T.C.

YEDİTEPE UNIVERSITY

INSTITUTE OF HEALTH SCIENCES

DEPARTMENT OF PHYSIOTHERAPY AND REHABILITATION

THE EFFECTIVENESS OF EXERCISES, MYOFASCIAL RELEASING AND MOBILIZATION TECHNIQUES IN PLANTAR FASCIITIS

MASTER THESIS

ELİF TUĞÇE ÇİL, PT.

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ONAY

Bu tez Yeditepe Üniversitesi Lisansüstü Eğitim-Öğretim ve Sınav Yönetmeliğinin ilgili maddeleri uyarınca yukarıdaki jüri tarafından uygun görülmüş ve Enstitü Yönetim Kurulu'nun 10./08./2018... tarih ve 2018/14-02...... sayılı kararı ile onaylanmıştır.

Prof. Dr. Bayram YILMAZ

Sağlık Bilimleri Enstitüsü Müdürü

DECLARATION

I hereby declare that this thesis is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person nor material which has been accepted for the award of any other except where due acknowledgment has been made in the text.

Elif Tuğçe ÇİL

DEDICATION

I would like to dedicate my thesis to my beloved and loving parents Mehtap and Mehmet Çil and my brother Mehmet Tuğberk Çil.

Elif Tuğçe ÇİL

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LIST OF SYMBOLS AND ABBREVIATIONS

Δ	Post Variables Minus Pre Variables
ACP	Autologous Conditioned Plasma
AJPS	Active Joint Position Sense
AP	Anterior-Posterior
APTA	American Physical Therapy Association
BMI	Body Mass Index
CPG	Clinical Practice Guideline
DM	Diabetes Mellitus
EDB	Extensor Digitorum Brevis
EDL	Extensor Digitorum Longus
EHB	Extensor Hallucis Brevis
EHL	Extensor Hallucis Longus
ESWT	Extracorporeal Shock Wave Therapy
F	Female
FDB	Flexor Digitorum Brevis
FDL	Flexor Digitorum Longus
FFI	Foot Functıon Index
FHB	Flexor Hallucis Brevis
FHL	Flexor Hallucis Longus
FHSQ	Foot Health Status Questionnaire
FL	Feiss Line
g	Gram
IMT	Intermetatarsal
IPJ	Interphalangeal Joint
JM	Joint Mobilization
JPS	Joint Position Sense
LAA	Longitudinal Arch Angle
LCL	Lateral Collateral Ligament
LLA	Lateral Longitudinal Arch
LLL	Low Level Laser
LLLT	Low Level Laser Therapy

LQYBT	Lower Quarter Y Balance Test
M	Male
MCL	Medial Collateral Ligament
MFR	Myofascial Releasing
ml	Millilitre
MLA	Medial Longitudinal Arch
mm	Millimetre
MRI	Magnetic Resonance
MT	Manual Therapy
MTPJ	Metatarsophalangeal Joint
N.	nervus
ND	Navicular Drop
NSAIDs	Nonsteroidal Anti-İnflammatory Drug
PF	Plantar Fasciitis
PHP	Plantar Heel Pain
PIP	Proximal Interphalageal Joint
PJPS	Passive Joint Position Sense
PRP	Platelet-Rich Plasma
RCTs	Randomized Controlled Trials
ROM	Range of Motion
RPM	Rounds Per Minute
s	Second
SIAS	Spina Illiaca Anterior Superior
SLR	Straight Leg Raising
SPSS	Statistical Package Analysis For Social Sciences
STM	Soft Tissue Mobilization
T0	Pre Intervention
T1	4th Week
T2	8th Week
TMT	Tarsometatarsal
TPDN	Trigger Point Dry Needling
US	Ultrasound
UT	Ultrasound Therapy

VAS	Visual Analogue Scale
WHO	World Health Organization
YBT	Y Balance Test

ABSTRACT

Çil, E.T. (2018). The Effectiveness of Exercises, Myofascial Releasing and Mobilization Techniques in Plantar Fasciitis, Yeditepe University, Institute of Health Science, Deparment of Physiotherapy and Rehabilitation,Master Thesis.Istanbul.

The aim of the study is to investigate the Effectiveness of Exercises, Myofascial Releasing and Mobilization Techniques in Plantar Fasciitis(PF). The study included 41 volunteers with PF(29F, 12M; 49,78±11,24 years) who were admitted Orthopedics and Traumatology department of Yeditepe University Istanbul, Turkey between November 2017 and May 2018.The sociodemographic features of participants were recorded by using a structured questionnare. The range of motion (ROM) of the ankle and the flexibility of gastrocnemius-soleus muscles were measured by using a goniometer. Proprioception assessment was applied with angle reproduction test in direction of dorsiflexion and plantar flexion by using electronic goniometer. The dynamic balance was evaluated byY balance test while foot sense was assessed with monofilament test from specific areas of each foot.Foot Function Index (FFI) was used for pain, disability and activity restriction while Visual Analogue Scale (VAS) for first step morning pain.The patients were randomly divided intoOutpatient Rehabilitation group (Group1, n=19) and Home Rehabilitation group (Group2, n=22). All subjects were participated in patient education program. Foot and ankle-hip exercises program, myofascial releasing, joint and soft tissue mobilization were applied to Group1 (twice a week totally 8 week) and foot and ankle exercises program were given for Group2 (8 weeks). The main results of our study revealed that the measurements of ROM, balance, proprioception, foot sense, flexibility, FFI and VAS were improved at 4th and 8th week in both groups($p<0.05$).The other result indicated that the means of plantar flexion ROM, balance, proprioception (dorsiflexion),foot sense, flexibility(gastrocnemius), FFI and VAS in Group1had more significant improvementthan Group2 ($p<0.05$).Consistent with hypothesis, Group1 which were applied exercises, myofascial releasing, joint and soft tissue mobilization by physiotherapist had statistically differences in terms of functional capacity, balance, proprioception, foot sense than Group2.In conclusion, we can recommend the combined protocol including foot and ankle-hip exercises program, myofascial releasing, joint and soft tissue mobilization than the only foot and ankle-hip exercises program in the management of PF.

Key Words:exercises,foot**,**foot function index, mobilization, myofascial releasing, physiotherapy, plantar fasciitis, proprioception

ABSTRACT(TURKISH)

Çil, E.T. (2018).Plantar Fasiitte Egzersiz, Miyofasyal Gevşetme ve Mobilizasyon Tekniklerinin Etkinliği. Yeditepe Üniversitesi Sağlık Bilimleri Enstitüsü, Fizyoterapi ve Rehabilitasyon ABD, Yüksek Lisans Tezi.İstanbul.

Bu çalışmanın amacı plantar fasiitisi (PF) olan bireylerde egzersiz, miyofasyal gevşetme ve mobilizasyon tekniklerinin ağrı, fonksiyonel kapasite, denge,duyu ve propriosepsiyon üzerine olan etkilerini araştırmaktır. Çalışmaya Kasım 2017-Mayıs 2018 tarihleri arasında Yeditepe Üniversitesi İhtisas Hastanesi,Ortopedi ve Travmatoloji Anabilim Dalı'na başvuran ve Ortopedi hekimi tarafından PFtanısı alan 41(29K, 12E; 49,78±11,24 yıl) gönüllü dahil edilmiştir.Katılımcıların sosyodemografik özellikleri yapılandırılmış bir anket kullanılarak sorgulanmıştır.Ayak bileği normal eklem hareket açıklığı(NEH) ve gastroknemius-soleus kaslarının esneklik değerleri gonyometre kullanılarak ölçülmüştür. Propriosepsiyon değerlendirmesi, açı reprodüksiyon testi ile dorsifleksiyon ve plantar fleksiyon yönünde yapılarak sapmalar kaydedilmiştir.Dinamik denge değerlendirmesi Y denge testi ile, ayak duyusu, ağrı hassasiyet bölgeleri baz alınarak monofilament testi ile, ağrı, yetersizlik, aktivite kısıtlılığı ise ayak fonksiyon indeksi(AFİ) ve sabah ilk adım ağrısı vizual analog skala (VAS)ile değerlendirilmiştir. Bireyler randomize olarak, ayaktan tedavi grubu (Grup1, n=19) ve evrehabilitasyon grubu (Grup2, n=22) olmak üzere iki gruba ayrılmıştır.Tüm katılımcılar hasta eğitim programına alınmış olup ayak-ayak bileği ve kalça egzersizleri, miyofasyal gevşetme, eklem ve yumuşak doku mobilizasyonu haftada 2 kez 8 hafta boyunca grup1'e uygulanırken, ayak ve ayak bileği egzersizleri grup2'ye verilmiştir.Her iki grupta bulunan hastaların NEH,denge, propriosepsiyon, ayak duyusu, esneklik, AFİ ve VASölçüm değerlerinde istatistiksel olarak anlamlıgelişmeler 4. ve 8. hafta sonuçlarında tespit edilmiştir($p<0.05$).Grup1 de bulunan hastaların plantar fleksiyon NEH, denge, propriosepsiyon (dorsifleksiyon), ayak duyusu, esneklik (gastroknemius), AFİ ve VAS skorları açısından Grup 2 ye kıyasla 8. haftada ilk haftaya göre istatistiksel olarak daha fazla gelişim gösterdiği tespit edilmiştir($p<0.05$).Hipotez ile uyumlu olarak,fizyoterapist tarafından egzersiz, miyofasyal gevşetme, eklem ve yumuşak doku mobilizasyonu gerçekleştirilen uygulamanın, Grup1 de Grup2 ye kıyasla ağrı, duyu, denge ve fonksiyonel kapasite üzerinde daha etkili olduğu bulunmuştur. Sonuç olarak, PF' li bireylerde ayak-ayak bileği ve kalça germe ve kuvvetlendirme egzersizleri, miyofasyal gevşetme, eklem ve yumuşak doku mobilizasyonu tedavi protokolunu öneriyoruz.

Anahtar Kelimeler:ayak, ayak fonksiyon indeksi, egzersiz, fizyoterapi, mobilizasyon,myofasyal gevşetme, plantar fasiitis, propriosepsiyon

1. INTRODUCTION AND PURPOSE

Plantar Fascia is a thick fibrous layer of fibrous connective tissue that protrudes from the medial tubercle of the calcaneus bone and adheres to the distal end of the metatarsophalangeal joints that form the longitudinal arch. The degeneration of the plantar fascia at end of the calcaneus is called plantar fascitiis [1]. Commonly, it can defiend as inferior heel pain. This can also be described as a pain that worsens especially in the first few steps taken after resting in the mornings, after long sitting or at the beginning of the exercise[2, 3]. Plantar fasciitis (PF) can be seen both in active sports and in sedentary populations [4]. It has been reported that between 8% and 15% in athletic and non-athletic populations had foot complaints[5].Although, the histopathology of PF cannot be definitively understood, the risk factors of PF are environmental (e.g. obesity, inappropriate footwear), anatomical (e.g. pes planus, pes cavus, lower limb length difference), biomechanical (e.g.lower extremity increased external rotation, pronation enhancement in subcortical joints, Achilles tendon shortness, plantar flexor shortness)[6]Recent studies have indicated that PF is not an inflammatory process, and that it develops as a secondary to myxoid degeneration, microleakage in the plantar fascia, collagen necrosis, and angioproblastic hyperplasic plantar aponeurosis[7]. In a study conducted, 78% of patients with plantar fasciitis who had heel pain were also shown to have a minimum 5 degrees limitation of dorsiflexion[8]. The pain because of PF causes functionally difficulty in daily activities, changing in balance oscillations and increases in risk of falls[9]. Surgical and non-surgical treatment methods are recommended for the treatment of PF. Although the number of studies showing efficacy of corticosteroid therapy in the literature are excessive, the evidences are limited. Researches on the efficacy of extracorporeal short wave therapy (ESWT) compared to other treatment modalities have also been found superior evidence in recent years,but the research methodologies of these field trials have been disputed. Low-intensity laser therapy and ultrasonographic studies are less evidence-based[10]. In a systematic review in Cochrain published in 2004, randomized controlled trials evaluated the results of steroid injections, ESWT, night splint, orthosis, and heel pad procedures in PF patients and reported limited evidence of these methods in reducing pain and improving functional levels[11]. In a guideline published in 2014, the treatment modalities was reviewed according to evidence levels. In this guide, clinicians emphasized that manual therapy, stretching exercises, and foot orthoses are more effective than electrotherapy modalities in the treatment of patients with PF, and the use of these treatments has been proposed[10].Additionally, the studies have shown that primary treatment goals of PF for clinicians are control of pain, improvement of mechanical function of plantar fascia, and increase of walking capacity and functional level[12].

