International Journal of Medical and Pharmaceutical Research

Online ISSN-2958-3683 | Print ISSN-2958-3675
Frequency: Bi-Monthly
Available online on: https://ijmpr.in/

Original Article

Prospective Study of Functional Outcome of Achilles Tendon Reconstruction with Gastrocnemius Soleus VYPlasty with FHL Tendon Transfer for Chronic Long Segment Defect

Dr Bindusar[1], Dr Rithvika Walad[2]

[1]Assistant Professor, Dept of Orthopaedics, ESIC Medical College Kalaburagi
[2]Assistant Professor, Dept of OBG, KoIMS, Madikeri

OPEN ACCESS

Corresponding Author:

Dr Rithvika Walad
Assistant Professor, Dept of OBG, KoIMS, Madikeri

Received: 09-06-2026
Accepted: 29-06-2026
Available online: 15-07-2026

ABSTRACT

Background: Chronic long-segment Achilles tendon ruptures present a significant surgical challenge due to tendon retraction, poor tissue quality, and large defects that preclude primary repair. Gastrosoleus V-Y plasty combined with flexor hallucislongus (FHL) tendon transfer is a reliable reconstructive technique that restores tendon continuity and improves functional outcomes.
Aim: To evaluate the functional outcome of Achilles tendon reconstruction using gastrosoleus V-Y plasty with FHL tendon transfer in patients with chronic long-segment Achilles tendon defects.
Materials and Methods: This prospective observational study was conducted at the Department of Orthopaedics, ESIC Medical College, Kalaburagi, from June 2025 to May 2026. Twenty patients with chronic Achilles tendon ruptures and long-segment defects (>5 cm) underwent reconstruction using gastrosoleus V-Y plasty with FHL tendon transfer. Patients were evaluated clinically and functionally over a minimum follow-up period of 12 months. Outcome measures included the Visual Analogue Scale (VAS), American Orthopaedic Foot and Ankle Society (AOFAS) Ankle-Hindfoot Score, Achilles Tendon Total Rupture Score (ATRS), ankle range of motion, plantar-flexion strength, ability to perform a single-leg heel rise, time to full weight bearing, return to work, patient satisfaction, and postoperative complications.
Results: The mean age of the patients was predominantly between 31 and 40 years, with males accounting for 75% of the study population. The mean tendon defect length was 6.3 ± 0.8 cm. Mean VAS score improved significantly from 7.5 ± 1.0 preoperatively to 1.1 ± 0.8 at 12 months ($p<0.001$). The mean AOFAS score increased from 46.2 ± 7.4 to 91.6 ± 4.5 ($p<0.001$), while the mean ATRS improved from 31.8 ± 6.8 to 88.9 ± 5.7 ($p<0.001$). At final follow-up, 90% of patients were able to perform a single-leg heel rise, and 75% regained Grade 5 plantar-flexion strength. Fourteen patients (70%) achieved excellent functional outcomes, while five (25%) had good outcomes. Overall patient satisfaction was 95%. Minor complications included superficial wound infection (10%), delayed wound healing (5%), hallux weakness (5%), sural nerve paresthesia (5%), and tendon adhesions (5%). No re-ruptures or deep vein thrombosis were observed.
Conclusion: Gastrosoleus V-Y plasty with FHL tendon transfer is an effective and reliable technique for reconstructing chronic long-segment Achilles tendon defects. It provides excellent functional recovery, significant pain relief, high patient satisfaction, and a low complication rate, making it a valuable surgical option for chronic Achilles tendon reconstruction.

Keywords: *Achilles tendon rupture, Chronic Achilles tendon defect, Gastrosoleus V-Y plasty, Flexor hallucislongus tendon transfer, AOFAS score, ATRS, Functional*

outcome.

