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## Functional outcome of Tendo Achilles augmentation using peroneus brevis grafting in Tendo Achilles rupture

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### Abstract

**Background:** It is difficult for orthopedic surgeons to repair a chronic total tendoachilles tendon. Tendoachilles augmentation with a Peroneus Brevis graft is one method for treating these tears. The study's goal is to evaluate how well the peroneus brevis graft for tendoachilles augmentation performed functionally. Furthermore, to compare the findings to research done by other authors that is already published

**Methods:** This is a prospective study of 30 patients with chronic tendoachilles tendon rupture conducted between May 2021 to May 2022 with a follow up of 2 years

**Results:** In our study, there were 14 female and 16 male participants, with the right side being the most often affected area. The patient's age ranged from 32 to 56 years, with a mean of 42.35 years. At the end of 18 months, all patients with tendoachilles augmentations could walk without experiencing any discomfort and were back to where they were before the injury. Following surgery, the average dorsiflexion and plantar flexion were (DF-17, PF-25). The modified Rupp score significantly increased from a mean of 2 prior to surgery to 23 following it. All patients were satisfied with the surgery and functional results.

**Conclusions:** Tendoachilles augmentation with peroneus brevis grafting is a good choice for treating Tendoachilles rupture. When compared to other grafts, the peroneus brevis graft provides good functional results when utilized to repair chronic tendoachilles tears.

**Keywords:** Chronic tendoachilles tear, tendoachilles augmentation, peroneus brevis grafting, Rupp score

### Introduction

Achilles Tendon is the strongest tendon in the body and is also the most commonly ruptured tendon in the body. Tendo achilles has no true synovial sheath unlike the flexor tendons of the hand, it is covered only by a paratenon and exogenous healing is not expected to occur as in case of healing from synovial fluid. The Incidence of tendo Achilles rupture Is 21 ruptures/1 lakh/ year<sup>[1]</sup>. Most commonly occurs in age groups of 4<sup>th</sup> to 6<sup>th</sup> decade. Most common site of tears is 4-6 cm superior to calcaneal tuberosity where tendoachilles is inserted. Blood supply to these areas is poor due to lesser number of blood vessels<sup>[2]</sup>. Tears are usually caused due to eccentric loading on dorsiflexed ankle with knee extended and also several mechanical factors like improper footwear with rigid shoes and running on irregular grounds also play an important role in tendoachilles rupture<sup>[3]</sup>. Side effects of Gout, Hyperparathyroidism, Steroid, Fluroquinolones may contribute to tendon rupture<sup>[4]</sup>. In chronic tendoachilles rupture the tendon sheath become thickened and adherent to retracted ends of tendon. Ruptured ends get significantly apart along with fibrosis in the gap. Compound rupture of tendoachilles is difficult to treat because end to end repair of such ruptured tendon is difficult and are prone to failure, infection and skin necrosis. Older injuries can lead to calf atrophy. Patient thereby gives history of sudden popping followed by pain over the posterior aspect of ankle. History of steroid injection given over the posterior aspect of the ankle<sup>[5]</sup>. Patient thereby experiences difficulty in walking, running, jumping, ascending/descending stairs due to dominant role of Tendo achilles for these activities.

Lack of pain and no obvious loss of plantar flexion can be misleading in up to 20-25% cases and diagnosis is often missed initially [6]. Proximal stump retraction produces shortening of proximal isometric plantar flexion strength of gastrocnemius soleus complex with weakness of plantar flexion of the ankle and flat foot gait without adequate push off. Diagnosis usually made clinically patient usually have visible and palpable defect over the back of the ankle, patient unable to walk over tip of toes on the involved limb. Calf squeeze test (Thomas test) thereby is performed while asking the patient to lie in a prone position for clinical diagnosis of this injury, foot thereby plantar flex involuntarily it would be the same in case of TA rupture as well as in normal individual. Active plantar flexion – intact due to partial rupture, recruitment of plantar flexor and plantaris muscle. X-rays can also be done to rule out associated calcaneal fracture and USG and MRI can be done to confirm the diagnosis of tendon rupture. Treatment of chronic Tendo achilles rupture usually different from Acute rupture as tendon ends have retracted. Management for such tendo achilles tear thereby demands surgical intervention. Conservative management can also be tried which thereby includes rest, Ice therapy, NSAIDS, physiotherapy, foot wear modification with custom insoles. Eccentric loading exercises have been proven to be effective to the tune of 60-90% [7]. Fredberg *Et al.* have found to have good improvement after peritendinous injection of corticosteroid injection only in short term [8]. If the defect between tendons is more than 3 cm after freshening the ends additional techniques of augmentation are necessary. Even in fresh ruptures repair of Tendo achilles should be augmented with tendon grafting, Tendon transfer, reinforcement with synthetic materials. The aim of the study is Peroneus brevis tendon transfer is thereby used for strengthening and repair of old or chronic tear of tendoachilles and outcome was assessed.