The intrinsic and extrinsic muscles of the foot also support the medial arch. It makes walking easier by providing shock absorption. In patients with PF, the effects of strengthening exercises on these muscles have not been clearly explained in the literature [13]. The deficit of the abductor and lateral rotator muscle strength may also cause pronated foot, genu valgum, adduction and medial rotation of the knee. Thus, strengthening of the hip abductor and external rotator muscles in the treatment program may reduce such compensatory changes and the valgus of the knee[14]. However, the exercise protocols which include the hip region for the PF treatment are only one according to literature.

Stretching exercises for the plantar fascia and triceps surae are frequently used conservatively in the treatment of PF. Sweeting et al. [15] reported in a systematic review that stretching exercises would be effective in reducing pain for individuals with PF. However, there is no consensus on the appropriate number of repetitions and exercise frequency in this respect. Studies on the effects of exercise protocols involving combinations of stretching and strengthening exercises are very limited.

In some studies, it has been reported that myofascial restraint in the gastrocnemius muscle may lead to heel pain. In case of decreased flexibility of myofascial tissue, painful responses are obtained during compression and muscle contraction[5]. If the myofascial tissue is relaxed (MFR) by applying a low-intensity and long-term stretch to the myofascial tissues, gaining optimal length, reducing pain and improving function can be achieved [16, 17]. Although MFR can be used in treatment strategies,the studies published in this area are still insufficient.

In a recent systematic review, it has been reported that manual therapy procedures involving joint and soft tissue mobilization in individuals with PF has strong evidence that are used to improve lower extremity joint mobility and flexibility of the calf muscle, reduce pain, and improve function. This systematic review also provided strong evidence for efficacy of stretch to specificially calf and plantar fascia [10].

The aim of this study is to investigate the effectiveness of patient education, exercises, myofascial releasing, joint and soft tissue mobilization program which are applied in the clinics compared with the results of the patient education and exercise program given as home schedule.

Two hypotheses identified in the study:

H0: Patient education, foot and ankle stretching and strengthening exercises are/ are not effective on pain, balance, foot sense, functional capacity and proprioception.

H1: Patient education, foot and ankle – hip stretching and strengthening exercises, myofascial releasing, joint and soft tissue mobilization are/ are not effective on pain, balance, foot sense, functional capacity and proprioception.

2. THEORETICAL FRAMEWORK AND LITERATURE REVIEW

2.1.Foot and Ankle Anatomy

The human foot is a complex mechanical structure with a very articulated body consisting of 26 bones, 33 joints and soft tissues[18]. Human feet is located somewhat in a unique direction other than the axial skeleton[19].

2.1.1. Bones,Tendons and Ligaments

The foot and ankle complex is a specific structure of the distal tibia and fibula with 7 tarsal, 5 metatarsal and 14 phalangeal bones with static and dynamic load bearing function[20].Foot consists of three functional units: fore, mid, rear. The rear foot is formed by the talus and the calcaneus bone, while the tarsal bones namely navicula, cuneiforms and cuboid form the middle foot while metatarsals and phalanges are components the fore foot[21] (Figure2.1).

Rare(Hind) foot: Talus and Calcaneus

Mid foot: Cuboid, navicular and three cuneiform bones

Fore foot: Metatarsals and phalanges bones[22].

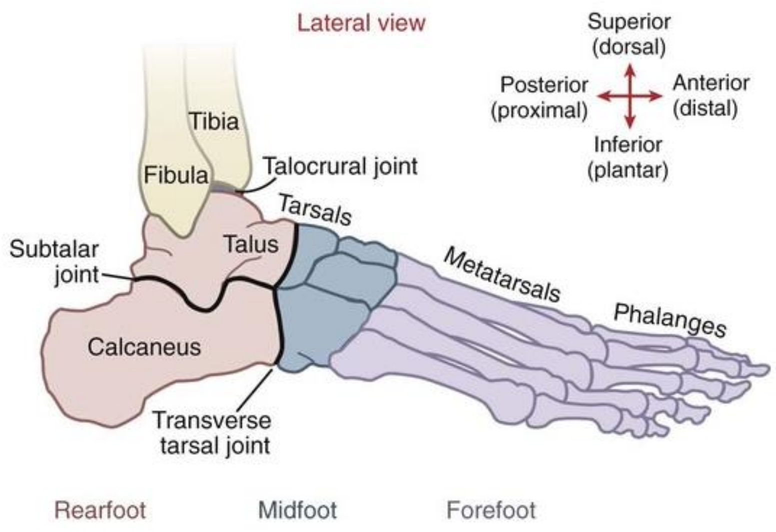


Figure2.1. The functional units of Foot [23]

Rare(Hind) Foot

The talus; provides the connection between the foot and the lower extremity[24]. Articulation cartilage covers more than half of this bone inferiorly, superiorly, medially and laterally[25]. Talus composes the proximally talar body, distally talar head and talarneck connecting these two parts. The body articulates with the tibia in the proximal - medial and the fibula in the lateral and in the inferior with calcaneus[26].Talar head with a convexity articulates with the navicular at the distal end. Talar head with the talar neck are turned to inferiomedial and this position plays asignificant role in preserving shape of longitudunal arch [27].Talar head can be palpated on the front of the ankle.Palpation at equal intervals from medial and lateral side indicates that the subtalar joint is in neutral position. The head is felt more in medial side,it means thatthe subtalar joint is pronated, if it is felt more in lateral side, it demonstrate thatthe subtalar joint is in supine[28](Figure2.2).

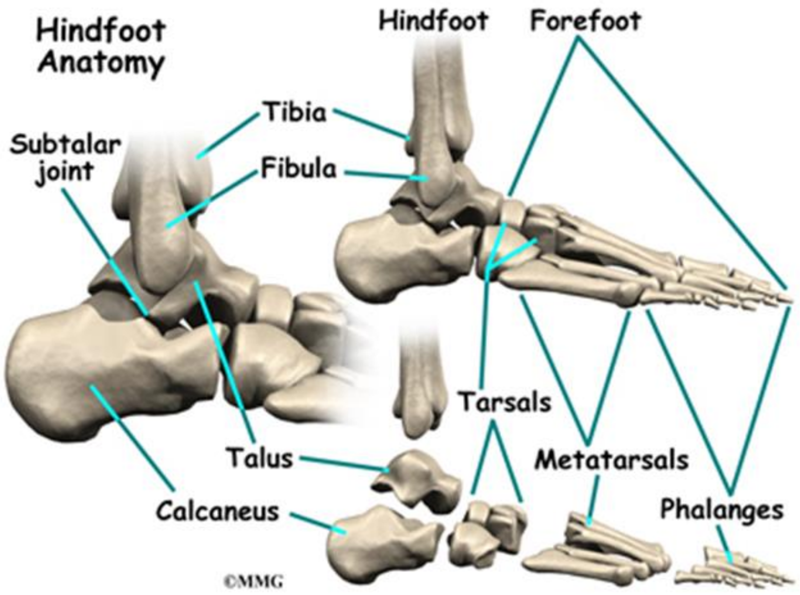


Figure 2.2. The anatomy of hindfoot[29]

The Calcaneus is the largest tarsal bone.Calcaneus is divided into 3 compartments: posterior, middle and anterior. The posterior aspect of the talus also brings up the joint formation with the middle part of the calcaneus. There are middle and anterior articular faces in the superior part of the anterior calcaneus. The joint is connected with sustentaculum tali,which is located in the middle joint calcaneus and supports the talus head.The larger anterior face supports the talus head. While the Sulcus at the superior separates the posterior and middle articular surfaces from each other, brings about sinus tarsi together with the sulcus in the talus plantar face. The posterior part of the calcaneus forms the momentum of the Achilles tendon. The portion of the posterior plantar face that contacts the ground during the loading of the calcaneus is called the calcaneal tubercle. Plantar fascia and most of the plantar instrinsic muscles of the foot originate from the calcaneal tubercle[20, 30](Figure2.2).

Mid Foot

It is composed of 5 tarsal bones which navicula is on the medial, cuboid is on the lateral and 3 cuneiform bones are on distal side.The navicular bone is located in front the talus, and articulates the whole tarsal bones. There is an inner tubercle at the medial aspect of the navicula which is clinically important[31]. The inner tubercle of the navicula can be palpated 2-3 cm below the medial malleolus and anterior to sustentaculum tali. The cuboid bone is articulated with the proximal faces of the 4th and 5th metatarsal bones in the anterior while in the medial, it is articulated with third cuneiform bone and the lateral ligament of the navicular.Cuneiform bone is formed by three bones. Medial cuneiform is the largest one. The middle and lateral cuneiform bones are wedge-shaped with narrow side down. According to this shape the middle and lateral cuneiform bones play important role for comprising and preserving the transverse arch.They are articulated with the navicula proximally and the proximal of the first 3 metatars distally. Middle cuneiform articulates with 1. Cuneiform in the medial, 3. cuneiform in the lateral, whereas third cuneiform bone joints with cuboid bone in the lateral[32](Figure2.3).

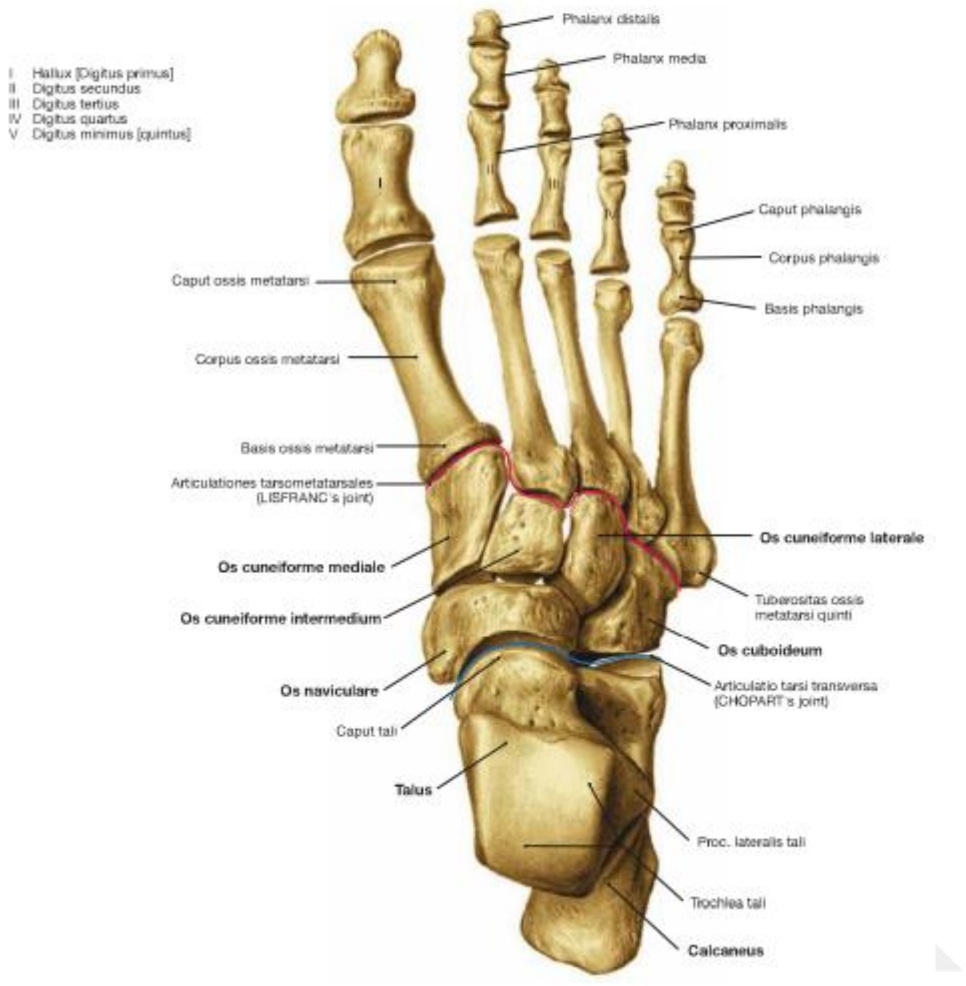


Figure 2.3. The anatomy of the foot [33]

Forefoot

It includes 5 metatars and 14 phalanges bones. First metatars is shorter and thicker than other metatarsals. The second metatars is the thinnest and longest. The proximal parts of metatarsal bones articulate with cuneiforms, cuboid with each other. There are 2 phalanges on big toe and 3 phalanges on the other toes.The proximal articular surfaces of the proximal phalanxes are concave to accommodate metatarsal heads. The proximal joint surfaces of the middle and distal phalanges conform to the distal trochlear joint surfaces of the proximal and middle phalanges[33](Figure2.4).

