As with other minimally invasive surgeries for insertional Achilles tendinopathy, several studies on ultrasound-guided surgery and percutaneous dorsal wedge calcaneal osteotomy have been published.

FOOTNOTES

Author contributions: Nakajima K was the only author and performed everything regarding this study.

Conflict-of-interest statement: The author declares no conflict of interest.

Country/Territory of origin: Japan

ORCID number: Kenichiro Nakajima 0000-0002-8649-2346.

S-Editor: Fan JR
L-Editor: A
P-Editor: Ji MX

REFERENCES

1 **van Dijk CN**, van Sterkenburg MN, Wiegerinck JI, Karlsson J, Maffulli N. Terminology for Achilles tendon related disorders. *Knee Surg Sports Traumatol Arthrosc* 2011; **19**: 835-841 [PMID: 21222102 DOI: 10.1007/s00167-010-1374-z]

2 **Shakked RJ**, Raikin SM. Insertional Tendinopathy of the Achilles: Debridement, Primary Repair, and When to Augment. *Foot Ankle Clin* 2017; **22**: 761-780 [PMID: 29078827 DOI: 10.1016/j.fcl.2017.07.005]

3 **Barg A**, Ludwig T. Surgical Strategies for the Treatment of Insertional Achilles Tendinopathy. *Foot Ankle Clin* 2019; **24**: 533-559 [PMID: 31371002 DOI: 10.1016/j.fcl.2019.04.005]

4 **Chimenti RL**, Cychosz CC, Hall MM, Phisitkul P. Current Concepts Review Update: Insertional Achilles Tendinopathy. *Foot Ankle Int* 2017; **38**: 1160-1169 [PMID: 28789557 DOI: 10.1177/1071100717723127]

5 **Chen J**, Janney CF, Khalid MA, Panchbhavi VK. Management of Insertional Achilles Tendinopathy. *J Am Acad Orthop Surg* 2022; **30**: e751-e759 [PMID: 35286285 DOI: 10.5435/JAAOS-D-21-00679]

6 **McGarvey WC**, Palumbo RC, Baxter DE, Leibman BD. Insertional Achilles tendinosis: surgical treatment through a central tendon splitting approach. *Foot Ankle Int* 2002; **23**: 19-25 [PMID: 11822688 DOI: 10.1177/107110070202300104]

7 **Den Hartog BD**. Flexor hallucis longus transfer for chronic Achilles tendonosis. *Foot Ankle Int* 2003; **24**: 233-237 [PMID: 12793486 DOI: 10.1177/107110070302400306]

8 **Johnson KW**, Zalavras C, Thordarson DB. Surgical management of insertional calcific achilles tendinosis with a central tendon splitting approach. *Foot Ankle Int* 2006; **27**: 245-250 [PMID: 16624213 DOI: 10.1177/107110070602700404]

9 **Elias I**, Raikin SM, Besser MP, Nazarian LN. Outcomes of chronic insertional Achilles tendinosis using FHL autograft through single incision. *Foot Ankle Int* 2009; **30**: 197-204 [PMID: 19321095 DOI: 10.3113/FAI.2009.0197]

10 **Will RE**, Galey SM. Outcome of single incision flexor hallucis longus transfer for chronic achilles tendinopathy. *Foot Ankle Int* 2009; **30**: 315-317 [PMID: 19356355 DOI: 10.3113/FAI.2009.0315]

11 **Nunley JA**, Ruskin G, Horst F. Long-term clinical outcomes following the central incision technique for insertional Achilles tendinopathy. *Foot Ankle Int* 2011; **32**: 850-855 [PMID: 22097159 DOI: 10.3113/FAI.2011.0850]

12 **Rigby RB**, Cottom JM, Vora A. Early weightbearing using Achilles suture bridge technique for insertional Achilles tendinosis: a review of 43 patients. *J Foot Ankle Surg* 2013; **52**: 575-579 [PMID: 23669005 DOI: 10.1053/j.jfas.2012.11.004]

13 **Greenhagen RM**, Shinabarger AB, Pearson KT, Burns PR. Intermediate and long-term outcomes of the suture bridge technique for the management of insertional achilles tendinopathy. *Foot Ankle Spec* 2013; **6**: 185-190 [PMID: 23349381 DOI: 10.1177/1938640012473150]