### Materials and Methods

This was a prospective cohort study conducted at Department of Orthopedics Saveetha Medical College and Hospital in Thandalam from May 1, 2022, through May 31, 2024. For the purpose of enhancing the healing of a chronic tendoachilles rupture, the Peroneus Brevis tendon was transferred during surgery on 30 patients. Patients with closed chronic rupture and those patients who are willing for the treatment, follow up and those who are qualified for anesthesia were included in the study, while patients with open traumatic rupture, peripheral vascular disease, diabetic patients, patients who are not willing for follow up were excluded. Three patients had a history of receiving a local steroid injection to alleviate posterior heel discomfort, although the ruptures occurred spontaneously in the other patients. All patients were seen either in the outpatient or emergency department and were advised to check into a hospital. After a thorough history was taken, including information about when the patient was injured and when they arrived at the hospital, information about any prior treatments was elicited, and a physical examination was then performed. The affected limb was then given a local examination, and findings like a deformity over the heel area, a restriction in the range of motion at the ankle, a Thomson test result that was positive, and a gait pattern were noted and documented. The Turco and Spinella study served as the foundation for the surgical approach. Patient was taken up for surgery under antibiotic cover (Inj.Cefglobe forte 1.5g IV BD) and was continued post operatively for 5 days. Under regional or general anesthesia, patients were

positioned in the prone posture. A tourniquet around the upper thigh was applied. The debris and foreign objects were cleared away. A posterolateral longitudinal incision was created and, if necessary, adjusted in accordance with the transverse or oblique wound. The sural nerve was protected by taking precautions not to get hurt. The torn tendon was trimmed, and (1-0 Vicryl/Ethibond) was used as a locking suture along the free tendon edge to stop the bundles from separating. The peroneus brevis tendon was located at its insertion at the base of the fifth metatarsal by a different incision. A tendon stripper was used to separate the tendon from the surrounding tissue. Additionally, the aponeurotic septum dividing the lateral from the posterior compartment was cut to allow the peroneus brevis tendon to be delivered through the proximal surgical site. The tendon was then mobilized proximally to extend its excursion by mobilizing its muscular belly. To create the same degree of equines in the wounded limb, the unaffected leg was observed in a resting equine position. The peroneus brevis tendon was next inserted through a mid-coronal slit in the distal stump of the Achilles tendon, and it was then reversed upward to reach the tendon's proximal end. Multiple interrupted sutures made with (1-0 Vicryl/Ethibond) were used to attach the tendon graft to the distal and proximal stumps of the Achilles tendon. The peroneus brevis tendon was inserted through a drill hole at the calcaneal tuberosity in individuals with an inadequate distal stump. Following surgery, an above-knee posterior plaster of Paris slab was placed, with the knee flexed 45 degrees and the ankle in gravity equinus. It was recommended that people move their toes actively and perform isometric calf muscle exercises. A below-knee slab was employed for an additional two weeks after the suture was removed in the outpatient department at week two. Plantar flexion, inversion, and eversion-focused activities for ankle movement were initiated in week 4. It was acceptable to use a walking aid when toe-touch weight bearing. After the ankle had recovered its complete range of motion, full weight bearing was permitted at week 8. The results during the 6-, 12-, and 18-month follow-up periods were evaluated using the modified Rupp score [Table-1]. During the follow-up, evaluations were conducted on both an objective and subjective basis. Using a modified Rupp score, subjective evaluation was conducted. During the objective follow-up assessment, the following factors were taken into account: the patient's capacity to stand on the operated side over their toes and range of motion over the ankle, neurological state of the foot, and other factors. Complications like re-rupture, superficial infection, hypertrophic scar, and hypoesthesia were also evaluated. SPSS version 17 was used to analyze the data. Statistical significance was determined by a P-value of less than 0.05.