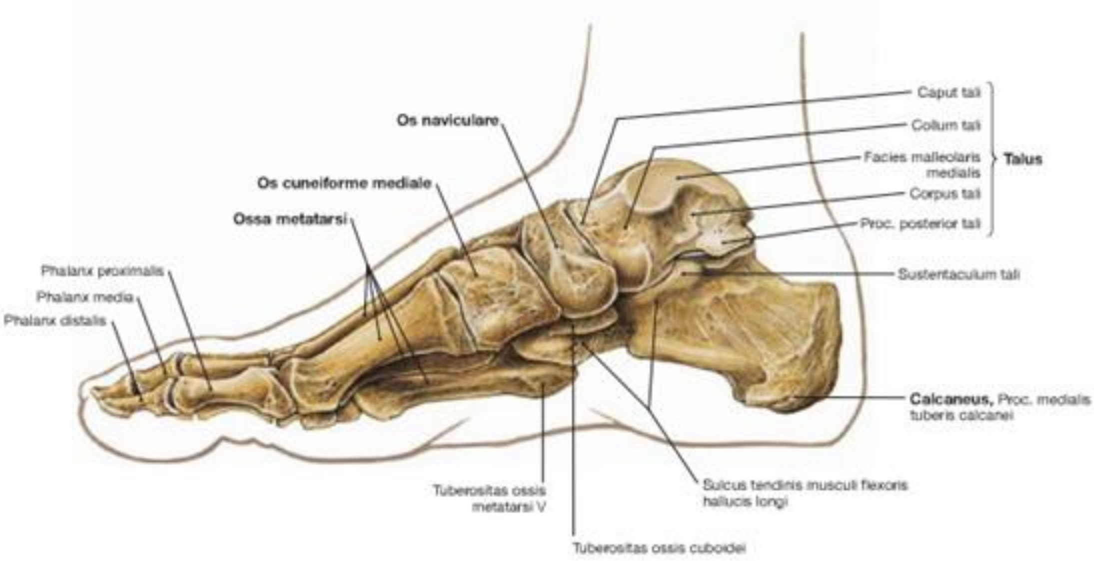


Figure 2.4: The anatomy of forefoot[33]

2.1.2. Muscles and Nervous System

Foot muscles are anatomically consist of intrinsic and extrinsic. Extrinsic muscles originate from tibia, fibula and femur while instrinsicsoriginate from tarsal bones[34].

Extrinsic muscles

Anterior groupof leg and foot muscles

Extrinsic muscles in the anterior group of the leg and foot are extensor hallucis longus(EHL),tibialis anterior, and extensor digitorum longus(EDL). Tibialis anterior starts from interosseous membrane, lateral, anterior and proximal half of the tibiaand inserts to the base of the first metatars and medial cuneiform. The foot is inverted and dorsiflexed by the tibialis anteriormuscle.

Extensor digitorum longus(EDL)arises from the fibula, lateral side of the tibia, interosseous membrane, and the fibula and sticks to the distal phalanges of 2 to 5th toes. Toes are extended by extensor digitorum longus.

The extensor hallucis longus(EHL) begins from theinterosseus memrane and fibula terminates in the distal phalanx of the great toe.The thumb is extended by the extensor hallucis longus.

Tibialis anterior is longest muscle and strongest dorsiflexor of foot.Extensor hallucis longus and extensor digitorum longus are auxiliary muscles of the tibialis anterior in the dorsiflexion movements of the ankle. Throughout the swing phase of the gait, the dorsiflexors permit the foot to elevate away from the ground and provide the eccentric contraction after the heel strike to control steps. Dorsiflexor muscles do not have great muscle strength as not being very active in daily activities and due to low muscle power so, the strength of the dorsiflexor muscles is 25% of the strength of the plantar flexors [35, 36].The anterior part of the extrinsic leg muscles are innervated by the nervus peroneus profundus.

Posterior groupsof leg and foot muscles

Superficial posterior group

Superficial group muscles are plantaris, gastrocnemius, soleus.The gastrocnemius starts at the medial and lateral condyles of the femur, inserts at posterior part of calcaneus.Soleus muscle arise from posterior aspect of tibia and fibula, which together with the gastrocnemius muscle ends up posterior tuberiositas calcanei, forming the tendon of the Achilles which is the strongest of the body.These two muscles bring plantar flexion to the ankle joint and at the same time, gastrocnemius contributes to the formation of the flexion movement in the knee joint. Plantaris is a long, thin muscle and enclosed of two joints and also, beginning from the lateral condyle of the fibula and terminating posteriorly of the calcaneus. It helps knee flexion and ankle plantar flexion[35].

Plantar flexion allows the body to move forward and upward. This movement is the strongest movement of the ankle and the foot. To protect the upright position of the body against gravitation, and forward movement of the body during walking, needs strong plantar group muscles. Other muscles except than gastrocnemius, soleus and plantaris contribute only 7% to the plantar flexor force. The plantar flexor muscles contracts eccentrically, preventing the foot from going straight to the dorsal flexion and allowing the movement to take place in a controlled manner and also, checkforward rotation of the tibia on the foot throughout walking. Gastrosoleus contributes to the formation of the supine movement while the forefoot is in the final phase of the stance phase of the gait cycle. The most effective plantar flexor during stance phase of the gait cycle is the soleus muscle. A shortened soleus muscle brings a functional short leg that is the most encountered situation to drive a car.

Inelastic or shortened soleus restricts the movement of the dorsiflexion, which stimulates the pronation movement. This pronation movement that occurs results in a short functional extremity.Posterior group muscles are inervated by the N.tibialis[35].

Deep posterior group

Posterior deep group muscles are tibialis posterior, flexor digitorum longus(FDL) and flexor hallucis longus(FHL). These muscles pass behind the ankle joint and help to move the plantar flexion of the foot. Tibialis posterior muscle is the deepest in which starting from the posterior of the tibia and fibula and interosseous membrane.The tendon passes behind the medial malleolus, then the some fibers of the tendon extends to the navicular and some fibers extend to the cuboid, cuneiform, the base of the 2nd, 3rd and 4th metatarsals.

The flexor hallucis longus beginning from interosseus membrane and fibula, terminating in the distal phalanx of the great toe.The most important function is the thumb plantar flexion, and also contribution to the formation of inversion and plantar flexion movement of the ankle joint.Flexor digitorum longus(FDL) starts from the posterior tibia and ends in distal phalanges. It makes lesser toes plantar flexes and also, help the foot inversion and plantar flexion.One of the most important muscles with inversion of the foot is tibialis posterior and also, it supports the stabilisation of the medial longitudinal arch(MLA) and helps the formation of plantar flexion in the ankle joint. When foot comes inversion, front leg is adducted by flexor hallus longus(FHL) and extensor hallucis longus(EHL).Deep posterior group muscles are innervated by N.tibialis[34, 35].

Lateral group muscles

Lateral muscle group consists of peroneus tertius, peroneus longus and peroneus brevis muscles.The peronous longus muscle beginning from the introsseous membrane and the 2/3 proximal of the fibula, ends at the base of the first cuneiform and the first metatars. It has function to foot plantar flexion and eversion and also, propsthe transverse and lateral longitudinal arches(LLA) of the foot.

Peroneus brevis muscle starts from 2/3 distal of the fibula, passes under the superior and inferior retinaculums and inserts to the base of the 5^{th}metatarsal. Peroneus brevis make eversion and plantar flexion.

Peroneus tertius muscle does not exist in all people and it is difficult to determine the extensor digitorum longus(EDL) as a part of it. Peroneus tertius muscle starts from distal and inferior part of the fibula and terminates at the base of the fifth metatars. It contributes to the movement of dorsiflexıon and eversion of the foot.The peroneal muscles extending along the lateral long axis of the fibula make the foot eversion and also, controls fine motor movement of the great toe. Lack of stabilization observed in the first metatarsal due to peroneus longus weakness may cause hypermobility in the medial aspect of the foot.Peroneus brevis and peroneus tertius are also responsible for the stabilization of the lateral aspect of the foot. Peroneus longus and brevis muscles are innervated by N.peroneus superficialis[35].

Intrinsic muscles

Dorsal group muscles

The the extensor hallucis brevis(EHB) and extensor digitorum brevis(EDB)muscles are located on the dorsal side of foot. The extensor digitorum brevis begins from the calcaneus, terminates in the 2 to 5 proximal phalanges and acts as extensor. The extansor hallucis brevis (EHB) starts from the calcaneus, ends in the proximal phalanges of great toe and extends toe. It is innervated by the N. peroneus profundus[35].

Plantar group muscles

First Layer

The adductor hallucis (ADH) muscle originates from medial tubercle of the calcaneus and attaches to side of proximal medial phalanges and great toe. It makes great toe abduction and flexion of interphalangeal joints(IPJ). It also promotes medial longitudinal arch[35].

The flexor digitorum brevis(FDB) starts from the medial tubercle of the calcaneus, ends in the middle phalanges of four fingers, makes the interphalangeal jointsflexion and also, supports the medial and lateral longitudunal arch. The abductor digiti minimi(ADM)beginning from the medial and lateral tubercles of the calcaneus, terminating at the base of the fifth distal phalanx and Works for fifth phalanx abduction and flexion. Also, supports the longitudinal arch and innervated by the Nerves tibialis[35].

Second Layer

The lumbricals in the second layer begin from the tendon of flexor digitorum longus, ending in proximal phalanges and work as metatarsophalangeal joint(MTPJ) flexion, extensor to proximal and distal interphalangeal joints. It is innervated by the N.Tibialis[34, 35].

Third Layer

The flexor hallucis brevis begins from tarsal bones, ends at great toe and medial and lateral sides of proximal phalanx. It is metatarsophalangeal joint flexor of the great toe. The adductor hallucis originates from the first metatarsal, terminates at the thumb and the lateral side of the proximal phalanx and first finger to adduct and flexion. The flexor digiti minimi starting at fifth metatars, attaching at fifth proximal phalanx, makes the PIP flexion and innervated by the N.tibialis [34, 35].

Fourth Layer

There are 3 interosseous muscles on the plantar and 4 on the dorsal sides. The plantar muscles are responsible for the adduction and the dorsal work for the abduction andinnervated by the N.tibialis. [34, 35].

2.2.Foot and Ankle Joint Biomechanic

2.2.1. Arches of Foot

The bones with the ligaments and muscles supporting them constitute 2transverse and 2longitudinal arches of the foot. The curves of arches are protected by the dynamic effects of the muscles, the joints and the ligaments.Mechanical energy is stored by the foot arches during walking and spend during walking[37](Figure 2.5).