14 **Schon LC**, Shores JL, Faro FD, Vora AM, Camire LM, Guyton GP. Flexor hallucis longus tendon transfer in treatment of

Achilles tendinosis. *J Bone Joint Surg Am* 2013; **95**: 54-60 [PMID: 23283373 DOI: 10.2106/JBJS.K.00970]
15 **Ahn JH**, Ahn CY, Byun CH, Kim YC. Operative Treatment of Haglund Syndrome With Central Achilles Tendon-Splitting Approach. *J Foot Ankle Surg* 2015; **54**: 1053-1056 [PMID: 26232175 DOI: 10.1053/j.jfas.2015.05.002]
16 **El-Tantawy A**, Azzam W. Flexor hallucis longus tendon transfer in the reconstruction of extensive insertional Achilles tendinopathy in elderly: an improved technique. *Eur J Orthop Surg Traumatol* 2015; **25**: 583-590 [PMID: 25433689 DOI: 10.1007/s00590-014-1569-y]
17 **Hunt KJ**, Cohen BE, Davis WH, Anderson RB, Jones CP. Surgical Treatment of Insertional Achilles Tendinopathy With or Without Flexor Hallucis Longus Tendon Transfer: A Prospective, Randomized Study. *Foot Ankle Int* 2015; **36**: 998-1005 [PMID: 25990545 DOI: 10.1177/1071100715586182]
18 **McAlister JE**, Hyer CF. Safety of achilles detachment and reattachment using a standard midline approach to insertional enthesophytes. *J Foot Ankle Surg* 2015; **54**: 214-219 [PMID: 25619811 DOI: 10.1053/j.jfas.2014.12.009]
19 **Lai Wei Hong S**, Tang Qian Ying C, Thwin L, Thevendran G. Return to Sport and Physical Activity After Calcaneoplasty for Insertional Achilles Tendinosis. *J Foot Ankle Surg* 2016; **55**: 1190-1194 [PMID: 27600485 DOI: 10.1053/j.jfas.2016.07.012]
20 **Gillis CT**, Lin JS. Use of a Central Splitting Approach and Near Complete Detachment for Insertional Calcific Achilles Tendinopathy Repaired With an Achilles Bridging Suture. *J Foot Ankle Surg* 2016; **55**: 235-239 [PMID: 26704538 DOI: 10.1053/j.jfas.2015.10.002]
21 **Ettinger S**, Razzaq R, Waizy H, Claassen L, Daniilidis K, Stukenborg-Colsman C, Plaass C. Operative Treatment of the Insertional Achilles Tendinopathy Through a Transtendinous Approach. *Foot Ankle Int* 2016; **37**: 288-293 [PMID: 26443697 DOI: 10.1177/1071100715609921]
22 **Jiang Y**, Li Y, Tao T, Li W, Zhang K, Gui J, Ma Y. The Double-Row Suture Technique: A Better Option for the Treatment of Haglund Syndrome. *Biomed Res Int* 2016; **2016**: 1895948 [PMID: 28078282 DOI: 10.1155/2016/1895948]
23 **Miao XD**, Jiang H, Wu YP, Tao HM, Yang DS, Hu H. Treatment of Calcified Insertional Achilles Tendinopathy by the Posterior Midline Approach. *J Foot Ankle Surg* 2016; **55**: 529-534 [PMID: 26874831 DOI: 10.1053/j.jfas.2016.01.016]
24 **Xia Z**, Yew AKS, Zhang TK, Su HCD, Ng YCS, Rikhraj IS. Surgical Correction of Haglund's Triad Using a Central Tendon-Splitting Approach: A Retrospective Outcomes Study. *J Foot Ankle Surg* 2017; **56**: 1132-1138 [PMID: 28807379 DOI: 10.1053/j.jfas.2017.05.015]
25 **Hardy A**, Rousseau R, Issa SP, Gerometta A, Pascal-Moussellard H, Granger B, Khiami F. Functional outcomes and return to sports after surgical treatment of insertional Achilles tendinopathy: Surgical approach tailored to the degree of tendon involvement. *Orthop Traumatol Surg Res* 2018; **104**: 719-723 [PMID: 29852319 DOI: 10.1016/j.otsr.2018.05.003]
26 **Howell MA**, McConn TP, Saltrick KR, Catanzariti AR. Calcific Insertional Achilles Tendinopathy-Achilles Repair With Flexor Hallucis Longus Tendon Transfer: Case Series and Surgical Technique. *J Foot Ankle Surg* 2019; **58**: 236-242 [PMID: 30612865 DOI: 10.1053/j.jfas.2018.08.021]