### Results

Between May 2021 and May 2022, 30 patients with chronic tendoachilles tears who underwent tendoachilles augmentation with peroneus brevis grafting were examined. In our study, there were 14 females and 16 male participants, with the right side being more frequently impacted in 16 of the patients [Table-2]. The patient's age ranged from 32 to 56 years, with a mean of 42.35 years. Slip-and-fall accidents and sports injuries were the two most frequent types of injuries. The average amount of time between the injury and hospital admission was 10 months, with a range of 5 months to 2 years. There was a considerable increase in postoperative dorsiflexion and plantarflexion compared to the average dorsiflexion and plantar flexion of the limb at presentation,

which was DF - 10°, PF - 14°, ranging from DF -5°, -13°, PF- 10°, to 19°. The operated limb had an average dorsiflexion and plantar flexion of DF - 17°, PF - 25°, ranging from DF - 14° to 20°, PF- 23° to 28° [Table-3a]. There was a considerable improvement in postoperative Modified Rupp scoring from the preoperative average modified Rupp score of 2, which ranged from 1 to 4. The range of the post-operative modified Rupp score was 14 to 34, with an average of 23 [Table-3b] [Figure-1]. After 18 months, all patients were able to walk easily and pain-free and were back to their pre-injury state. In 4 patients, there was evidence of a superficial skin infection, which improved after receiving antibiotic treatment. Following the patient's appointment for hypertrophic scar excision and secondary suturing as well as with sufficient intravenous and oral antibiotic coverage, the hypertrophic scar was subsequently resolved. In our study, we did not experience any issues like re-rupture or hypoesthesia [Table-4] [Figure-2]. None of the patients were lost to follow up.

### Discussion

**Achilles** The body's strongest and most frequently torn tendon is the tendon, which is also the body's strongest. Contrary to the flexor tendons of the hand, the tendo achilles is solely covered by a paratenon and external healing, such as that caused by synovial fluid, is not anticipated. 4-6 cm superior to the calcaneal tuberosity, where the tendoachilles is implanted, is the most typical location for tears. the fourth to sixth decade of life, where it most frequently occurs. In our study, every patient complained of heel pain, walking difficulty, and ankle dorsiflexion when they arrived at the OPD or Emergency Department. The presence of a tendoachilles tear on the Thomson test. The preferred course of treatment would be peroneus brevis grafting for tendoachilles augmentation. Other methods of treatment include orthosis, direct end to end approximation of injured ends. Direct end to end repair of chronic tendoachilles tear is usually not successful due to the poor blood supply to tendoachilles which is usually the cause for rupture<sup>[9, 10]</sup>. Other tendons used for augmentation were plantaris tendon and flexor hallucis longus tendon<sup>[11,12,13]</sup>. The prone position was used for patients who were under regional or global anaesthesia. Around the upper thigh, a tourniquet was put on. The dirt and foreign bodies were removed. The transverse or oblique wound was taken into account when making a posterolateral longitudinal incision, which may have needed to be corrected. Precautions were taken to avoid injury in order to protect the sural nerve. To prevent the bundles from splitting, the ripped tendon was cut, and (1-0 Vicryl/Ethibond) was used as a locking suture along the free tendon edge. A separate incision was used to find the insertion of the peroneus brevis tendon at the base of the fifth metatarsal. To separate the tendon from the surrounding tissue, a tendon stripper was employed. The aponeurotic septum separating the lateral from the posterior compartment was additionally removed to enable the delivery of the peroneus brevis tendon through the proximal surgical site. The tendon was then moved proximally to loosen its muscular belly and increase its excursion. The uninjured leg was seen in an equine position while at rest, imitating the injured limb to the same degree. Next, a mid-coronal slit was made in the distal stump of the Achilles tendon, and the peroneus brevis tendon was introduced through it. It was then reversed upward to reach the proximal end of the tendon. The tendon graft was