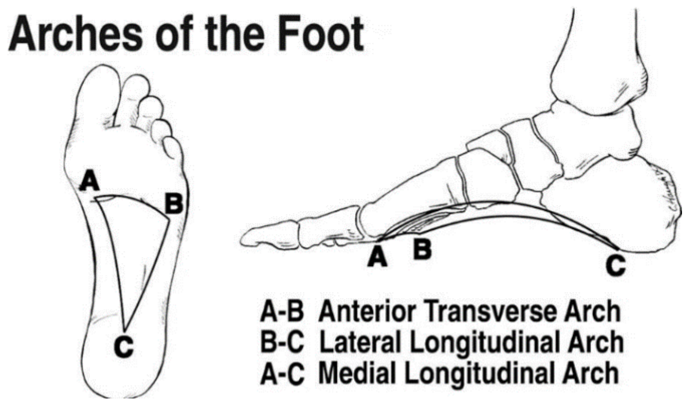


Figure2.5. The arches of the foot[38]

Longitudinal Arches

It consists 2 parts; medial and lateral. The medial arch is constituted by calcaneus, talus navicula, cuneiform, and plantar calcaneonavicular ligament with the first three internal metatarsals. The medial arch (MLA) is more prominent than the lateral arch.

The lateral arch consists of calcaneus, cuboid, and 2 outer metatarsals. These two arches provide foot strength to support body weight and foot flexibility during walking.These arches are dynamically supported as primarly by peroneus longus and tibialis anterior muscles. These muscles provide dynamic support by acting as a hook for the foot arch[37].

Transverse Arches

Posterior transverse arch is constituted of navicula and cuboidal bones.The anterior transverse arch is formed by the head parts of the metatarsals and is dynamically supported by the peroneus longus and tibialis anterior muscles. These arches are mainly engaged in pronation and supination[37].

2.2.2. Talo-crural joint (ankle joint)

It is a snovial type with ball-socket formed by 3 connections; distal tibiofibular, tibiotalar and fibulotalar.The joint surfaces are perfectly aligned with each other, very stable capacity of the weight of the body reaching 1.5 times when walking and 8 times when running with this unique anatomic structure and strong ligaments and covered with hyaline cartilage which is harder and slimmer than the hip and knee joint [39, 40].The collateral ligaments are non-contractile supporters of the ankle and divided in to medial and lateral collateral ligaments which have 2 parts; deep and superficial. The posterior tibiotalar fibers (deep part) continue from the tibia to talus and it is a strong ligament of tibiotalar joints. The superficial fibers, also called tibionavicular ligament, extend from the tibia to the navicula and calcaneus, thus supporting the subtalar joint and the ankle. While the anterior and posterior talofibular ligaments forming the lateral collateral ligament directly support the ankle, the calcaneofibular ligament supports both the ankle and the subtalar joint.The deltoid ligament (medial collateral) counteracts valgus stresses while the lateral collateral ligament resits to varus[40](Figure2.6).

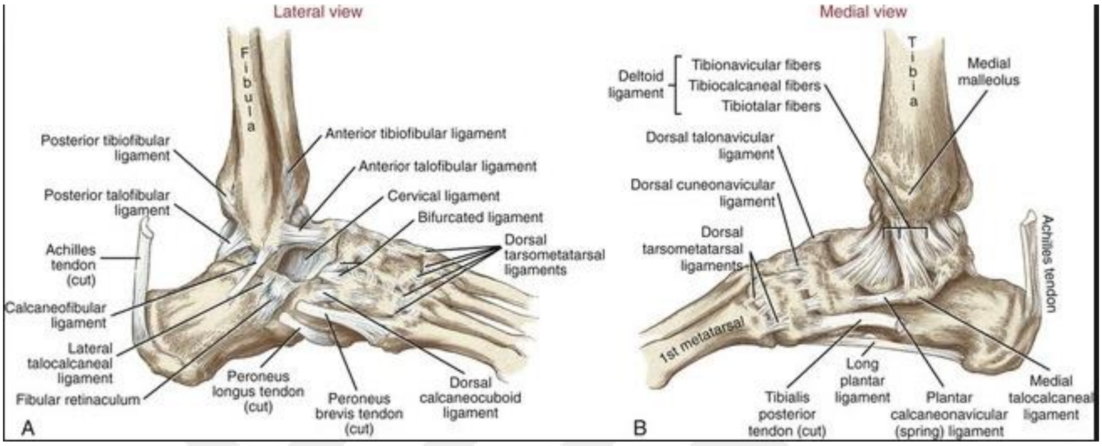


Figure 2.6. Right ankle (A) the lateral collateral and distal tibiofibular ligaments, and (B) deltoid (medial collateral) ligament[23].

2.2.3. Subtalar joint

Functionally, the subtalar joint consists of 3 facets between talus and calcaneus[41]. It is a hinge type joint and allows the transfer of the tibia during walking and adapts the foot to different grounds or sudden direction changes. The interosseous talocalcaneal ligament, which is very strong bond with the medial and lateral talocalcaneal ligaments supports joint capsule and adheres to the cartilage parts of the both talus and calcaneus, is a construct that stabilizes and holds the joint anatomically(Figure2.7).

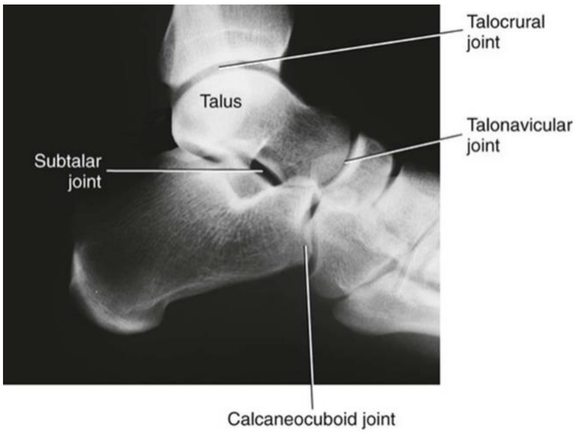


Figure 2.7. The radiograph of a healthy right the proximal joints of the ankle and foot[23]

2.2.4. Midtarsal Joint

Transverse tarsal jointis a complex structure also called Chopart joint and formed by talonavicular and calcaneocuboid joints[42].

Talonavicular Joint

The convex talar head articulates with the concave posterior face of navicula is convexity and concavity that provides the ability to motion the joint. It has 3 planar movements including supination and pronation as in the other joints of the foot and contributes more to the plantar flexion of the foot with lower limb movements[42, 43] . Studies have shown that 12% of the first 30-degree of the plantar flexion is performed by the talonavicular joint[43]. Additionally, it out abduction / eversion or adduction / inversion movements with pronation and supination[44]. With these properties, talonavicular joint is similar to subtalar joint[43].

Calcaneocuboid Joint

It is a saddle-type joint supported by synovial capsule and ligament. The dorsal side is supported by the bifurcated(Y) ligament composed of dorsal calcaneonavicular and dorsal calcaneocuboid ligaments while the plantar side is supported by short and long plantar ligaments.

The short plantar ligament, also known as the plantar calcaneocuboid ligament, is deeply in the direction of the plantar side of the cuboid from the anterior part of the calcaneus and it is also strong ligament that supports the lateral longitudinal arch[45]. The long plantar ligament starts from plantar side of the calcaneus to plantar side of the cuboid and sticks on from here to 2-4 or 5th of proximal of the metatarsal[46]. Studies have shown that the amount of movement occurring in the calcaneocuboid joint is less than talonavicular[42].

2.2.5. Distal Intertarsal Joints

Distal intertarsal joints are located between lateral cuneiform and cuboid with naviculocuneifom joints. Additionally, the joints where the cuneiform bones are brought to themselves are in this group. These joints are supported by the joint capsule and ligaments in the dorsal and plantar sides. The movements in these joints are quite restricted and only promote to the psupiantion-pronation movement of foot with only a few degrees[20].

2.2.6. Tarsometatarsal and Intermetatarsal Joints

Tarsometatarsal (TMT) joints are also known as lisfranc joints. The joint capsule supporting this joint is in 3 synovial segments. The first one is the joint between the first metatarsal bone and medial cuneiform bone, the second one is the joint between the 2. and 3. metatarsal bones and the lateral and middle cuneiform bones, and the last one is the joint betweencuboid and the fourth-fifth metatarsals. Synovial spaces extend to intermetatarsal (IMT) joint spaces. Dorsal and stronger plantar ligaments support the foot arches and joint capsules. Cuneometatarsal ligaments of first and second metatarsal bones are very strong and these are the main supporters[47]. The movement of each TMT joint is different from each other.

The first metatarsal bone and the great toe plantar flexes with eversion and abduction[48]. The second TMT joint is more limited than the first one and lesser toes.TMT joints are more mobile[42](Figure2.8).

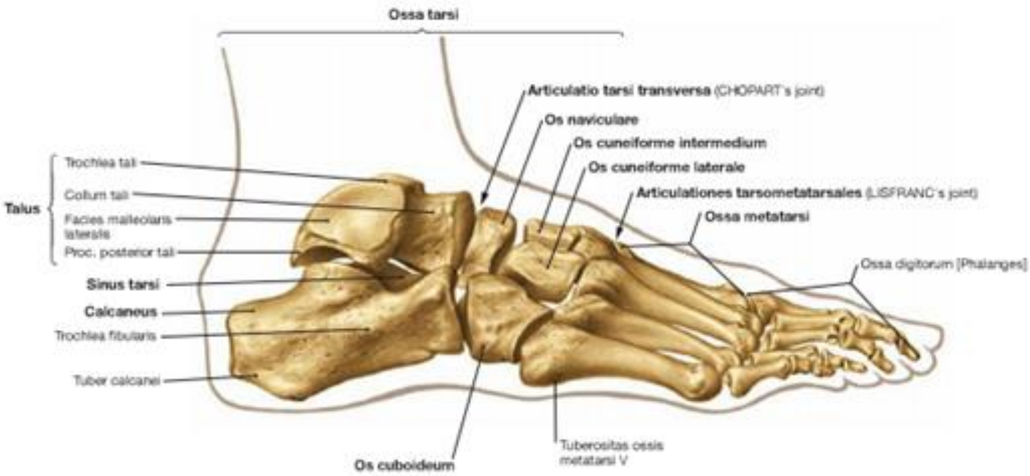


Figure 2.8. The ankle joints of the foot[33]

2.2.7. Metatarsofalangeal Joints

These joints are synovial and supported by collateral ligaments and fibrous plantar cushion. While the joint capsule is supported by dorsal ekstensor tendons and is controlled by collateral ligaments that startfrom the lateral and medial sides of metatarsal heads and adhere to the medial and lateral parts of proximal phalanges close to the plantar. During loading, the cushions of the MTP and interphalangeal(IP) joints of the plantar surface plays a significant role in the preservation of articular surfaces particularly during MTP joint dorsiflexion. During dorsiflexion, these cushions are positioned distally and protect the joint from overloading. These functions are important for the protection of joint surfaces in the thrust phase[49](Figure2.9).