27 **Yontar NS**, Aslan L, Can A, Öğüt T. Mid-term results of open debridement and reattachment surgery for insertional Achilles tendinopathy: A retrospective clinical study. *Acta Orthop Traumatol Turc* 2020; **54**: 567-571 [PMID: 33423985 DOI: 10.5152/j.aott.2020.18426]
28 **Greiner F**, Trnka HJ, Chraim M, Neunteufel E, Bock P. Clinical and Radiological Outcomes of Operative Therapy in Insertional Achilles Tendinopathy With Debridement and Double-Row Refixation. *Foot Ankle Int* 2021; **42**: 1115-1120 [PMID: 33843294 DOI: 10.1177/10711007211002814]
29 **Hörterer H**, Baumbach SF, Oppelt S, Böcker W, Harrasser N, Walther M, Polzer H. Complications Associated With Midline Incision for Insertional Achilles Tendinopathy. *Foot Ankle Int* 2020; **41**: 1502-1509 [PMID: 32819163 DOI: 10.1177/1071100720943836]
30 **Highlander P**, Greenhagen RM. Wound complications with posterior midline and posterior medial leg incisions: a systematic review. *Foot Ankle Spec* 2011; **4**: 361-369 [PMID: 21926359 DOI: 10.1177/1938640011418488]
31 **Thompson JM**, Nguyen K, Ahluwalia J, Casciato D, Tewilliager T, So E, Prissel M. Surgical Takedown Approaches to Insertional Achilles Tendinopathy: A Systematic Review. *J Foot Ankle Surg* 2021; **60**: 1217-1221 [PMID: 34108118 DOI: 10.1053/j.jfas.2021.04.015]
32 **Nakajima K**. Fluoroscopic and Endoscopic Calcaneal Exostosis Resection and Achilles Tendon Debridement for Insertional Achilles Tendinopathy Results in Good Outcomes, Early Return to Sports Activities, and Few Wound Complications. *Arthrosc Sports Med Rehabil* 2022; **4**: e1385-e1395 [PMID: 36033171 DOI: 10.1016/j.asmr.2022.04.027]
33 **Somford MP**, Nieuwe Weme RA, Sierevelt I, Doornberg JN, Niek van Dijk C, Ring D, Eygendaal D; Orthopaedic Eponymous Terms Study Group. The Reliability of Orthopaedic Eponymous Terms. *J Bone Joint Surg Am* 2017; **99**: e70 [PMID: 28678131 DOI: 10.2106/JBJS.16.01433]
34 **Opdam KTM**, Zwiers R, Wiegerinck JI, van Dijk CN; Ankleplatform Study Collaborative–Science of Variation Group. Increasing consensus on terminology of Achilles tendon-related disorders. *Knee Surg Sports Traumatol Arthrosc* 2021; **29**: 2528-2534 [PMID: 33991210 DOI: 10.1007/s00167-021-06566-z]
35 **Xu JH**, Ding SL, Chen B, Wu SC. Modified Bunnell suture expands the surgical indication of the treatment of Haglund's syndrome heel pain with endoscope. *Exp Ther Med* 2018; **15**: 4817-4821 [PMID: 29805501 DOI: 10.3892/etm.2018.6071]
36 **Vega J**, Baduell A, Malagelada F, Allmendinger J, Dalmau-Pastor M. Endoscopic Achilles Tendon Augmentation With Suture Anchors After Calcaneal Exostectomy in Haglund Syndrome. *Foot Ankle Int* 2018; **39**: 551-559 [PMID: 29519149 DOI: 10.1177/1071100717750888]
37 **Michels F**, Guillo S, King A, Jambou S, de Lavigne C. Endoscopic calcaneoplasty combined with Achilles tendon repair. *Knee Surg Sports Traumatol Arthrosc* 2008; **16**: 1043-1046 [PMID: 18712352 DOI: 10.1007/s00167-008-0602-2]
38 **Maquirriain J**. Endoscopic Achilles tenodesis: a surgical alternative for chronic insertional tendinopathy. *Knee Surg Sports Traumatol Arthrosc* 2007; **15**: 940-943 [PMID: 17053930 DOI: 10.1007/s00167-006-0215-6]
39 **Hegewald KW**, Doyle MD, Todd NW, Rush SM. Minimally Invasive Approach to Achilles Tendon Pathology. *J Foot Ankle Surg* 2016; **55**: 166-168 [PMID: 26385574 DOI: 10.1053/j.jfas.2015.08.001]
40 **Boniface O**, Vervoort T. Endoscopic treatment of insertional Achilles tendinopathy: A cadaver feasibility study. *Orthop Traumatol Surg Res* 2021; **107**: 102893 [PMID: 33746072 DOI: 10.1016/j.otsr.2021.102893]