INTRODUCTION

The Achilles tendon is the strongest and largest tendon in the human body, transmitting the force generated by the gastrocnemius-soleus complex to facilitate plantar flexion during walking, running, and jumping. Despite its remarkable tensile strength, the Achilles tendon is vulnerable to rupture because of its relatively hypovascular watershed zone located approximately 2–6 cm proximal to its calcaneal insertion. Achilles tendon ruptures are increasingly encountered due to the growing participation in recreational sports and the aging active population. Chronic Achilles tendon ruptures, generally defined as injuries diagnosed more than four weeks after rupture, remain a challenging orthopedic problem because of tendon retraction, scar tissue formation, muscle atrophy, and large tendon defects that preclude direct end-to-end repair (1,2).

Delayed diagnosi of Achilles tendon rupture is common, particularly in elderly patients and individuals with low-demand lifestyles, where the injury may initially be mistaken for an ankle sprain. Chronic ruptures often present with weakness during push-off, impaired gait, difficulty climbing stairs, inability to perform a single-leg heel rise, and persistent pain. These functional deficits substantially affect quality of life and daily activities, necessitating surgical reconstruction in patients with significant tendon gaps (3,4).

Several reconstructive techniques have been described for chronic Achilles tendon defects, including V-Y advancement plasty, turndown flaps, tendon grafting, allograft reconstruction, synthetic augmentation, peroneus brevis transfer, flexor hallucislongus (FHL) tendon transfer, and combinations of these procedures. The choice of technique largely depends on the defect size, tendon quality, chronicity of injury, and surgeon experience (5,6).

Among the available reconstructive options, gastrosoleus V-Y plasty effectively lengthens the proximal musculotendinous unit and permits closure of moderate-to-large tendon defects while preserving muscle continuity. However, in chronic ruptures with defects exceeding 5–6 cm, V-Y advancement alone may not provide sufficient strength. Flexor hallucislongus tendon transfer has therefore gained considerable popularity because of its favorable anatomical location, similar line of pull to the Achilles tendon, strong plantar-flexion power, and reliable vascularity. Furthermore, harvesting the FHL tendon results in minimal functional impairment of the great toe due to compensation by the flexor hallucisbrevis muscle (7,8).

Combining gastrosoleus V-Y plasty with FHL tendon transfer provides both structural augmentation and biological reinforcement, allowing restoration of tendon continuity while improving plantar-flexion strength. This combined technique has demonstrated encouraging clinical outcomes with low complication and re-rupture rates in several clinical studies. The transferred FHL tendon contributes dynamic muscular support and enhances tendon healing by improving vascularity at the repair site (9,10).

Functional outcome following Achilles tendon reconstruction is commonly evaluated using validated scoring systems such as the American Orthopaedic Foot and Ankle Society (AOFAS) Ankle-Hindfoot Score and the Achilles Tendon Total Rupture Score (ATRS). Pain assessment using the Visual Analogue Scale (VAS), range of motion, ability to perform heel rise, return to work, and complication rates are equally important indicators of surgical success (11,12).

Although numerous techniques have been proposed for managing chronic Achilles tendon ruptures, evidence regarding combined gastrosoleus V-Y plasty with FHL tendon transfer in patients with chronic long-segment defects remains relatively limited, particularly in the Indian population. Therefore, the present prospective study was undertaken to evaluate the functional outcomes, pain relief, recovery parameters, and complications following Achilles tendon reconstruction using gastrosoleus V-Y plasty combined with FHL tendon transfer in patients with chronic long-segment Achilles tendon defects treated at ESIC Medical College, Kalaburagi.

MATERIALS AND METHODS

Study Design and Setting

This prospective, hospital-based interventional study was conducted in the Department of Orthopaedics, ESIC Medical College and Hospital, Kalaburagi, Karnataka, India, over a period of one year from June 2025 to May 2026. The study was undertaken to evaluate the functional outcomes of Achilles tendon reconstruction using gastrosoleus V-Y plasty combined with flexor hallucislongus (FHL) tendon transfer in patients with chronic long-segment Achilles tendon defects.

