



Post-surgical plantar fasciitis

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Current evidence suggest that plantar fasciitis is multi-factorial in etiology. The following report introduces an extended post-surgical nonweightbearing period (6-10 weeks) as a previously unknown cause of plantar fasciitis. Through a univariate statistical analysis, the present study compares the presence of heel pain in twenty patients who remained nonweightbearing for 2-6 weeks (group 1) and twenty patients who remained nonweightbearing for 6-10 weeks in the post-surgical period (group 2). Results indicate a statistically significant correlation ($p < 0.05$) between patients who endured an extended postoperative nonweightbearing period (group 2) and the presence of plantar fascial symptoms in the immediate weightbearing period. Findings of the present study suggest that a stretching regimen should be initiated prior to ambulation for patients remaining nonweightbearing greater than six weeks post-surgery.

Key Words: Plantar fasciitis, postoperative, nonweightbearing, heel pain, surgery, fascia

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Plantar fasciitis is one of the most common pedal pathologies requisitioning medical evaluation and treatment, which translates to over one million outpatient visits annually in the United States [1]. Though the pain associated with plantar fasciitis can be debilitating, the syndrome is characterized as self-limiting since approximately 90% of symptomatic patients find relief through conservative measures [2,3]. Plantar fasciitis is the result of multi-factorial etiologies from increased body mass index to ankle equinus [1,4]. The following retrospective analysis introduces the extended post-surgical nonweightbearing period as a previously unknown cause of plantar fasciitis.

Methods

A retrospective review of forty patients who underwent surgery between August 2010 and August 2011 was conducted. These patients remained nonweightbearing between 2 and 10 weeks in the postoperative period. Twenty patients who were completely offloaded between 2 and 6 weeks post surgery were consecutively enrolled in the study as group 1. Similarly, twenty patients who remained completely nonweightbearing between 6 and 10 weeks after surgery were consecutively enlisted as group 2. The six-week mark was considered the divide as most reconstructive surgeries involve offloading for more than 6 weeks. Additionally, all patients remained nonweightbearing between 2 and 10 weeks; thus 6 weeks is the mean week. Exclusion criteria included any prior complaint or treatment of plantar heel pain or any surgery involving the plantar fascia. Patients who bore weight in the heel or forefoot without a two-week nonweightbearing period were also excluded from the study.

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All patients were questioned as to the areas of discomfort in the beginning two weeks of the post-surgical weightbearing (WB) period. Specifically, each patient was questioned as to the presence or absence of heel pain. The heel was anatomically defined as the area underlying the calcaneal tuberosity. The presence of postoperative heel pain during the initial weightbearing period was recorded and statistically evaluated with a univariate analysis. If the patient related to having heel pain when first bearing weight, they were instructed to perform at least 15 minutes of calf stretching exercises daily. Patients were monitored until complete resolution of symptoms.

Results

Twenty patients in each group yielded usable results. A description of groups 1 and 2 are depicted in Tables 1 and 2, respectively. A statistically significant difference ($p=0.0002$) in the presence of heel pain in the early weightbearing period was found between patients who remained nonweightbearing between 2 and 6 weeks (group 1) and those who remained nonweightbearing between 6 and 10 weeks (group 2). Noting that the presence and resolution of symptoms are “yes” and “no” questions, the mean was calculated by assigning “yes” to 1 and “no” to 0. In group 1, 15% of patients reported heel pain during the first two weeks of bearing weight on the operated limb (Table 1). Of these patients, 100% reported total resolution of symptoms within the first six weeks of the weightbearing period with conservative calf stretching exercises. In group 2, 70% of patients reported heel pain during the first two weeks of bearing weight on the operated limb (Table 2). All patients who reported heel pain in both groups related complete relief of symptoms to the heel of the operated extremity within six weeks using conservative modalities, primarily through regimented stretching exercises. However, one patient in group 2 (patient 15) who reported significant relief without total resolution of symptoms was additionally fitted with custom-molded orthotics. With a stretching exercise protocol and orthoses, the patient found complete resolution within 6 weeks of bearing weight.

Discussion

Plantar fasciitis is a complex pathology involving the ligament-bone interface at the inferior aspect of the calcaneal tuberosity [3]. As a primary supporter of the plantar arch, the plantar fascia minimizes transverse plane motion between the calcaneus and metatarsals [3]. Vertical forces from the body travel down the body and exert pressure flattening the medial longitudinal arch [5]. Subjected to significant traction as weight is transferred from the rearfoot to the forefoot, the plantar fascia accommodates the transfer with minimal disruption to the plantar arch [6]. Biomechanical studies simulating total fascial release demonstrate extensive arch deformation in stance and over 200% increase in stresses to the long plantar ligament [7]. Rapid fascial elongation occurs before midstance, hence patients with plantar fasciitis present with sharp pains between heel strike and midstance [6]. Furthermore, research has shown that with 90N of force, the plantar fascia will stretch 4% with the failure point being the clamps [8]. Such research confirms the integrity of the plantar fascia and indicates the majority of the pathology occurs at the fascial-calcaneal interface.