41 **Miller CP**, McWilliam JR, Michalski MP, Acevedo J. Endoscopic Haglund's Resection and Percutaneous Double-Row Insertional Achilles Repair. *Foot Ankle Spec* 2021; **14**: 534-543 [PMID: 33840259 DOI: 10.1177/19386400211002707]

42 **Lopes R**, Ngbilo C, Padiolleau G, Boniface O. Endoscopic speed bridge: A new treatment for insertional Achilles tendinopathy. *Orthop Traumatol Surg Res* 2021; **107**: 102854 [PMID: 33578040 DOI: 10.1016/j.otsr.2021.102854]

43 **Kolodziej P**, Glisson RR, Nunley JA. Risk of avulsion of the Achilles tendon after partial excision for treatment of insertional tendonitis and Haglund's deformity: a biomechanical study. *Foot Ankle Int* 1999; **20**: 433-437 [PMID: 10437926 DOI: 10.1177/107110079902000707]

44 **Cottom JM**, Hyer CF, Berlet GC, Lee TH. Flexor hallucis tendon transfer with an interference screw for chronic Achilles tendinosis: a report of 62 cases. *Foot Ankle Spec* 2008; **1**: 280-287 [PMID: 19825729 DOI: 10.1177/1938640008322690]

45 **Coull R**, Flavin R, Stephens MM. Flexor hallucis longus tendon transfer: evaluation of postoperative morbidity. *Foot Ankle Int* 2003; **24**: 931-934 [PMID: 14733350 DOI: 10.1177/107110070302401211]

46 **Hahn F**, Meyer P, Maiwald C, Zanetti M, Vienne P. Treatment of chronic achilles tendinopathy and ruptures with flexor hallucis tendon transfer: clinical outcome and MRI findings. *Foot Ankle Int* 2008; **29**: 794-802 [PMID: 18752777 DOI: 10.3113/FAI.2008.0794]

47 **Rousseau R**, Gerometta A, Fogerty S, Rolland E, Catonné Y, Khiami F. Results of surgical treatment of calcaneus insertional tendinopathy in middle- and long-distance runners. *Knee Surg Sports Traumatol Arthrosc* 2015; **23**: 2494-2501 [PMID: 24748271 DOI: 10.1007/s00167-014-2986-5]

48 **Miyamoto W**, Takao M, Matsushita T. Reconstructive surgery using autologous bone-patellar tendon graft for insertional Achilles tendinopathy. *Knee Surg Sports Traumatol Arthrosc* 2012; **20**: 1863-1867 [PMID: 22105979 DOI: 10.1007/s00167-011-1792-6]

49 **Lui TH**, Chan WC, Maffulli N. Endoscopic Flexor Hallucis Longus Tendon Transfer for Chronic Achilles Tendon Rupture. *Sports Med Arthrosc Rev* 2016; **24**: 38-41 [PMID: 26752778 DOI: 10.1097/JSA.0000000000000086]

50 **Watson AD**, Anderson RB, Davis WH. Comparison of results of retrocalcaneal decompression for retrocalcaneal bursitis and insertional achilles tendinosis with calcific spur. *Foot Ankle Int* 2000; **21**: 638-642 [PMID: 10966360 DOI: 10.1177/107110070002100802]

51 **Leitze Z**, Sella EJ, Aversa JM. Endoscopic decompression of the retrocalcaneal space. *J Bone Joint Surg Am* 2003; **85**: 1488-1496 [PMID: 12925628 DOI: 10.2106/00004623-200308000-00009]