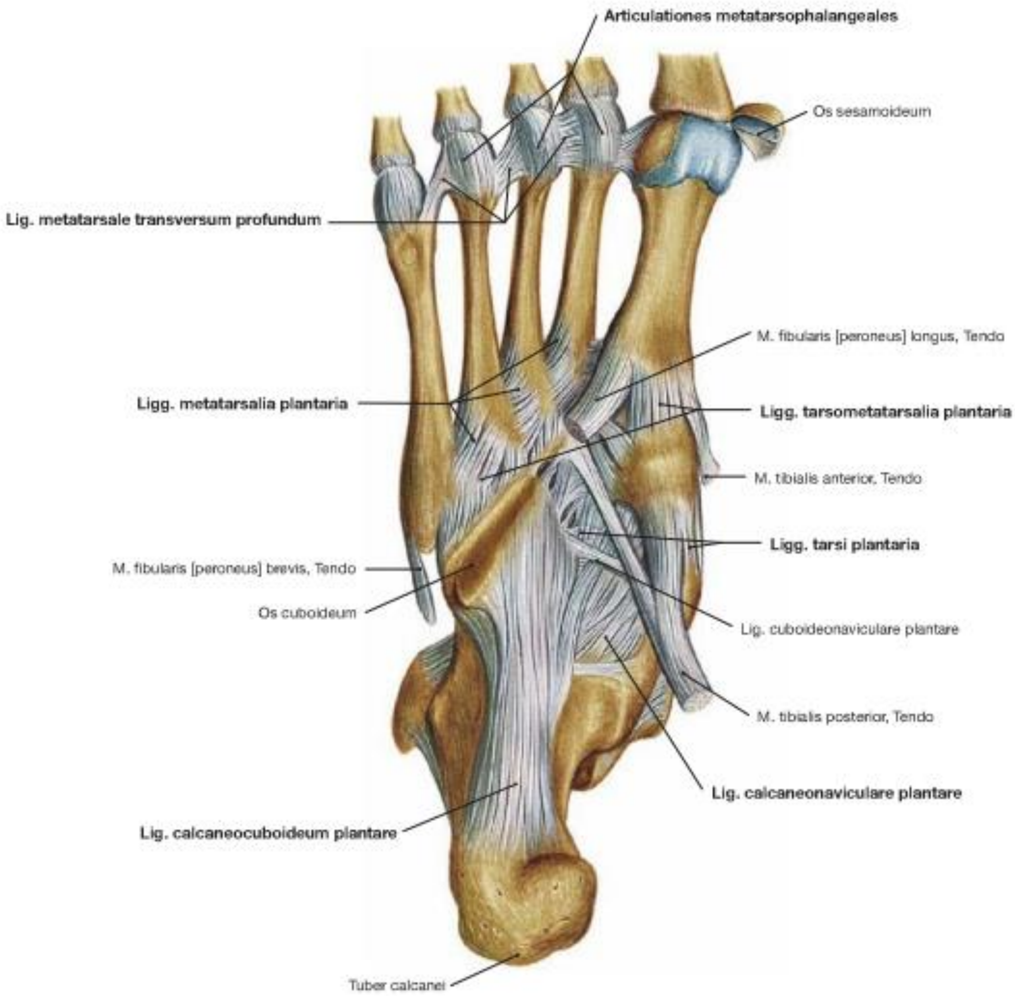


Figure 2.9. Joints of the Foot[33]

2.2.8. Interphalangeal Joints

IP joints are kown as simple hinge joints andpromoted by the collateral ligaments, joint capsule and plantar cushion. The plantar flexion of the PIP joints is less than ninety degrees with no dorsiflexion.The plantar flexion movement is decreasing towards lateral PIP. Lateral 2-4 IP joints have some degree of hyperextension movement but there is no normative data[20].

2.2.9. Kinematics of the Foot

The ankle and foot functions as a whole, it is easy to understand that most of the joints function similar to each other and have three plane motions[50]. In the studies performed, the foot moves within the closed-chain system when it is functional in all cases where the lower extremity is considered as an open-chain system. In the closed kinetic system, the subtalar joint transfers the foot movements to the leg or versuswhile the foot is stationary on the floor, the external rotation of tibia is transmitted as the foot supinationby means of the subtalar joint. Similarly, the internal rotation of tibia is transmitted through the subtalar joint to the foot as pronation and the talus head moves to the medial[24]. While the calcaneus is in valgus, navicula and cuboid bones evert with abduction[21, 48, 51]. During walking, the foot moves to pronation in the base-contact phase, while tibia rotates internally; in the push-off phase, the external rotation of the tibia works up the foot into supination[52].Foot pronation allows the lower extremity to be more flexible and more shock absorptive while the supine foot causes more rigidity[53, 54](Figure 2.10).

The knee extension is facilitated when the tibia goes into external rotation. The excessive pronation or supination can lead to some problems in knees and hips or even in the spine[55].

The plantar and dorsiflexors are usually considered when evaluating muscle strength of the foot and ankle in the clinical evaluation. In studies conducted, it was determined that the plantar flexion torque was 117 Nm and the dorsiflexing torque was 32 Nm. This difference also occurs in the cross-sectional areas of two muscle groups, indicating that the total cross-sectional area of the plantar flexors is 3-4 times wider than that of the dorsiflexors. This stituation indicates that the force and cross-sectional area are very closely related[56]. The plantar flexor torque is increased by 10-20% in the extented knee joint[57].Some studies concluded that inversion torque is 75 Nm and the eversion torque is 74 Nm[58].

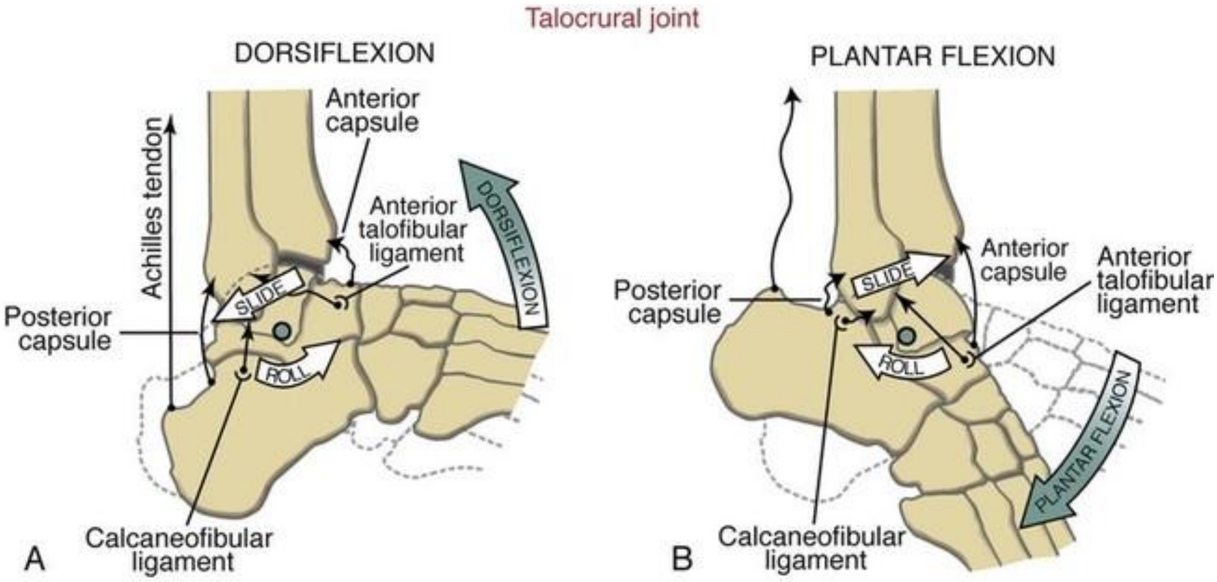


Figure 2.10.The lateral view of arthrokinematics talocrural joint of the foot during dorsiflexion (A) and plantar flexion (B) [23].

Any activity performed reveals more reaction force in the foot than the standing upright. During walking, this force reaches 120% of body weight and 275% during running. It has been shown that the foot pressure distribution differs among individuals.Some variables affecting plantar pressure;

- Age; lower pressures are observed in young people, especially in children. The reason is the flexibility of soft tissues.
- Gender; are reported to be higher in males.
- Foot Shape; foot pressure distribution differs in deformities like pes cavus, pes planus, pes equinus. Deformity changes with the accordance of the malformation.
- Gait Velocity;the pressure increases as the speed increases
- Range of motion of joints in particular, limitation of joint motion, and joint contractures affect the base pressure distribution.
- The distribution of the base pressures varies with the shoe garment[58].

2.3.Ankle Joint Proprioception

The five senses were first described by the Greek philosopher Aristotle. Afterwards, Sir Charles Bell described the sense of position and movement of the extremities, the proprioception as the sixth sense. Proprioception, which comes from the Latin word "proprius" and means "on its own-alone", is the ability to convey the sense of position of the body, to interpret the information, and to give conscious or unconscious response to the warning to act. It is the collective information that is transmitted to the central nervous system through the joint capsule, ligaments, muscles, tendons and deep mechanoreceptors. This information-driven neuromuscular feedback mechanisms enable the formation and maintenance of functional joint stability[59](Figure 2.11).

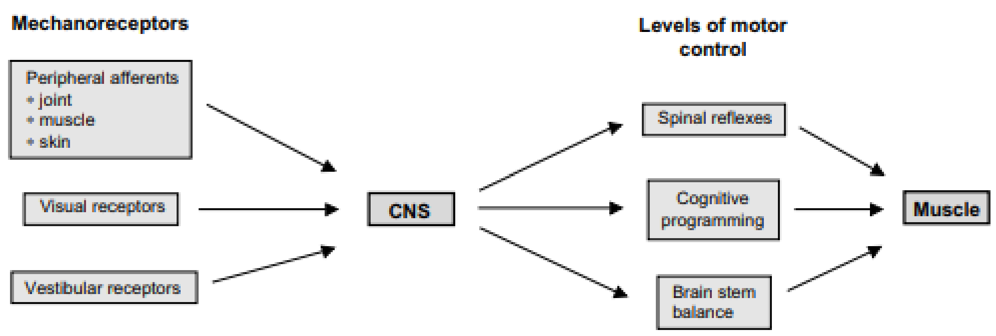


Figure 2.11. : Neuromuscular control pathways[60].

Proprioception allows one to feel even the joints are when the visual sensation is gone and to maintain standing balance. It allows proper writing, jumping, running and throwing. The proprioception gives the agility to change the direction of movement quickly, the balance that provides stability and the coordination in right and harmonious. Conscious proprioceptive sense is composed of joint position sensation (JPS), kinesthesia and tension sensation. Each is assessed using different testing. The proprioceptive sense is usually assessed both at the position that weighs on the extremity. Functional position is used during testing in the position where the extremity is weighted, so proprioceptive information to be formed due to compression is more[61].

The JPS from proprioception tests is tested by that, the patient is actively repeating the tested degree (active joint position sense test), and is able to find the degree of movement (passive joint position sense test). The JPS test measures the repeatability of a given position and is active or passive in both closed and open kinetic chain positions. Recurrent joint angles are tested by both direct (potentiometer, goniometer, video) and indirect methods (visual analogue scale -VAS). Kinesthesia is assessed by calculating the threshold value for the detection of passive motion, or more specifically by finding the threshold value for the direction of motion. Thus, not only the movement but also the direction of the movement occuring at the same time is determined. The feeling of tension is measured by contrasting the ability of individuals to reproduce the torque magnitudes they produce under changing conditions of a group of muscles. Various isokinetic dynamometers and electromagnetic tracing devices have been developed to evaluate conscious proprioception. The goal of future investigations should confirm conscious proprioceptive sharpness with simultaneous measurement of afferent pathway action potentials (eg, microneurography) and to assess sensorimotor to compare the lack of control with the decrease in conscious proprioception[62-64].

In the literature, only one study evaluating about ankle joint proprioception for Plantar Fasciitis was found [61]. However, functional articular instability showed partial afferent message loss in joint mechanoreceptors after injury, joint position sensation and kinesthetic errors were detected and prolonged peroneal muscle reaction time was found[65-68].

2.4.Plantar Fascia

The plantar fascia consists of a sheet of fibrous, dense andconnective tissue (aponeurosis)that starts from the medial tubercle of the calcaneus, passes forward to place into the deep short transverse ligaments of the metatarsal heads,and goes on to form the fibrous flexor sheathes on the plantar aspect of the toes[69, 70](Figure2.12).

In healthy adults, the thickness of the plantar fascia in the dorsoplantarly is about 3 mm, while the affected from plantar fasciitis increasingly can be 15 mm[71].