The study protocol was reviewed and approved by the Institutional Ethics Committee of ESIC Medical College, Kalaburagi. Written informed consent was obtained from all participants before enrolment. The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki.

Study Population
A total of 20 consecutive patients diagnosed with chronic Achilles tendon rupture with long-segment defects and meeting the eligibility criteria were included in the study.

Inclusion Criteria
- Patients aged 18–70 years.
- Chronic Achilles tendon rupture (>4 weeks after injury).
- Tendon gap measuring ≥5 cm after debridement and freshening of tendon ends.
- Patients with neglected Achilles tendon ruptures or failed previous primary repair.
- Ability to undergo surgery and participate in postoperative rehabilitation.
- Patients willing to provide informed written consent and comply with follow-up.

Exclusion Criteria
- Acute Achilles tendon rupture (<4 weeks).
- Active local or systemic infection.
- Peripheral vascular disease affecting the lower limb.
- Uncontrolled diabetes mellitus or severe neuropathy.
- Neuromuscular disorders affecting lower limb function.
- Previous extensive surgery involving the FHL tendon.
- Patients with severe ankle arthritis or hindfoot deformity.
- Patients unwilling or unable to complete follow-up.

Preoperative Evaluation
All patients underwent detailed clinical evaluation including:
- Demographic profile (age, sex)
- Occupation
- Side involved
- Mechanism of injury
- Duration since injury
- Medical comorbidities
- Previous treatment history

Clinical examination included assessment of:
- Tenderness over Achilles tendon
- Palpable tendon gap
- Thompson squeeze test
- Matles test
- Ankle range of motion
- Plantar flexion strength
- Gait pattern
- Ability to perform single-leg heel rise

Radiological Evaluation
All patients underwent standard imaging investigations including:
- Plain radiographs of ankle (AP and lateral views)
- Ultrasonography of Achilles tendon
- Magnetic Resonance Imaging (MRI)

MRI was performed to determine:
- Site of rupture
- Length of tendon defect
- Degree of tendon retraction
- Quality of tendon stump
- Associated soft tissue abnormalities

The tendon gap was measured intraoperatively after excision of fibrotic tissue.

Surgical Technique
All procedures were performed under spinal anesthesia with the patient in prone position using pneumatic tourniquet control.
A longitudinal posterior incision was made over the Achilles tendon.

Following exposure,

- Fibrotic scar tissue was excised.
- The proximal and distal tendon ends were refreshed.
- The tendon defect was measured.

Gastrosoleus V-Y Advancement
A V-shaped incision was created proximally within the gastrocnemius-aponeurotic complex.
The musculotendinous unit was advanced distally to bridge the tendon gap.
The limbs of the V were approximated into a Y configuration using non-absorbable sutures, thereby increasing tendon length.
Flexor HallucisLongus Tendon Transfer
The FHL tendon was identified posterior to the ankle.
The tendon was harvested distally after preserving adequate muscle belly.
A tunnel was drilled through the calcaneus.
The FHL tendon was passed through the tunnel and fixed using an interference screw or suture anchor while maintaining the ankle in slight plantar flexion.
The transferred FHL tendon was sutured to the Achilles tendon using Krackow locking sutures for reinforcement.
Hemostasis was achieved and the wound was closed in layers.
A below-knee plaster slab was applied with the ankle maintained in approximately 20° plantar flexion.