connected to the distal and proximal Achilles tendon stumps using a number of interrupted sutures produced using (1-0 Vicryl/Ethibond). Those with an insufficient distal stump had the peroneus brevis tendon implanted through a drill hole at the calcaneal tuberosity. The knee was flexed 45 degrees and the ankle was in gravity equinus after surgery, and an above-knee posterior plaster of Paris slab was put in place. Exercises for the calf muscles that are isometric in nature and active toe movement were advised. Surgery was performed to evaluate the functional results of tendo achilles augmentation with peroneus brevis grafting in cases of chronic tendo achilles tears. The functional outcome was estimated using the modified Rupp score after the dorsiflexion and plantarflexion were assessed preoperatively and postoperatively. In comparison to the average dorsiflexion and plantarflexion of the limb at presentation, which were DF - 10°, PF - 14°, and ranged from DF -5°, -13°, PF- 10° to 19°, there was a significant increase in postoperative dorsiflexion and plantarflexion. The average dorsiflexion and plantar flexion of the operated limb were DF - 17° and PF - 25°, respectively, with a range of DF - 14° to 20° and PF - 23° to 28°. In comparison to the preoperative average modified Rupp score of 2, which ranged from 1 to 4, there was a significant improvement in postoperative Modified Rupp scoring. The post-operative modified Rupp score had a range of 14 to 34 and an average of 23. At the end of 18 months, all patients had recovered to their pre-injury state and were able to walk pain-free and pleasantly. Evidence of a superficial skin infection was present in 4 patients, which improved after receiving antibiotic therapy according to Singh *et al.*<sup>[14]</sup>. The hypertrophic scar was eventually resolved after the patient's visit for hypertrophic scar excision and secondary suturing, as well as with adequate intravenous and oral antibiotic treatment<sup>[15]</sup>. In our trial, no significant issues occurred, and no patients were lost to follow-up. Following the procedure, the functional results were all received favourably by the patients. Galant *et al.* observed mild objective weakness regarding these two aspects but in our study we noted such weakness in 4 patients<sup>[16]</sup>. 20 individuals who had chronic Achilles tendon ruptures repaired using the peroneus brevis tendon participated in a study by Hari O Aggarwal *et al.* developed superficial skin complications in 3 individuals, 3 of whom needed skin grafting surgery, and 1 of whom experienced a slow healing<sup>[17]</sup>. The tendon Achilles tendon was never ruptured again in any patient. At the 1-year checkup, every patient had a favourable functional outcome. Peroneus brevis tendon was used to treat the chronic Achilles tendon rupture in 16 individuals, according to Nicola Maffulli *et al.*<sup>[18]</sup>. None of the sixteen patients employed a heel lift or walked with a noticeable limp; all of the patients were able to stand on tiptoe. Compared to the contralateral limb, the affected limb was noticeably weaker. One patient ruptured the contralateral Achilles tendon five years after the initial injury, one patient acquired a tendinopathy of the rebuilt tendon, and one patient had a tendinopathy of the opposite Achilles tendon. Similar results were seen in our study, when patients were able to tiptoe walk, carry out daily tasks, and resume their pre-injury state after 18 months. We therefore conclude that tendoachilles augmentation utilising peroneus brevis grafting is a good alternative for the treatment of chronic tendoachilles rupture and provides good functional effects.

**Table 1:** Shows in questions scores and results

S. No	Questions	Results	Scores
1)	Subjective Satisfaction	Excellent	5
		Good	1
		Satisfactory	-1
		Poor	-5
2)	Whether patient is having pain on weight bearing	None	5
		Pain with extended weight bearing	1
		Pain with slight weight bearing	-2
		Continuous pain	-5
3)	Whether patient has pain independent of weight bearing	None	5
		Pain associated with weight bearing walking	1
		Pain present during rest	-2
		Continuous pain	-5
4)	Postoperative ankle function	Normal	±2
		Reduction of muscle strength	±2
		Tendency of swelling	±2
		Tendency of cramp	±2
5)	Fear of Rerupture	Yes	-1
		No	0
6)	Limitations in Patients Work	Do Not Apply	0
		None	5
		Minor	-1
		Major	-3
		Stopped activity due to Achilles tendon problem	-5
7)	Limitations in Sporting activities	Do Not Apply	0
		None	5
		Minor	-1
		Major	-3
		Stopped activity due to Achilles tendon problem	-5
8)	Total	>30	Excellent
		15-30	Good
		5-15	Fair
		<5	Poor

**Table 2:** Modified Rupp Scoring

Demographic features		Total no of patients (n=30)
Sex	Male	16
	Female	14
Side	Right	17
	Left	13

**Table 2:** Demographic features of patients with chronic tendoachilles rupture

Modified Rupp score (Objective score)		Non operated site	Operated side
Range of Motion	Dorsiflexion	Average – 26 degree	Average – 17 degree
	Plantarflexion	Average – 38 degree	Average – 25 degree
Toe Raise	Sustained	-	24
	< 60 seconds	-	4
	Unable	-	2
Neurological Examination	Sensory hypoesthesia in the area supplied by Sural Nerve	-	-
	Normal	-	30