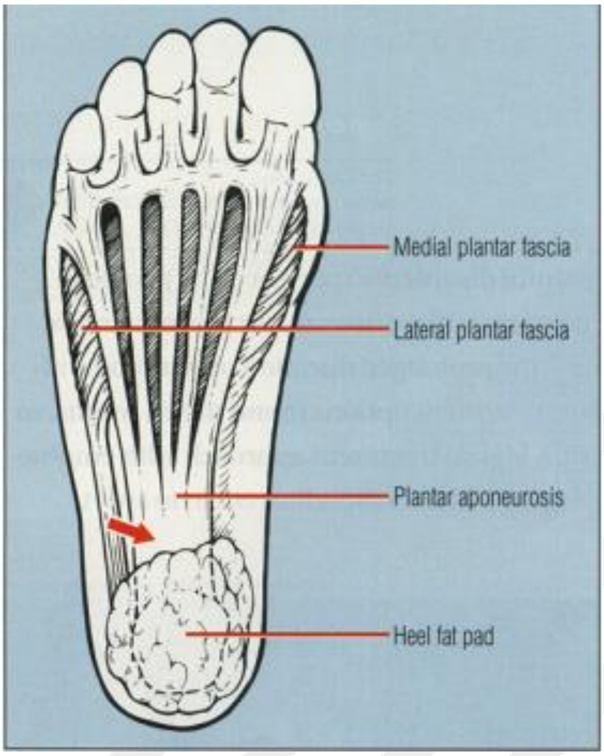


Figure 2.12. : The exposed plantar fascia of the foot [72]

Plantar fascia is a strong fibrous structure consisting of three layers;medial, lateral and central. The central band adheres to the proximal phalanges of the fingers by dividing into 5 under the heads of the metatarsals[73, 74].The medial longitudunal arc of the foot is shaped by the plantar fascia. During the walking and running of the flant, two main tasks are to support longitudinal arc and to provide static and dynamic shock absorption of the foot[75]. The plantar fascia is pulled distally around the barrel (metatarsal heads) and a continuous traction is applied at the same time; the longitudinal arc ascends, the hind leg turns and becomes inverted and the leg comes to external rotation. This mechanism depends entirely on bone and joint stability [76](Figure2.13).

Figure 2.13. Representative triangle formed by plantar fascia and medial longitudinal arc[77].

During swing phase of the gait, the plantar fascia is turning to the normal shape and prepare the foot for the stance phase. When in the stance phase, the plantar fascia helps the harmonisation between the base of the foot and the floor and also absorbs a large part of the shocking from the floor.A study conducted that the burden on plantar fascia was 1.8 times the weight of the body while walking and 3.7 with running[78].

2.5.Plantar Fasciitis

2.5.1. Definition and PrevalenceEstimations of the Plantar Fasciitis

Heel pain is one of the most extensive foot problems in adults. It is seen about 10% of the population throughout life. Approximately 20-30% of patients can be seen bilaterally[79, 80].Differences in the anatomical structure of the foot, pathologies of the nervous system, soft tissue problems and systemic disorders bring heel pain. These are the disorders such as calcaneal stress fracture, nerve compressions, tears in the plantar fasciitis, plantar fascia, heel spur, tarsal tunnel syndrome, degeneration of heel cushion, neuromaandtendinitis[79, 81].

Plantar fasciitis (PF) is a degeneration of the plantar fascia and tear that cause changes in the tuberosity of the calcaneus. The most important signs of PF arepain, tenderness and limitation of movement. Pain associated with PF occurs in gradually increasing and most prominent morning standing or after a long period of inactivity. Pain is often described proximal to the medial longitudinal arch (MLA) of the heel, around the medial tubercle, at the adherence site of the plantar fascia. The average rate of plantar fasciitis in patients with heel pain was 53.2%[82, 83] (Figure 2.14).

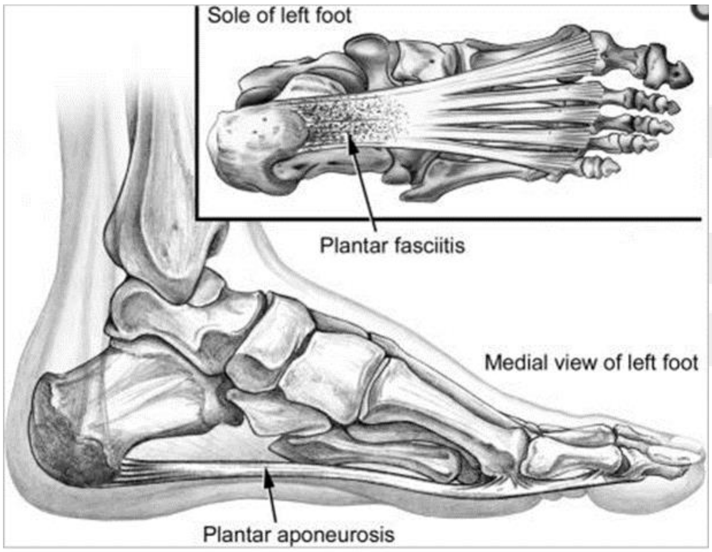


Figure 2.14. The plantar aponeurosis of the foot[77].

Heel spurs have been identified by Plett in 1900. Bone formation observed at the origins of plantar muscles or plantar fascia is expressed as plantar heel stiffness, bone formation observed at the insersio of the Achilles tendon is expressed as dorsal heel spikes. Dorsal heel spur is less common in society and is usually asymptomatic. It is thought that the inflammation and tissue tension coming from the plantar fascia is caused by the heel spur. In contrast, in recent studies showed that infracalcaneal heel pain occurs because of the soft tissue –based disorder and calcaneal spurring is not the initiative factor [84].To sum,ın conducted research,the prevalence of heel spur in patients with heel pain was between 30% and 70%. In addition, 15% of asymptomatic patients were found to have heelspurs[85].

2.5.2. Pathomechanics and Etiology

Plantar fasciitis is the most common musculoskeletal system disease in the foot which has the different theories about etiology affecting espically the plantar fascias. According to this theories; PF can be classified as anatomic (such as pes planus, pes cavus, height difference of the lower extremities), biomechanics (such as excessive external rotation in the lower limbs, increased pronation in the subtalar joint, shortening of the Achilles tendon, weakness of the plantar flexors[6].

In compliance with one theory, there is a close relation between plantar fasciitis and obesity. It is thought that obesity increases the risk of plantar fasciitis by decreasing the arc height and forcing the plantar fascia to stretch more. Plantar fasciitis rates were found to be between 40% and 58% among those whose body mass index was over 30. It has also been shown that there may be a relationship between the ankle motion and the development of plantar fasciitis. Daniel et al[86]. found that plantar fascia tendency of ankle dorsiflexion limitation in their study of 50 patients.It has been reported that the presence of pes planus and pes cavus increases plantar fasciitis risk as it disrupts the foot biomechanics[87].Apart from these, other anatomical problems that cause risk are leg length inequality, excessive tibial torsion, excessive anteversion and excessive foot pronation[87-89].

Tension or weakness in gastrocnemius, soleus and intrinsic foot muscles have shown to be a risk factor for PF. The increased frequency of PF with increased age is attributed to the loss of intrinsic foot muscles and gastro-soleus group. In addition, decreased water and collagen contents in tissues cause degenerative changes in heel fat pad and plantar fascia. It may be thought that standing for a long time and carrying out the work that requires weight bearing would also cause fatigue in these muscles over time and prevent the necessary support from being provided, thus laying the foundation for the formation of plantar fasciitis[90, 91].In some athletic activities, the frequency of plantar fasciitis is higher, eg.runners[92].

Rome et al [93].found that the presence of plantar fasciitis in 166 athletes was 21.7%. This is because the cumulative excessive stress load on the plantar fascia[94].After all, shoe use without sufficient support and ground changes are other reasons for accelerating the formation of plantar fasciitis.

Plantar fascia is the major stabilizer of the longitudinal arch. As, factors distrupting the normal biomechanics of the foot increase tension of the plantar fascia. The abnormal stretching of the plantar fascia caused by biomechanical factors does not initially constitute a clinical symptom. However, stress factors such as sudden increase in activity level, running, obesity and rapid weight gain, uneven shoes, prolonged standing or walking, activity in harsh conditions cause recurrent microtrauma in plantar fascia and other structures, leading to clinical symptoms[95].Also,whenpassing from the heel strike to the toe strike, the foot pronation movement occurs and causes the plantar fascia stretching. Furthermore, in the stance phase of walking,passing from the heel off to the finger off reveals the passive dorsi flexion. As a result, the medial longitudinal arch(MLA) rises and the fascia is stretched. Excessive stretching from plantar fascia results in edema and inflammation of the feet. If this situation does not treated, micro calcification willoccur and then, followed by soft tissue calcification[96].

Calcification and degenerative changes occur because of the the pulling force brought by the FDB muscle to the distal medial tubercle of the calcaneus which is the point where the plantar fascia merges, the pulling force created by the abductor hallusis and the flexor digitorum longus in the medial tuberculum and the overgrowth of the plantar fascia[97, 98] and also,a tight Achilles is thought to come up with major tensile loads in the fascia by directly transmission of tension of the calcaneal trabecular system. Increasing passive mechanical longitudinal tension result in ankle dorsiflexion stiffnes[99].

Additionally, 2 groups of patients can be defined as plantar fasciitis without regard to biomechanical risk factors: (1) athletes \runners, (2) sedentary individuals. In athletic populations, the development of plantar fasciitis symptoms is more associated with higher foot arch and genu varum counter to a higher BMI, pronated foot, and ankle equinus are in greater risk factors in sedentary populations[100].Hamstring tightness and both lower heel pad dissipation of energy and lower maximum heel pad stiffness also cause plantar fasciitis [3].

To sum, it is still not clear if biomechanical and clinical observations are causative or result of PF[84].

2.5.3. Diagnosis-Differential diagnosis

Systemic or local causes can be the cause of plantar heel pain. These include predominantly Achilles tendinitis, heel injuries, decreased atrophy and "crushing ability" of heel mastectomy, plantar fasciitis inflammation or rupture, posterior tibial tendonitis, calcaneal stress fracture, subcalcaneal spurs, infections, osteomalacia, subtalar arthritis, tumors, Paget's disease, vascular insufficiency, pes planus, pes cavus compression of the first branch of the lateral or medial plantar nerve and sub-articular joint constraints(Table 2.1).

Table 2.1. The conditions that can cause heel pain[101]

Disease	Syndrome
NEUROLOGİC	
• Abductor digiti quinti nerve entrapment	Burning in heel pad
• Lumbar spine disorders	Pain radiating down the leg to the heel, weakness, abnormal reflexes
• Medial calcaneal nerve entrapment	Medial and plantar heel pain
• Tarsal tunnel syndrome	Pain, burning sensation, and tingling on the sole of the foot
• Neuropathies	Common in patients who abuse alcohol and uncontrolled Diabetes Mellitus, Diffuse foot pain, night pain
SOFT TISSUE	
• Achilles tendonitis	Pain is retrocalcaneal
• Fat pad atrophy	Pain in area of atrophic heel pad
• Heel contusion	History of trauma
• Plantar fascia rupture	Intense tearing sensation on bottom of foot

• Posterior tibial tendonitis • Retrocalcaneal bursitis	Pain on the inside of the foot and ankle Pain is retrocalcaneal
BONE	
• Calcaneal epiphysitis (Sever’s disease)	Heel pain in adolescents
• Calcaneal stress fracture	Calcaneal swelling, warmth, and tenderness
• Infections	Osteomyelitis Systemic symptoms (e.g., fever, night pain)
• Inflammatory arthropathies	More likely with bilateral plantar fasciitis Multiple joints affected
• Subtalar arthritis	Heel pain is supracalcaneal
MISCELLANEOUS	
• Osteomalacia • Paget’s disease • Sickle cell disease	Diffuse skeletal pain, muscle weakness Bowed tibias, kyphosis, headaches Acute episodes of pain involving long bones, pelvis, sternum, ribs
• Tumors (rare)	Deep bone pain, night pain, constitutional symptoms
• Vascular insufficiency	Pain in muscle groups that is reproducible with exertion, abnormal vascular examination

It is difficult to evaluate the pain in a structure consisting of many bones, joints and ligaments such as the foot.To diagnose plantar fasciitis patients, story of the patient and clinical evaluation are valuable. The most obvious symptom is the worsening; burning, stinging pain in the medial aspect of heel because of prone to crop up overnight stay in position that causes the shortening of the length of the plantar fascia after that when the weighted on the plantar fasciaon the first steps in the morning, it is stretched and severe pain is felt and thickening in the plantar fascia[91, 102, 103].