Postoperative Rehabilitation
Postoperative rehabilitation was standardized for all patients.
Phase I (0–2 weeks)

- Limb elevation
- Immobilization in below-knee cast
- Non-weight bearing
- Pain management
- Wound care

Phase II (2–6 weeks)

- Suture removal
- Functional walking boot
- Gradual passive ankle mobilization
- Partial weight bearing with walker support

Phase III (6–12 weeks)

- Active ankle range of motion exercises
- Progressive strengthening exercises
- Proprioceptive training
- Transition to full weight bearing

Phase IV (After 12 weeks)

- Heel raise exercises
- Calf muscle strengthening
- Gait training
- Return to routine daily activities
- Sports-specific rehabilitation when indicated

Outcome Measures
Patients were evaluated preoperatively and during follow-up at:

- 2 weeks
- 6 weeks
- 3 months
- 6 months
- 12 months

The primary outcome measure was functional recovery assessed using:

- American Orthopaedic Foot and Ankle Society (AOFAS) Ankle-Hindfoot Score
- Achilles Tendon Total Rupture Score (ATRS)

Secondary outcome measures included:

- Visual Analogue Scale (VAS) for pain
- Ankle range of motion
- Plantar flexion strength (Medical Research Council grading)
- Ability to perform single-leg heel rise
- Time to full weight bearing
- Time to return to work
- Time to return to sports (where applicable)
- Patient satisfaction

Complications recorded included:

- Wound infection
- Skin necrosis
- Delayed wound healing
- Sural nerve injury
- Re-rupture
- Deep vein thrombosis
- Tendon adhesions
- Hallux weakness
- Hardware-related complications

Data Collection

All clinical findings, operative details, rehabilitation progress, complications, and functional outcome scores were recorded using a structured case record form.

The following variables were documented:

- Age
- Sex
- Body mass index (BMI)
- Side involved
- Mechanism of injury
- Duration from injury to surgery
- Defect length
- Operative duration
- Blood loss
- Hospital stay
- Follow-up duration
- Functional scores
- Complications

Statistical Analysis

Data were entered into Microsoft Excel 2021 and analyzed using IBM SPSS Statistics version 26.0 (IBM Corp., Armonk, NY, USA).

Continuous variables were expressed as mean ± standard deviation (SD) or median with interquartile range (IQR) where appropriate. Categorical variables were presented as frequency and percentage.

Preoperative and postoperative functional scores (AOFAS, ATRS, VAS, and ankle range of motion) were compared using the paired Student's t-test for normally distributed variables or the Wilcoxon signed-rank test for non-normally distributed data.

Categorical variables were analyzed using the Chi-square test or Fisher's exact test, as appropriate. A p-value <0.05 was considered statistically significant. All statistical tests were two-tailed.

RESULTS AND OBSERVATIONS

A total of 20 patients with chronic long-segment Achilles tendon defects underwent Achilles tendon reconstruction using gastrosoleus V-Y plasty with flexor hallucislongus (FHL) tendon transfer. All patients completed a minimum follow-up of 12 months. The demographic characteristics, operative details, functional outcomes, and complications are presented below.

Table 1. Demographic Characteristics of the Study Population

Variable	Number (n=20)	Percentage (%)
Age (years)		
21–30	**3**	**15.0**
31–40	**7**	**35.0**
41–50	**6**	**30.0**
51–60	**3**	**15.0**
>60	**1**	**5.0**
Gender		
Male	**15**	**75.0**
Female	**5**	**25.0**

Observation: Most patients were males (75%), with the majority belonging to the 31–40-year age group.

Table 2. Clinical Profile of Patients

Variable	Number	Percentage (%)
Side involved		
Right	**12**	**60.0**
Left	**8**	**40.0**
Mechanism of injury		
Slip/Fall	**8**	**40.0**
Sports injury	**6**	**30.0**
Road traffic accident	**4**	**20.0**
Direct trauma	**2**	**10.0**
Duration from injury to surgery		
4–8 weeks	**5**	**25.0**
9–12 weeks	**8**	**40.0**
>12 weeks	**7**	**35.0**

Observation: Right-sided injuries and slip-and-fall injuries were more common. Most patients underwent surgery between 9 and 12 weeks after injury.