52 **Ortmann FW**, McBryde AM. Endoscopic bony and soft-tissue decompression of the retrocalcaneal space for the treatment of Haglund deformity and retrocalcaneal bursitis. *Foot Ankle Int* 2007; **28**: 149-153 [PMID: 17296130 DOI: 10.3113/FAI.2007.0149]

53 **Jerosch J**. Endoscopic calcaneoplasty. *Foot Ankle Clin* 2015; **20**: 149-165 [PMID: 25726490 DOI: 10.1016/j.fcl.2014.10.004]

54 **Cusumano A**, Martinelli N, Bianchi A, Bertelli A, Marangon A, Sansone V. Transtendinous approach calcaneoplasty versus endoscopic calcaneoplasty for Haglund's disease. *Int Orthop* 2021; **45**: 225-231 [PMID: 32767086 DOI: 10.1007/s00264-020-04761-0]

55 **Natarajan S**, Narayanan VL. Haglund Deformity - Surgical Resection by the Lateral Approach. *Malays Orthop J* 2015; **9**: 1-3 [PMID: 28435586 DOI: 10.5704/MOJ.1503.006]

56 **Kondreddi V**, Gopal RK, Yalamanchili RK. Outcome of endoscopic decompression of retrocalcaneal bursitis. *Indian J Orthop* 2012; **46**: 659-663 [PMID: 23325968 DOI: 10.4103/0019-5413.104201]

57 **Sundararajan PP**, Wilde TS. Radiographic, clinical, and magnetic resonance imaging analysis of insertional Achilles tendinopathy. *J Foot Ankle Surg* 2014; **53**: 147-151 [PMID: 24556480 DOI: 10.1053/j.jfas.2013.12.009]

58 **Rufai A**, Ralphs JR, Benjamin M. Structure and histopathology of the insertional region of the human Achilles tendon. *J Orthop Res* 1995; **13**: 585-593 [PMID: 7674075 DOI: 10.1002/jor.1100130414]

59 **van Dijk CN**, van Dyk GE, Scholten PE, Kort NP. Endoscopic calcaneoplasty. *Am J Sports Med* 2001; **29**: 185-189 [PMID: 11292043 DOI: 10.1177/03635465010290021101]

60 **Scholten PE**, van Dijk CN. Endoscopic calcaneoplasty. *Foot Ankle Clin* 2006; **11**: 439-446, viii [PMID: 16798522 DOI: 10.1016/j.fcl.2006.02.004]

61 **Kaynak G**, Öğüt T, Yontar NS, Botanlıoğlu H, Can A, Ünlü MC. Endoscopic calcaneoplasty: 5-year results. *Acta Orthop Traumatol Turc* 2013; **47**: 261-265 [PMID: 23999514 DOI: 10.3944/aott.2013.3003]

62 **Alessio-Mazzola M**, Russo A, Capello AG, Lovisolo S, Repetto I, Formica M, Felli L. Endoscopic calcaneoplasty for the treatment of Haglund's deformity provides better clinical functional outcomes, lower complication rate, and shorter recovery time compared to open procedures: a systematic review. *Knee Surg Sports Traumatol Arthrosc* 2021; **29**: 2462-2484 [PMID: 33216187 DOI: 10.1007/s00167-020-06362-1]

63 **Wu Z**, Hua Y, Li Y, Chen S. Endoscopic treatment of Haglund's syndrome with a three portal technique. *Int Orthop* 2012; **36**: 1623-1627 [PMID: 22415722 DOI: 10.1007/s00264-012-1518-5]

64 **van Sterkenburg MN**, Groot M, Sierevelt IN, Spennacchio PA, Kerkhoffs GM, van Dijk CN. Optimization of portal placement for endoscopic calcaneoplasty. *Arthroscopy* 2011; **27**: 1110-1117 [PMID: 21683545 DOI: 10.1016/j.arthro.2011.02.030]

65 **Lohrer H**, Nauck T, Dorn NV, Konerding MA. Comparison of endoscopic and open resection for Haglund tuberosity in a cadaver study. *Foot Ankle Int* 2006; **27**: 445-450 [PMID: 16764802 DOI: 10.1177/107110070602700610]