Additionally, one of the symptoms of PF is reduction in pain during walking. Individuals with PF indicate that they have performed painless walking but at the end of the day the pain was exacerbated due to loading and activity[104].

The feeling of severe pain in the first step taken after sitting in a place for a long time or a long period of inactivity is also classic finding. One of the important findings to be evaluated in plantar fasciitis is susceptibility. Generally, when the rear and inner portion of the heel of palpable, tenderness and pain occurs[105, 106].

Plantar medial tubercle of the calcaneus, the course of the plantar fascia into the central arch(less prevalent finding) are the most common location of pain. Also,lateral band (more variable finding) and plantar lateral heel pain may be exhibit[84](Figure 2.15).

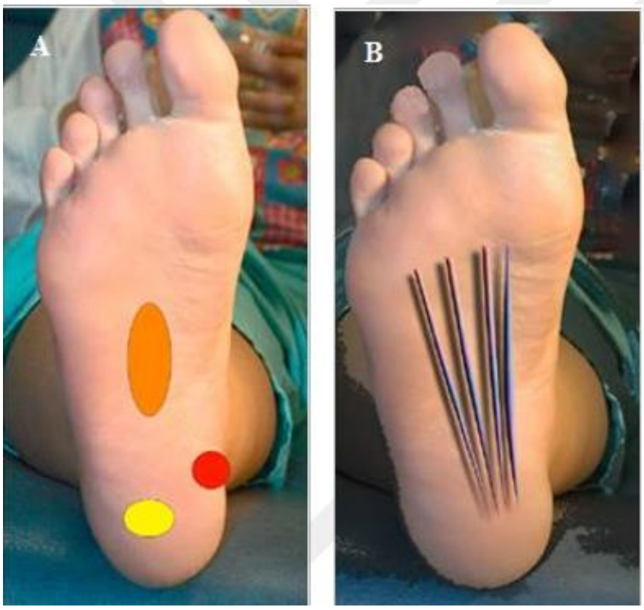


Figure 2.15.A: Plantar fasciitis is felt throughout the plantar fascia (orange), on medial tuberositas (red), or on calcaneal tuberositas (yellow). B: Plantar fascia tension lines are shown[107].

Long-lasting inflammatory changes in the plantar fascia; edema occurs in the plantar fascias at the first stage of inflammation, and thickening occurs in the plantar fascia with delayed healing. In normal humans, the plantar fascia has an average thickness of 3 mm. In patients with PF, it is stated that this value is 15 mm[108].

Pain in the heel may be due to heel cushion atrophy, radiculopathy, tarsal tunnel syndrome, calcaneus stress fractures, peripheral neuropathic foot and medial lateral compression of the calcaneus is not plantar fascia-based symptoms and if it exists,it can be stress fracture or other bone pathology. Additionally, hindfoot, midfoot, pain and ankle range of motion is absent [84, 85].

Radiography andMagnetic Resonance Imaging(MRI) can be used to differentiate PF from other diseases but in a recent conducted studies with the consensus was reached that the use of routine radiography, advanced imaging such as magnetic resonance were not requiredfor the nontraumatic PF diagnosis and the presence of calcaneal spur often does not change the course of treatment[84].

2.5.4. Treatment

Plantar fasciitis can be a compelling condition for both the patient and the clinician, since dense connective tissue regeneration is slower than metabolically more active tissues such as bone and muscle. Therefore, it is necessary the suficient understanding chronicity of symptoms for the proper treatment of PF. It is substantial to determine stage of PF for selecting appropriate treatment options. According to symptoms, plantar fasciitis is generally divided into 3 phases; acute, subacute, and chronic. After onset, the start up 4 to 6 weeks is called acute plantar fasciitis.It is related with traumatic in etiology or mechanical overload. Subacute PF refers approximately 6 to 12 weeks, and for >3 months presents chronic PF which includes subdivision: refractory/recalcitrant that does not recover with proper treatment program for >6 months and is more uneasy to successfully cure[84].

Plantar fasciitis cure is divided into non-surgical and surgical treatments. Conservative treatment is the basis of cure because of 90% success in it. Surgical treatment is the last resort method. Biomechanical, anatomical, and environmental factors should be considered when assessing the patient and the treatment program should be determined according to the cause[91, 109].

The necessary adjustments must be made by observing the conditions such as weight, wrong shoe selection, training errors, inaccuracies and overloads that may lead to this priority. These minor arrangements are significant in the course of treatment[71, 110]. It has been indicated that treatment modalities should be combined to be successful in conservative treatment of PF patients. 85-90% of patients respond to conservative treatments within 2-3 months and surgical treatment can be considered in patients who do not respond a conservative treatment for 6-12 months[107]. The purpose of treatment in general; reduce pain, inflammation and tissue tension, increase muscle strength and tactile flexibility[111].

In a review of plantar fasciitis treatment options, clinicians should prescribe joint and soft tissue mobilizations and relaxation of the fascia technique, stretching and strengthening exercises, taping, use of foot orthoses, either prefabricated or custom fabricated, instead of electrotherapy devices to provide intermediate and long-term (1-6 months) improvements in clinical results for PF patients. Clinicians can or can not use iontophoresis, phonophoresis and low level laser therapy to improve short-term (2-4 weeks) pain revealing and function. Additionally, the use of Extracorporeal shockwave therapy(ESWT) is generally carried out once a week for 3 - 5 sessions total. According to conducted research, low or high dose energy; focused or radial ESWT, both are impressive method for chronic and subacute heel pain and also, ESWT is effective method in heel pain at 12 weeks compared with placebo[112, 113]. On the other hand, ESWT is not an impressive first-line treatment choice for patients with acute PF. Additionally,Rompe et al[114]. indicated that manual stretching had more beneficial effects compared with low-energy radial ESWT. To sum, ESWT is a valuable choice for treating PF but there is still no consensus on it.

In a conducted review study by Shanks et al. [115] it was reported that there is no high-quality proof to prop ultrasound therapy for musculoskeletal conditions of the lower limb. In addition, according to another studied review, patients were given ultrasound therapy (0.5 W/cm^2 power, 3-MHz frequency, 1:4 pulsed duty cycle) for eight 8 minute seances at a twice weekly for four weeks no more valuable results than a sham therapy for heel pain. To sum, ultrasound therapy cannot be advised for the people with PF[115, 116].The use of trigger point dry needling (TDN) cannot be exhorted for PF patients [10].A systematic review showed that there is restricted proof to improve the clinical advantage of TDN for plantar heel pain for reducing treatment time[117].In conducted another review, Imamura et al.[118]concluded in a non-randomized study that they compared a group receiving TDN with a standardized home exercises and physical agents.In contrary, according to one noteworthy randomized clinical trial Cotchett et al.[119] concluded that the effect of TDNcompared with sham dry needling was a important effect of improved FHSQ score and decreased pain on symptoms and disability associated with heel pain at 6-week follow-up and harms were transient and minor with immediate needle insertion pain, delayed bruising and increased symptoms of heel pain.On the other hand, Footwear, counseling on loosing weight, education, and exercises are really ımportant compenent of the PF treatment strategies[10]. Additionally, "Nonsteroidal antiinflammatory drugs (NSAIDs) are commonly used to reduce pain and inflammation for acute phase of PF, but published data does not prop its use. Donley et al. [120] conducted review about the usage of oral NSAIDs in a prospective, randomized and placebo-controlled review study. Patients were given a therapy which involved either placebo or celecoxib. Both groups had not seen no statistically significant differences between NSAID and the placebo groups at 1, 2, and 6 months and also, in an another conducted systematic review, Platelet Rich Plasma has been found to be more effective than the NSAIDs[121]. Summary, ıt can be concluded that the groove use of NSAIDs in treating PF does not recommend.

Altough the progress of the conservative treatment of PF, the patients need surgical management to retain their daily life activities. Surgical management should reserve for chronic, refractory cases which have not responded proper conservative management for ≥6[122, 123].

Surgery has 2 extensive and accepted types of procedures work by removing the strain of the plantar fascia. The decrease of plantar fascial strain is an essential part of surgical management for PF.The plantar fasciotomy is the first curation modality which includes cutting a part of the plantar fascia directly to reduce the strain on the fascial band. The second one is gastrocnemius recession to release the strain indirectly[84].

To sum, in considering a curation protocol for PF, it is significant to comprehend that each patient presentation and proper diagnosis is compulsory to exclude other reasons of heel pain. Management modalities differs as regards the severity of the patient’s pain and chronicity. It can be used the most extensive effective modalities for treatment and diagnosis. The appropriate treatment plan should be organized to each patients with regard to their specificphysical requirements and expectations. Additionally, it is important to be responsible for the health care system and standardized treatment regimen to check the patients and their response to re-organize the treatment properly according to their improvement of the disease statute.

Conservative treatment options according to conducted studies with proven efficiency are:

2.5.4.1.Education

The first grade in the treatment of plantar faciitis is to arrange the conditions causing these first line problems in the foot and describe the disease, process and coping methods to the patient with regard to treatment. Patients should be informed about the compulsive situations of plantar fascias such as increasing load weight bearing, intensive activities, work on rough surfaces, using proper shoes. Also, the patients should be avoided as much as possible long standing activities and given advice on immobilization of the foot in a neutral position, ice massage and drugs[124]. Additionally, resting is important factor to prevent microtrauma and relieve the symptoms [125]and 'Relative Resting' which based on the principle of selecting and removing the activities that can affect the treatment of PF is recommended by many sports physicians[124].

2.5.4.2.Weight Control

The controlling overweight is the most affective condition for the conservative treatment. The percentage of plantar fasciitis was found to be between 40% and 58% among those whose body mass index(BMI)was over 30 and so, high BMI index is the significant risk factor for PF [71, 86]. Köse et al[126]. have proven that obesity increases the risk of plantar fasciitis by decreasing the height of the arcus and by forcing plantar fascias to stretch more in their work.

In a conducted systematic review, Butterworth et al[127].focused on the relationship between BMI and foot disorders and 12 of the 25 writings in their study were related with chronic plantar heel pain and showed a significant relationship between chronic plantar heel pain and higher BMI in nonathletic individuals. There was restrictive, weak proof about certain alteration in pain following weight loss. In addition, Tanamas et al.[128]noted that greater BMI, and specifically fat mass have relationship with generalized foot pain and disability.Thus encouraging patients to lose weight and lowering the BMI to below 25 is important for PFs treatment and prophylaxis. Physiotherapist should provide counseling on exercises to get or maintain optimalbody mass for people with PF. Clinicians should also refer people to proper medical personnel to address nutrition issues.

2.5.4.3.Appropriate Foot Wear and Biomechanical Support

Making proper modification in the shoes used by patients are beneficial to some patients and are known to be one of the important parts of conservative treatment. Because the primary cause of PF is increased tension in the fascia and mechanical over load, it is significant to determine any biomechanical factors which could be contributing. This contains BMI counseling, over the counter insoles,proper shoes and custom foot orthoses to avoid from recurrence [129].

Patients with whole stages of PF should be avoid non-supportive shoes, involving ballet slippers and flip-flops. It is significant to prop the MLA to release tension on the plantar fascia. Escalona et al[130]. interpreted if a sandal which incorporates the arch type of an inshoe foot orthosis raises MLA and concluded that MLA height is raised by contoured sandals and the neutral position of subtalar joint of the foot, similar with achieved by an orthosis. Also, note that eroded shoes cause insufficient cushioning. Patients must be alerted at the point of walking on bare feet and sandals on hard floors[71]. Additionally, the ankle will come to more plantar flexion on the high heel shoe, in which case the metatarsophalangeal joints of the fingers will bring the dorsiflexion and strecht the plantar fascias due to the pulley mechanisim and increase the stress on the adhesion. This means that your pain will increase even more[131, 132]. Katoh et al [132]. according to their work, showed that in high-heeled shoes, the load did not shift toward the front of the foot, but the stress increased even more in middle and hind feet and also, Okçu et al [133]. have reported that they should avoid wearing high-heeled-heavy shoes. Generally flat, at least 3 cm in height, and soft, MLA-supporting footed shoes reduce the pain of patients[88, 124].