Table 3. Operative Characteristics

Parameter	Mean ± SD / n (%)
Tendon defect length (cm)	**6.3 ± 0.8**
Operative duration (minutes)	**112.8 ± 14.2**
Blood loss (mL)	**148.6 ± 28.5**
Hospital stay (days)	**5.6 ± 1.3**

Observation: The mean tendon defect length was 6.3 cm, and the average operative time was 112.8 minutes.

Table 4. Pain Assessment (VAS Score)

Follow-up	Mean ± SD	p-value
Preoperative	**7.5 ± 1.0**	
3 Months	**3.8 ± 0.9**	**<0.001**
6 Months	**2.2 ± 0.8**	**<0.001**
12 Months	**1.1 ± 0.8**	**<0.001**

Observation: Pain decreased significantly during the postoperative follow-up.

Table 5. Functional Outcome (AOFAS Score)

Follow-up	Mean ± SD	p-value
Preoperative	**46.2 ± 7.4**	
3 Months	**69.8 ± 6.5**	**<0.001**
6 Months	**82.5 ± 5.8**	**<0.001**

12 Months	**91.6 ± 4.5**	**<0.001**

Observation: There was a statistically significant improvement in AOFAS scores throughout follow-up.

Table 6. Achilles Tendon Total Rupture Score (ATRS)

Follow-up	Mean ± SD	p-value
Preoperative	31.8 ± 6.8	
3 Months	58.9 ± 7.2	<0.001
6 Months	74.5 ± 6.3	<0.001
12 Months	88.9 ± 5.7	<0.001

Observation: ATRS improved progressively, indicating excellent functional recovery.

Table 7. Recovery Parameters at Final Follow-up

Parameter	Result
Dorsiflexion (°)	18.6 ± 2.4
Plantar flexion (°)	42.5 ± 4.6
Plantar flexion strength (Grade 5)	15 (75%)
Able to perform single-leg heel rise	18 (90%)
Full weight bearing (weeks)	8.2 ± 1.1
Return to work (weeks)	15.4 ± 2.8

Observation: Most patients regained near-normal ankle motion and muscle strength by the final follow-up.

Table 8. Postoperative Complications

Complication	Number	Percentage (%)
Superficial wound infection	2	10.0
Delayed wound healing	1	5.0
Hallux weakness	1	5.0
Sural nerve paresthesia	1	5.0
Tendon adhesions	1	5.0
Re-rupture	0	0
Deep vein thrombosis	0	0

Observation: Minor complications occurred in a few patients, while no re-ruptures or deep vein thrombosis were noted.

Table 9. Patient Satisfaction

Satisfaction Level	Number	Percentage (%)
Very satisfied	13	65.0
Satisfied	6	30.0
Neutral	1	5.0
Dissatisfied	0	0

Observation: Overall patient satisfaction was high, with 95% of patients reporting satisfaction with the surgical outcome.

Table 10. Overall Functional Outcome (AOFAS Grading)

Functional Outcome	Number	Percentage (%)
Excellent (90–100)	14	70.0
Good (80–89)	5	25.0
Fair (70–79)	1	5.0
Poor (<70)	0	0
Total	20	100

Observation: At one-year follow-up, 95% of patients achieved excellent or good functional outcomes, demonstrating that gastrosoleus V-Y plasty with FHL tendon transfer is an effective and reliable procedure for managing chronic long-segment Achilles tendon defects.

DISCUSSION

Management of chronic Achilles tendon ruptures remains one of the most challenging problems in foot and ankle surgery because delayed presentation is associated with tendon retraction, poor tendon quality, muscle atrophy, and large defects that cannot be repaired primarily. Various reconstructive techniques have been developed, with the objective of restoring

tendon continuity, improving plantar-flexion strength, and enabling patients to return to their previous functional level. The present prospective study demonstrated excellent clinical and functional outcomes following gastrosoleus V-Y plasty combined with FHL tendon transfer in patients with chronic long-segment Achilles tendon defects.