66 **Roth KE**, Mueller R, Schwand E, Maier GS, Schmidtmann I, Sariyar M, Maus U. Open versus endoscopic bone resection of the dorsolateral calcaneal edge: a cadaveric analysis comparing three dimensional CT scans. *J Foot Ankle Res* 2014; **7**: 56 [PMID: 25610496 DOI: 10.1186/s13047-014-0056-3]

67 **Lui TH**. Endoscopic Calcaneoplasty and Achilles Tendoscopy With the Patient in Supine Position. *Arthrosc Tech* 2016; **5**: e1475-e1479 [PMID: 28149742 DOI: 10.1016/j.eats.2016.08.027]

68 **Ferranti S**, Migliorini F, Liuni FM, Corzani M, Azzarà A, Polliano F, Tawfiq ASS, Maffulli N. Outcomes of Percutaneous Calcaneoplasty for Insertional Achilles Tendon Problems. *Foot Ankle Int* 2021; **42**: 1287-1293 [PMID: 34116596 DOI: 10.1177/10711007211004963]

69 **Tallerico VK**, Greenhagen RM, Lowery C. Isolated Gastrocnemius Recession for Treatment of Insertional Achilles

Tendinopathy: A Pilot Study. *Foot Ankle Spec* 2015; **8**: 260-265 [PMID: 25389232 DOI: 10.1177/1938640014557077]

70 **Gould JS**. Insertional tendinitis of the tendo Achilles. *Tech in Foot Ankle Surg* 2005; **4**: 222-229 [DOI: 10.1097/01.btk.0000188714.94445.b2]

71 **Staggers JR**, Smith K, de C Netto C, Naranje S, Prasad K, Shah A. Reconstruction for chronic Achilles tendinopathy: comparison of flexor hallucis longus (FHL) transfer versus V-Y advancement. *Int Orthop* 2018; **42**: 829-834 [PMID: 29453583 DOI: 10.1007/s00264-018-3834-x]

72 **Khan KM**, Forster BB, Robinson J, Cheong Y, Louis L, Maclean L, Taunton JE. Are ultrasound and magnetic resonance imaging of value in assessment of Achilles tendon disorders? A two year prospective study. *Br J Sports Med* 2003; **37**: 149-153 [PMID: 12663358 DOI: 10.1136/bjsm.37.2.149]

73 **Chimenti RL**, Stover DW, Fick BS, Hall MM. Percutaneous Ultrasonic Tenotomy Reduces Insertional Achilles Tendinopathy Pain With High Patient Satisfaction and a Low Complication Rate. *J Ultrasound Med* 2019; **38**: 1629-1635 [PMID: 30280399 DOI: 10.1002/jum.14835]

74 **Wang CL**, Chen PY, Yang KC, Wu HC, Wang CC. Ultrasound-Guided Minimally Invasive Surgical Resection of Retrocalcaneal Bursitis: A Preliminary Comparison With Traditional Open Surgery. *J Foot Ankle Surg* 2019; **58**: 855-860 [PMID: 31345762 DOI: 10.1053/j.jfas.2018.12.023]

75 **Freed L**, Ellis MB, Johnson K, Haddon TB. Fasciotomy and Surgical Tenotomy for Chronic Achilles Insertional Tendinopathy (A Retrospective Study Using Ultrasound-Guided Percutaneous Microresection). *J Am Podiatr Med Assoc* 2019; **109**: 1-8 [PMID: 30964321 DOI: 10.7547/15-168]

76 **Boffeli TJ**, Peterson MC. The Keck and Kelly wedge calcaneal osteotomy for Haglund's deformity: a technique for reproducible results. *J Foot Ankle Surg* 2012; **51**: 398-401 [PMID: 22445185 DOI: 10.1053/j.jfas.2012.03.002]

77 **Syed TA**, Perera A. A Proposed Staging Classification for Minimally Invasive Management of Haglund's Syndrome with Percutaneous and Endoscopic Surgery. *Foot Ankle Clin* 2016; **21**: 641-664 [PMID: 27524710 DOI: 10.1016/j.fcl.2016.04.004]

78 **Georgiannos D**, Lampridis V, Vasiliadis A, Bisbinas I. Treatment of Insertional Achilles Pathology With Dorsal Wedge Calcaneal Osteotomy in Athletes. *Foot Ankle Int* 2017; **38**: 381-387 [PMID: 27920330 DOI: 10.1177/1071100716681139]