**Table 3a:** Objective tests performed during follow up

Modified Rupp score (Subjective score)	Total no of patients (n=30)
Excellent	7
Good	20
Fair	1
Poor	2

**Table 3b:** Subjective tests performed during follow up

Complications	Total no of patients (n=30)
Rerupture	-
Superficial infection	4
Hypertrophic scar	2
Hypoesthesia	-

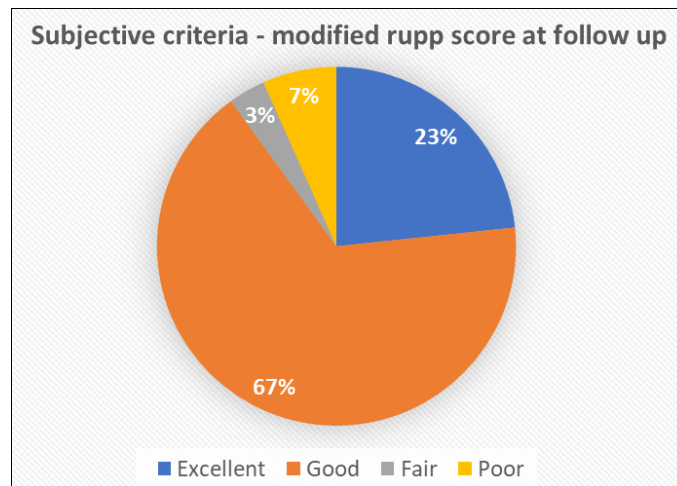


Fig 1: Showing the Subjective Criteria (modified Rupp score) of postoperative patients during follow up in percentage

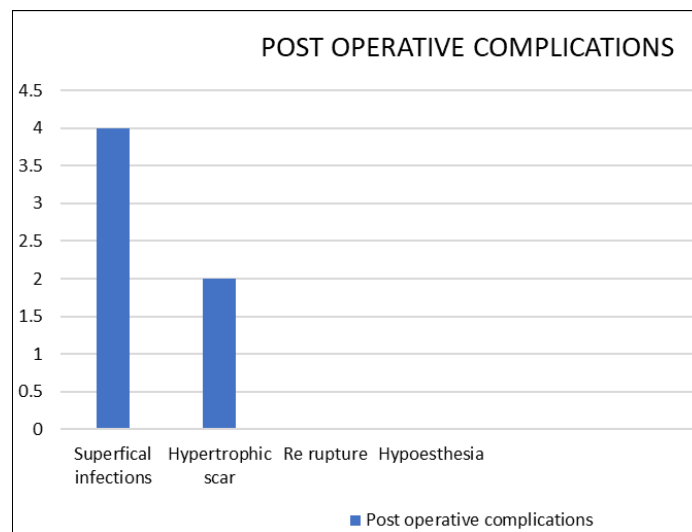


Fig 2: Shows the postoperative complications which were encountered during the follow-up period