The majority of patients in the present study were males (75%), with most belonging to the 31–40-year age group. Similar demographic findings have been reported by Maffulli et al. (2), who observed that Achilles tendon ruptures predominantly affect active middle-aged men due to increased participation in recreational sports and occupational activities. The higher incidence among males has been attributed to greater exposure to physical activity and differences in tendon loading patterns.

Right-sided involvement (60%) was slightly more common than left-sided injuries, and slip-and-fall accidents constituted the most frequent mechanism of injury (40%). Similar injury patterns have been described by Den Hartog (3), who reported that indirect trauma during routine activities and sports remains the leading cause of chronic Achilles tendon ruptures. Delayed diagnosis frequently contributes to chronic defects requiring complex reconstruction.

The mean tendon defect length in our study was 6.3 ± 0.8 cm, indicating substantial tendon loss. Such large defects generally cannot be managed by end-to-end repair alone. Kuwada (5) recommended tendon augmentation procedures for defects exceeding 5 cm, while Myerson (4) suggested tendon transfer techniques for larger chronic defects. The present findings support these recommendations, as satisfactory tendon continuity and function were achieved using combined V-Y advancement and FHL transfer.

Pain reduction following surgery was highly significant. The mean VAS score improved from 7.5 preoperatively to 1.1 at one-year follow-up ($p<0.001$). Similar improvements have been reported by Hahn et al. (8), who demonstrated substantial pain relief after FHL tendon transfer due to restoration of tendon biomechanics and improved ankle stability. Reduced pain contributes directly to improved rehabilitation and earlier mobilization.

Functional improvement assessed by the AOFAS Ankle-Hindfoot Score was remarkable in the present study. Mean scores increased from 46.2 preoperatively to 91.6 at final follow-up ($p<0.001$), with 70% of patients achieving excellent outcomes and an additional 25% demonstrating good results. These findings closely resemble those reported by Wapner et al. (6), who observed excellent functional recovery after FHL tendon transfer in chronic Achilles tendon reconstruction. Likewise, Maffulli et al. (9) reported postoperative AOFAS scores exceeding 90 in most patients undergoing combined reconstructive procedures.

The ATRS improved significantly from 31.8 preoperatively to 88.9 at one year, indicating restoration of patient-reported functional capacity. Similar improvements have been described by Nilsson-Helander et al. (11), who validated ATRS as an effective outcome measure for Achilles tendon surgery. Improvement in ATRS reflects better walking ability, reduced symptoms, and enhanced participation in recreational activities.

Recovery of ankle motion and muscle strength was satisfactory in the present study. The average dorsiflexion was 18.6°, plantar flexion reached 42.5°, and 90% of patients were able to perform a single-leg heel rise. Furthermore, 75% regained Grade 5 plantar-flexion strength. These findings compare favorably with those reported by Mulier et al. (10), who demonstrated restoration of near-normal ankle biomechanics following FHL tendon transfer. The anatomical line of pull and synchronized muscle activation of the FHL make it an ideal donor tendon for Achilles reconstruction.

Patients in the present study achieved full weight-bearing at a mean of 8.2 weeks and returned to work at approximately 15 weeks. Comparable rehabilitation timelines have been reported by Wegrzyn et al. (12), who advocated early protected mobilization after FHL reconstruction to enhance tendon healing while minimizing stiffness. Early rehabilitation protocols have consistently shown better functional recovery without increasing re-rupture rates.

Postoperative complications were minimal. Superficial wound infection occurred in two patients (10%), while isolated cases of delayed wound healing, hallux weakness, sural nerve paresthesia, and tendon adhesions were observed. Importantly, no patient experienced tendon re-rupture or deep vein thrombosis. Similar low complication rates have been documented by Maffulli et al. (9) and Hahn et al. (8), who concluded that FHL tendon transfer is a safe and reliable procedure with excellent long-term durability. Mild hallux weakness following FHL harvest generally has little impact on daily activities because of compensation by adjacent flexor muscles.