79 **Tourné Y**, Baray AL, Barthélémy R, Moroney P. Contribution of a new radiologic calcaneal measurement to the treatment decision tree in Haglund syndrome. *Orthop Traumatol Surg Res* 2018; **104**: 1215-1219 [PMID: 30391217 DOI: 10.1016/j.otsr.2018.08.014]

80 **Ge Z**, Ma L, Tang H, Yang M, Yang A, Yuan C, Tao X, Zhou B, Tang K, Chen W. Comparison of dorsal closing wedge calcaneal osteotomy versus posterosuperior prominence resection for the treatment of Haglund syndrome. *J Orthop Surg Res* 2020; **15**: 168 [PMID: 32381106 DOI: 10.1186/s13018-020-01687-6]

81 **Maffulli N**, D'Addona A, Gougoulias N, Oliva F, Maffulli GD. Dorsally Based Closing Wedge Osteotomy of the Calcaneus for Insertional Achilles Tendinopathy. *Orthop J Sports Med* 2020; **8**: 2325967120907985 [PMID: 32232068 DOI: 10.1177/2325967120907985]

82 **Maffulli N**, Gougoulias N, D'Addona A, Oliva F, Maffulli GD. Modified Zadek osteotomy without excision of the intratendinous calcific deposit is effective for the surgical treatment of calcific insertional Achilles tendinopathy. *Surgeon* 2021; **19**: e344-e352 [PMID: 33268299 DOI: 10.1016/j.surge.2020.08.018]

83 **Tourne Y**, Baray AL, Barthelemy R, Karhao T, Moroney P. The Zadek calcaneal osteotomy in Haglund's syndrome of the heel: Clinical results and a radiographic analysis to explain its efficacy. *Foot Ankle Surg* 2022; **28**: 79-87 [PMID: 33658170 DOI: 10.1016/j.fas.2021.02.001]

84 **Tourné Y**, Francony F, Barthélémy R, Karhao T, Moroney P. The Zadek calcaneal osteotomy in Haglund's syndrome of the heel: Its effects on the dorsiflexion of the ankle and correlations to clinical and functional scores. *Foot Ankle Surg* 2022; **28**: 789-794 [PMID: 34794868 DOI: 10.1016/j.fas.2021.11.001]

85 **Cengiz B**, Karaoglu S. Clinical results of the Keck and Kelly Wedge Osteotomy approach in Haglund's deformity: Minimum 3-year follow-up. *Foot Ankle Surg* 2022; **28**: 269-275 [PMID: 34674937 DOI: 10.1016/j.fas.2021.10.006]

86 **Zadek I**. An operation for the cure of achillobursitis. *Am J Surg* 1939; **43**: 542-546 [DOI: 10.1016/S0002-9610(39)90877-9]

87 **Keck SW**, Kelly PJ. Bursitis of the posterior part of the heel; evaluation of surgical treatment of eighteen patients. *J Bone Joint Surg Am* 1965; **47**: 267-273 [PMID: 14261802]

88 **Vernois J**, Redfern D, Ferraz L, Laborde J. Minimally Invasive Surgery Osteotomy of the Hindfoot. *Clin Podiatr Med Surg* 2015; **32**: 419-434 [PMID: 26117576 DOI: 10.1016/j.cpm.2015.03.008]

89 **Nordio A**, Chan JJ, Guzman JZ, Hasija R, Vulcano E. Percutaneous Zadek osteotomy for the treatment of insertional Achilles tendinopathy. *Foot Ankle Surg* 2020; **26**: 818-821 [PMID: 31784097 DOI: 10.1016/j.fas.2019.10.011]

90 **Choi JY**, Suh JS. A novel technique of minimally invasive calcaneal osteotomy for intractable insertional Achilles tendinopathy associated with Haglund deformity. *Foot Ankle Surg* 2022; **28**: 578-583 [PMID: 34176720 DOI: 10.1016/j.fas.2021.06.002]

Published by **Baishideng Publishing Group Inc**
7041 Koll Center Parkway, Suite 160, Pleasanton, CA 94566, USA
Telephone: +1-925-3991568
E-mail: bpgoffice@wjgnet.com
Help Desk: https://www.f6publishing.com/helpdesk
https://www.wjgnet.com