Factors

As demonstrated in the present study, post-static dyskinesia is a hallmark of plantar fasciitis [3]. Frequently, patients give a history of sharp pain with insidious onset when first bearing weight after recumbent periods. Typically patients complain of maximal pain with initial ambulation in the morning. Plantar fasciitis is caused by bearing weight after a state of relative inactivity [9]. In the static nonweightbearing state, the plantar fascia is void of tension and thus rests in a contracted state [9]. In the immediate weightbearing period following recumbency, the plantar fascia undergoes a rapid elongation up to 4%, thus the patient experiences sharp, stabbing pains with initial weightbearing [6,8]. When extrapolating the recumbent state from a few hours to several weeks, the fascia is in a state completely void of weightbearing tension. Consequently, patients applying pressure to the heel of a limb which has not carried weight for a significant period of time will likely exhibit symptoms of plantar fasciitis as demonstrated by the current study.

Patient	Surgery	Heel pain while bearing weight	Nature of heel pain	Resolution of pain within 6 weeks
1	Subtalar joint fusion hardware removal	No	-	-
2	Percutaneous pinning of hallux fracture	No	-	-
3	Plantar condylectomy with PIPJ arthroplasty	No	-	-
4	2 nd metatarsal-cuneiform arthrodesis	Yes	Pain with initial few steps	Yes
5	Bunionectomy	No	-	-
6	Cheilectomy with excision of soft tissue mass	No	-	-
7	Digital amputations	No	-	-
8	Resection of fifth metatarsal head	No	-	-
9	Excision of flexor digitorum accessorius muscle	No	-	-
10	Bunionectomy with digital arthroplasty	No	-	-
11	Excision of Morton's neuroma	No	-	-
12	Metatarsal-phalangeal arthroplasty with digital arthrodesis	Yes	Sharp pain with initial WB	Yes
13	Open reduction internal fixation for metatarsal-phalangeal joint dislocation	No	-	-
14	Metatarsal-cuneiform exostectomy with resection of soft tissue mass	No	-	-
15	Metatarsal-phalangeal joint arthroplasty with capsulorrhaphy	Yes	Pain with initial WB	Yes
16	Removal of hardware of ankle fracture	No	-	-
17	Posterior ankle arthroscopy with resection of posterior talar process	No	-	-
18	Removal of calcaneal hardware	No	-	-
19	Partial ray resection	No	-	-
20	Metatarsal-phalangeal joint arthrodesis exostectomy with excision of soft tissue mass	No	-	-

Table 1 Heel pain in patients remaining nonweightbearing between 2 and 6 weeks (Group 1).

Previous research has demonstrated an increased incidence of plantar fasciitis in individuals experiencing weight gain in the cases of pregnancy or obesity [10]. The mechanical overload causes excessive strain to the arch supporting capacity of the plantar fascia resulting in microtears in the plantar fascia [3]. Histopathological analysis of fascial specimens in chronically symptomatic patients reveal fibroblastic proliferation and granulomatous tissue signifying the cyclic degeneration and limited inflammatory response sustained at the fascial origin [11]. MRI and ultrasound reviews indicate that the dorsal-plantar thickness of plantar fascia in symptomatic patients can increase to 10 mm in thickness, whereas normal plantar fascia is approximately 3 mm [12,13,14]. Though patients in the present study did not exhibit chronicity in their fascial symptoms, the weight gain generally associated with the post-surgical nonweightbearing period may have exacerbated plantar fascial symptoms demonstrated in the early ambulatory stage.

In addition to an elevated body mass index, studies have reported patients with limited ankle flexion to have an increased incidence of plantar fasciitis [10]. Patients with ankle equinus are unable to fully utilize

the entire length of the plantar fascia since the heel is bearing less than its proportional weight [10]. Similarly, in the nonweightbearing state the ankle usually rests in some degree of plantarflexion, thus allowing the plantar fascia to contract [9]. When patients begin ambulation after an extended nonweightbearing period, they may experience an incapacitating plantar fascial pain as demonstrated by the current study. All patients exhibited acute manifestations of fasciitis; hence, time to resolution of symptoms was abbreviated in the present study compared to clinical patients demonstrating chronic symptoms. With persistence of plantar fasciitis, pain becomes recalcitrant throughout the day and night [15]. Research correlates the presence of rest pain and night pain with a high failure rate of conservative treatment and serves as an indication for surgical intervention [15].