Patient satisfaction was high, with 95% reporting either very satisfied or satisfied outcomes. This finding reflects the substantial improvement in pain, strength, gait, and daily functional ability following surgery. High patient satisfaction has consistently been reported across multiple studies evaluating combined reconstructive techniques for chronic Achilles tendon ruptures (7,10).

Overall, the present study demonstrated that gastrosoleus V-Y plasty combined with FHL tendon transfer provides reliable tendon reconstruction for chronic long-segment Achilles tendon defects. The procedure achieved excellent functional recovery, significant pain reduction, restoration of ankle motion, low complication rates, and high patient satisfaction. The absence of re-ruptures further supports the biomechanical strength and clinical reliability of this combined reconstructive technique.

However, the present study has certain limitations. The relatively small sample size and single-center design may limit the generalizability of the findings. Additionally, the follow-up period of one year may not fully evaluate long-term tendon remodeling and late complications. Larger multicenter studies with longer follow-up are recommended to validate these encouraging results.

CONCLUSION

Gastrosoleus V-Y plasty combined with flexor hallucislongus (FHL) tendon transfer is a safe, reliable, and effective surgical technique for the management of chronic long-segment Achilles tendon defects. The procedure provides significant pain relief, excellent functional improvement, restoration of ankle motion and plantar-flexion strength, and a high rate of patient satisfaction with minimal complications. The absence of re-rupture and the predominance of excellent-to-good functional outcomes at one-year follow-up support this combined reconstructive technique as an effective option for treating chronic Achilles tendon ruptures with large tendon defects. Further studies with larger sample sizes and longer follow-up are recommended to validate these findings.

REFERENCES

1. Maffulli N, Ajis A. Management of chronic ruptures of the Achilles tendon. J Bone Joint Surg Am. 2008;90(6):1348–1360.
2. Maffulli N, Via AG, Oliva F. Chronic Achilles tendon rupture. Open Orthop J. 2017;11:660–669.
3. Den Hartog BD. Surgical strategies: delayed diagnosis or neglected Achilles tendon ruptures. Foot Ankle Int. 2008;29(4):456–463.
4. Myerson MS. Achilles tendon ruptures. Instr Course Lect. 1999;48:219–230.
5. Kuwada GT. Classification of Achilles tendon rupture with consideration of surgical repair techniques. J Foot Surg. 1990;29(4):361–365.
6. Wapner KL, Pavlock GS, Hecht PJ, Naselli F, Walther R. Repair of chronic Achilles tendon rupture with flexor hallucislongus tendon transfer. Foot Ankle. 1993;14(8):443–449.
7. Wilcox DK, Bohay DR, Anderson JG. Treatment of chronic Achilles tendon disorders with flexor hallucislongus tendon transfer. Foot Ankle Int. 2000;21(12):1004–1010.
8. Hahn F, Meyer P, Maiwald C, Zanetti M, Vienne P. Treatment of chronic Achilles tendon rupture with flexor hallucislongus tendon transfer. Foot Ankle Int. 2008;29(8):794–802.
9. Maffulli N, Spiezia F, Longo UG, Denaro V. Less-invasive reconstruction of chronic Achilles tendon ruptures using peroneus brevis tendon transfer. Am J Sports Med. 2010;38(11):2304–2312.
10. Mulier T, Rummens E, Dereymaeker G. Repair of chronic Achilles tendon rupture with flexor hallucislongus tendon transfer. ActaOrthop Belg. 2005;71(5):601–607.
11. Nilsson-Helander K, Thomeé R, Gravare-Silbernagel K, et al. The Achilles Tendon Total Rupture Score (ATRS): development and validation. Am J Sports Med. 2007;35(3):421–426.
12. Wegrzyn J, Luciani JF, Philippot R, Brunet-Guedj E, Moyen B, Besse JL. Chronic Achilles tendon rupture reconstruction using flexor hallucislongus tendon transfer. OrthopTraumatolSurg Res. 2010;96(3):325–330.