Table 4: Master chart

S.NO	AGE/SEX	SIDE	MODE OF INJURY	DURATION OF TEAR	PREOPERATIVE DORSIFLEXION AND PLANTAR FLEXION	POST OPERATIVE DORSIFLEXION AND PLANTAR FLEXION	PREOPERATIVE RUPP SCORE	MODIFIED RUPP SCORE AT 6 MONTHS	MODIFIED RUPP SCORE AT 12 MONTHS	MODIFIED RUPP SCORE AT 18 MONTHS	COMPLICATIONS (RERUPTURE, SUPERFICIAL INFECTION, HYPERTROPHIC SCAR, HYPOESTHESIA)
1)	36/M	RIGHT	SLIP AND FALL	4 MONTHS	DF-10° PF-15°	DF-18° PF-26°	1	10	16	20	NIL
2)	34/F	LEFT	SLIP AND FALL	6 MONTHS	DF-12° PF-14°	DF-17° PF-24°	3	12	18	22	NIL
3)	45/F	RIGHT	SLIP AND FALL	3 MONTHS	DF-8° PF-12°	DF-15° PF-28°	4	18	24	28	NIL
4)	42/M	RIGHT	SLIP AND FALL	5 MONTHS	DF-10° PF-18°	DF-16° PF-27°	1	14	20	24	NIL
5)	47/M	LEFT	STERIOD INJECTION	4 MONTHS	DF-6° PF-19°	DF-14° PF-26°	2	20	26	30	NIL
6)	44/M	LEFT	SPORTS INJURY	6 MONTHS	DF-8° PF-17°	DF-15° PF-25°	3	22	28	32	NIL
7)	39/M	LEFT	SLIP AND FALL	7 MONTHS	DF-10° PF-17°	DF-17° PF-24°	1	24	30	34	NIL
8)	38/F	RIGHT	SLIP AND FALL	5 MONTHS	DF-12° PF-16°	DF-20° PF-25°	3	14	20	24	NIL
9)	52/F	RIGHT	SLIP AND FALL	6 MONTHS	DF-10° PF-18°	DF-15° PF-26°	4	12	18	22	HYPERTROPHIC SCAR
10)	50/F	LEFT	SLIP AND FALL	2 YEARS	DF-10° PF-16°	DF-14° PF-24°	1	10	16	20	SUPERFICIAL INFECTION
11)	48/M	RIGHT	SLIP AND FALL	4 MONTHS	DF-9° PF-15°	DF-17° PF-25°	2	08	14	18	SUPERFICIAL INFECTION
12)	44/M	RIGHT	SLIP AND FALL	4 MONTHS	DF-8° PF-14°	DF-18° PF-26°	1	10	16	20	NIL
13)	40/M	LEFT	SPORTS INJURY	6 MONTHS	DF-9° PF-12°	DF-16° PF-26°	4	22	28	32	NIL
14)	41/M	LEFT	SPORTS INJURY	5 MONTHS	DF-10° PF-15°	DF-18° PF-23°	1	10	16	20	NIL
15)	35/M	RIGHT	SPORTS INJURY	1 YEAR	DF-10° PF-13°	DF-18° PF-26°	1	18	24	28	NIL
16)	39/M	RIGHT	SLIP AND FALL	4 MONTHS	DF-11° PF-16°	DF-17° PF-25°	4	12	18	22	NIL
17)	37/F	RIGHT	SLIP AND FALL	5 MONTHS	DF-11° PF-18°	DF-17° PF-26°	3	06	12	16	NIL
18)	32/F	RIGHT	SLIP AND FALL	1 YEAR	DF-12° PF-11°	DF-14° PF-26°	2	04	10	14	NIL
19)	33/M	LEFT	SPORTS INJURY	5 MONTHS	DF-9° PF-12°	DF-18° PF-26°	1	04	10	16	NIL
20)	42/M	LEFT	SPORTS INJURY	5 MONTHS	DF-10° PF-12°	DF-19° PF-25°	3	08	14	18	NIL
21)	46/M	RIGHT	SPORTS INJURY	6 MONTHS	DF-10° PF-13°	DF-18° PF-26°	1	10	16	20	NIL
22)	45/F	RIGHT	SLIP AND FALL	2 YEARS	DF-11° PF-15°	DF-19° PF-23°	4	06	12	16	NIL
23)	40/F	RIGHT	SLIP AND FALL	1 YEAR	DF-10° PF-14°	DF-18° PF-26°	1	12	18	22	NIL
24)	41/F	LEFT	STERIOD INJECTION	2 YEARS	DF-13° PF-11°	DF-17° PF-28°	3	18	24	28	NIL
25)	36/F	LEFT	STERIOD INJECTION	2 YEARS	DF-10° PF-10°	DF-18° PF-26°	1	04	10	16	NIL
26)	39/F	LEFT	SLIP AND FALL	6 MONTHS	DF-5° PF-11°	DF-15° PF-27°	4	08	14	18	NIL
27)	37/F	RIGHT	SPORTS INJURY	1 YEAR	DF-10° PF-16°	DF-18° PF-26°	2	06	12	16	NIL
28)	56/F	RIGHT	SPORTS INJURY	2 YEARS	DF-11° PF-16°	DF-19° PF-28°	3	12	18	22	HYPERTROPHIC SCAR
29)	52/M	RIGHT	SPORTS INJURY	2 YEARS	DF-12° PF-15°	DF-18° PF-27°	1	18	24	28	SUPERFICIAL INFECTION
30)	50/M	LEFT	SPORTS INJURY	1 YEAR	DF-10° PF-17°	DF-16° PF-26°	2	20	26	30	SUPERFICIAL INFECTION

## Conclusion

According to this study, we can say that Tendoachilles Augmentation utilizing Peroneus Brevis Grafting is a good alternative for treating chronic tendon tears. The result is a positive functional outcome and the promotion of early mobilization. For the treatment of these fractures, we highly advise using it.

## Declarations

**Funding:** None

**Conflict of Interest:** None declared

**Ethical Approval:** Not required

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