Patient	Surgery	Presence of heel pain while bearing weight	Nature of heel pain	Resolution of pain within 6 weeks
1	Opening based wedge bunion procedure with metatarsal osteotomy	No	-	-
2	First metatarsal-phalangeal joint arthrodesis	No	-	-
3	Achilles tendon debridement, repair, detachment, and reattachment with graft	Yes	Pain with heel placement on ground	Yes
4	Repair of posterior tibial tendon tear with removal of first metatarsal-phalangeal joint implant	Yes	Stabbing pain with first few steps	Yes
5	Midfoot arthrodesis with gastrocnemius recession	Yes	Painful initial steps	Yes
6	Bimalleolar ankle fracture	Yes	Excruciating pain when bearing weight	Yes
7	Subtalar joint fusion	Yes	Unable to bear weight on heel initially	Yes
8	Achilles tendon repair with detachment and reattachment	Yes	Stabbing pain with heel pressure	Yes
9	Peroneal groove deepening with repair of superior peroneal retinaculum	Yes	Pain with heel placement on ground	Yes
10	Tarsal tunnel with repair of posterior tibial tendon tears	Yes	Limping within first few steps	Yes
11	Resection of hypertrophic peroneal tubercle with repair of peroneal tendon	No	-	-
12	Ankle arthroscopy with lateral ankle stabilization	No	-	-
13	Augmented lateral ankle stabilization with repair of peroneal brevis and longus tendon tears	Yes	Excruciating pain when bearing any weight	Yes
14	Achilles tendon debridement, repair, detachment, and reattachment with graft	Yes	Shooting pains when pressure on the heel	Yes
15	Triple arthrodesis	Yes	Sharp pain with pressure to heel	Yes
16	Resection of os peroneum with peroneus longus-brevis tenodesis	No	-	-
17	Achilles tendon debridement, repair, detachment, and reattachment with graft	Yes	Stabbing pain with partial WB	Yes
18	Open reduction internal fixation of metatarsal fracture	No	-	-
19	Removal of posterior talar process with lateral ankle stabilization and repair of peroneus brevis tendon tear	Yes	Excruciating pain to heel in initial ambulation	Yes
20	Repair of peroneus brevis tendon tears with peroneal longus-brevis tenodesis and lateral ankle stabilization	Yes	Sharp pains with bearing weight to heel	Yes

Table 2 Heel pain in patients remaining nonweightbearing between 6 and 10 weeks (Group 2).

Treatment

Preliminary treatment protocols for acute plantar fasciitis involve regimented stretching exercises. Plantar fasciitis has earned the reputation of being a self-limiting condition since most patients achieve resolution of symptoms with conservative treatment alone as supported by the present study [2,16]. Stretching protocols often focus on either the posterior compartment of the leg or the plantar fascia itself. Prospective studies demonstrate that regular stretching of either focal point decreases overall pain and pain experienced with initial ambulation [17]. Fascial stretching exercises involve dorsiflexion of the hallux and lesser digits which passively tensions the plantar fascia [3]. Calf stretching exercises work by actively tensing the gastrosoleal complex as well as the

plantar fascia [4]. Over 80% of patients with plantar fasciitis demonstrate a concomitant equinus; consequently, equinus is characterized as an etiologic factor of plantar fasciitis [4]. Research has shown that calf stretching exercises result in increased ankle dorsiflexion which directly increases fascial stretch [18,19]. The effectiveness of calf stretching exercises alone is evident in the present study. Furthermore, one case in the current study supported the effectiveness of combining calf stretching exercises with custom molded arch supports as demonstrated by previous research [20].

Conclusion

To the author's knowledge, the following statistical analysis is the first to introduce an extended post-surgical nonweightbearing period (6-10 weeks) as an etiology of plantar fasciitis. The data presented suggests a statistically significant correlation between the length of postoperative nonweightbearing period and the presence of plantar fascial symptoms in the early ambulatory stage. The lack of fascial tension in the recumbent state, post-surgical weight gain, and ankle plantarflexion may be factors which intensify plantar fasciitis. These compounding factors deserve further research to clarify their significance in post-surgical plantar fasciitis. The clinical implication of the present research suggests that practitioners should implement stretching protocols prior to initiating ambulation. Accordingly, surgeons may facilitate a smoother transition to return to activity by preventatively countering plantar fascial symptoms. The current study is limited in its capacity to determine the full nature of post-surgical plantar fasciitis by its inability to accurately assess patient compliance to the nonweightbearing regimen and patient adherence to the prescribed stretching program. By correlating post-surgical plantar fasciitis in terms of ranges, the current study obviates the need to determine exact patient compliance to the nonweightbearing timeline. Moreover, the minute p -value ($p=0.0002$) indicates a strong correlation between a nonweightbearing postoperative period greater than six weeks and plantar fascial symptoms. In conclusion, the current study presents a new etiology and clinical scenario associated with plantar fasciitis which surgeons and practitioners may preventatively treat by implementing stretching protocols prior to ambulation for patients with a lengthened post-surgical nonweightbearing period.

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