To sum, clinicians should advise a rocker-bottom shoe construction in conjunction and shoe rotation even as the work for those who stand for long period of time to reduce pain for PF patients.

2.5.4.4.Orthoses Treatment

One of the conservative treatment methods is to maintain the normal alignment of the foot by supporting subtalar and midtarsal joint to prevent over-pronation of the foot, to reduce the load on the medial part of the foot during activity and to support soft tissues.

There are 3 types of orthoses commonly used in the treatment of PF. These are; medial arch support, heel cushion and foot-ankle orthoses that support the foot- ankle joint as 90 degrees. The use of medial arc support by PF and pes planus patients is useful for revealing symptoms. It is also possible to find the ready-to-wear medial arch supports at various hardnesses such as hard, semi-soft and soft[134]. Rigid plastic arch supports rarely reduce symptoms, usually causing heel pain to increase. Soft arch reinforcements are absorbing 42% of shocks exposed to the foot during walking as pillows[71, 135]. Kogler et al [136]. in the study published by; the most important role of the foot orthoses in the treatment of PF is to reduce stress under the foot by providing total contact and to provide support to the plantar structure of the foot.Also, the foot is usually in the position of the equinus while sleeping. If the foot remains in the equinus position for a long time, it causes shortening of the plantar fascia and achilles tendon. The foot- ankle orthesis used in PF patients allows the fascia to be more flexible by inhibiting length sorthening of plantar fascia and Achilles tendon as well as to prevent the plantar fascia from length shortening when tissue healing occurs, making the fascia more flexible[91].

Clinicians should prescribe foot orthoses, either prefabricated or custom fabricated to prop MLA and cushion the heel for PF patients to improve function and reduce pain from short- (2 weeks) to long-term (1 year) periods, specifically in those who answer back positively to anti-pronation taping techniques[10].

2.5.4.5.Taping

Pronation with a weight on a flat ground occurs with calcaneus eversion, talus plantar flexion, internal rotation and medial deviation movement and excessive pronation leads to dorsiflexion in the first tarsometatarsal joint. This is a factor that reduces the MLA height that can cause excessive strecth of plantar fascia[108]. An increase in foot pronation is seen in 81-86% of people with PF symptoms[137]. When there is an increase in foot pronation, the tapping technique helps regain the normal biomechanical properties of the foot and can reduce the risk of injury due to excessive pronation. The patients immediately perceive well-being stituation according to taping treatment[110].

Clinicians can usage anti-pronation taping for immediate(up to 3 weeks) pain revealing and also, elastic therapeutic tape carried out the gastrocnemius and plantar fascia short-term (1 week) pain releasing for individuals with PF[10].

2.5.4.6.Physical Therapy Modalities: Low Level Laser, Iontophoresis Phonophoresis

Iontophoresis is the use of electrical implants obtained from a low-voltage galvanic current stimulation unit to penetrate topical steroids into soft tissue. There was a significant improvement in pain after 2 weeks in a study, but no significant difference was found in the long term. The disadvantage of ıontophoresis is mainly that it has high cost and time consuming[138].

Phonophoresis is a noninvasive procedure, treated conservatively. It included use of ultrasound waves to deliver anti-inflammatory drugs to the site of pain.In A review of 25 cases of PF with phonophoresis,using the anti-inflammatory gel involving a combination of salicylic acid, flufenamic acid, and mucopolysaccharide polysulphate concluded that phonophoresis is preventitive way for heel pain for a long term period[139]. These modalities, such as phonophoresis (ultrasound plus a 10% hydrocortisone crcam) and ıontophoresis are often useful. Especially if the tenderness and pain are spread over the plantar aspect of the foot. 9 treatments are generally recommended and they can be applied either once a day for nine days or three times a week[140].

Low level laser Therapy (LLLT) has been used for pain, inflammation and reduction of swelling, acceleration of wound healing, regeneration for 40 years.It is known as a reinforced beam Low intensity laser wavelength is a light seen in the electromagnetic spectrum.

In the study done by Kiritsive et al[141]. LLLT was applied to the plantar fasciitis patients and at the end of treatment; the control group had 26% , whereas it was indicated that this rate was 59% in the LLLT group. In a result,there was a important difference in pain between the 2 groups.

In theory, these modalities increase blood flow to the affected area or use other physical processes to stimulate healing, but physicians should be aware of the evidence of these modalities is limited. Clinicians may or may not prescribe them routinely but keep them for cases of PF that are resistant to other tratments[90].

2.5.4.7.Platelet-Rich Plasma and Corticosteroid Injections Treatment

New treatment strategies that urge a recovering reaction rather than suppressing the inflammatory process can be considered as a more effective treatment choices. This has provided the usage of platelet-rich plasma (PRP) that is well-recognized to lead to cell growth and tissue healing. To increase tendon regenerative abilities is the rationale for using PRP with a high content of cytokines and cells which should support cellular chemotaxis, matrix synthesis, and proliferation.

Centrifugation to mechanically to accumulate the level of platelets 7–25 times more than the base of entire blood. These have induce the usage of PRP as a vector to give over growth component to tendon injury and repair zones and local muscle for supportingheal process[121, 142].

The impact of PRP injection should also pay regard the initial effect and the time course for patients to not to occur symptoms. Treatment which offer instantaneous pain relief with no recurrence of symptoms would be more preferable for most patients. In many studies, after injection, the healing progress was observed during the first 3 months. Considerable improvement was also observed when the patient was traced till 12 months postinjection. The initial of action after PRP treatment also eminently depends upon the degree of degeneration as the tissue or organ needs longer recovery time for a complete regeneration.The coupled home therapy after the injection may have an effect upon the outcome of the efficacy of PRP. Those patients who reported relief and improvement, believed that PRP affected directly, although all patients were also suggested to remain under conventional treatment, which includes gel heel cups and stretching exercises[121].There is also convenient relationship between a higher rate of relapse and recurrence. Moreover directly pain releasing after injection ends up a tendency to overuse the affected foot. In addition, it carries the risk of tendon rupture as mentioned earlier. There were few studies that compare the results of PRP injections and steroid in other chronic tendon conditions apart from PF[143-145].The results reported that a single injection of PRP provides the improvement of function and decreased pain better than a corticosteroid injection.As direct injection onto a degenerative area of the plantar fascia, do not come in sight any unfavorable side effect or complication then theoretically PRP injection also do not have any side effect. As expected, none of the above studies demonstrated any complication from PRP injection. In fact to date, study of PRP injection for musculoskeletal conditions has not arised any hazardous side effects. PRP can be deemed as a reliable application for treating PF[146, 147].

In a current Cochrane review, David et al[148]. reported that local steroid injections collated with no treatment or placebo may decrease heel pain for ≤1 month, but not immediately after. According to the study findings clearly concluded that injectable steroids can relief acute symptoms of PF and have little lasting effect beyond the first 4 weeks.Tatli and Kapasi[144]commented that the "real risks" of steroid injections and they reported significant advancement on pain relief thanks to combined with stretching, corticosteroid injections in the short term, but they noted that ultrasound monitoring can decrease potential risk of the injection. In a current meta-analysis, Li et al[149].compared ultrasound versus palpation guided corticosteroid injections and they examined 5 randomized-controlled trials and reported that ultrasound-guided injection was superior with think of response rate, the VAS, and plantar fascia configuration on ultrasound,but there was no statistically important difference between the 2 groups for plantar heel pain tenderness.Additionally, there was very little guidance according to proper steroid strength, placement of injections, and its frequency. In a conducted recent panel, the members reported their preferred technique, giving maximum 2 to 3 injections within a 12 month, and citing the risk of rupture or fat pad atrophy as the primary spotlight with continued usage. The members are all of one mind about caution which should be practised when injecting steroids to avoid tissue atrophy and fat pad with multiple injections using too high of a steroid dose.Finally, whole panel attendants varied considerably their preferred placement of steroid for patients with PF (e.g.below, above, or within the fascia) and made consensus that corticosteroid injectios are effective and safe for PF treatment [84].

2.5.4.8.Stretching and Strengthening Exercises

Stretching and strengthening exercises are really important for the treatment of PF.These exercises can correct functional risk factors such as tension in gastro-soleus muscle group and intrinsic muscle strength. Generally,the regular Achilles tendon, plantar fascia and triceps surae stretching exercises reduce the stress on the plantar fascia by preventing the foot from going to excessive pronation and cause the symptoms to decrease.Especially, the increase of the flexibility of the calf muscles is also important[150].In addition, they can provide the ligament to come in more flexible and strengthen muscles which prop the arch, in turn decreasing stress on the ligament.Exercises for plantar fasciitis can be especially helpful for reducing morning heel pain[151].

Stretching of the plantar fascia and triceps surae muscle is often played important role for the conservative treatment of PF. The main success of the PF stretching program is to reductıon of the symptoms that includes painful first steps in the morning, followed by extended sitting and inactivity and it limits the emerging microtrauma and inflammation[76, 152]. Sweeting et al [15]. conducted a systematic review on the impacts of stretching and they reported that this method can help to reduce in symptoms of pain. However, there is no consensus on the absolute number of frequency and repetitions. Moreover, there is no proof of the advantages of combining stretching and strengthening exercises.Dyck et al[153]. in their study, observed that alone stretching exercises which performed on the entire lower extremity, especially Gastrosoleus-Achilles report that there is a simple and most effective treatment and 83% of patients have significant improvement.Wolgin et al[125]. Studied that compared stretching exercises with other methods. It is more successful than the orthers as a pain relief. DiGiovanni et al[154]. reported that in their study, there is significant improvement in PF patients who had 10-month following specific stretching exercise therapy. In a conducted few studies reported that decreased strength of the, toe flexors, plantar flexors and abductor hallucis muscles as well as a decreased in muscle volume in the forefoot are reported to give rise to PF[155-158].

Extrinsic and intrinsic and muscles of the feet support the MLA to provide the absorption of impact during gait cycle and function of lower limb. However, Soysa et al [13]. conducted the study on the impacts of strengthening exercises for these muscles in PF patients and they reported the inconclusive result. In addition, the reduced strength of the lateral rotator and abductor muscles of the hips is the low risk factor for PF [10, 159]. These are really important muscles for the dynamic alignment of the lower limbs. A reduced strength of these muscles can bring about the medial rotation and adduction of the hip and dynamic knee valgus, that is related to foot pronation[160-162]. Thus, strengthening the lateral rotator and abductor muscles of the hips can provide the dynamic alignment of the lower limbs and ease pain related to dynamic valgus.However, the impacts of strengthening exercises for PF are not fully comprehended yet [163-165].In conducted one study; reported that strengthening exercises were more effective in 34.9% of patients than the night splints, orthoses, heels, NSAIDs, steroid injections and surgery[166]. Also, Rathleff et al [4]. reported that the basic progressive exercise including of high-load strength training protocol practised every second day, outcome at 3 months has more significant quick reduction in pain and advancement of function than the plantar-specific stretching and exercise. There were no important differences in secondary outcomes in study including USI of plantar fascia thickness at one, three and six months and FFI: Item 1 (foot pain at worst) and ıtem 2 (painful first step in the morning).There is restricted external evidence that short foot exercises covered toe flexion of all metatarsophalangeal and interphalangeal joints against resistance provide to advanced intrinsic foot muscularity and functional performance when evaluated against a variety of results in young asymptomatic adults[167-169].

Treatment options for PF have been varied with conflicting proof [159]. Until the currently exercise therapy reviews have indicated impression of plantar fascia strecthing and showed that it can have limited benefits [89, 170]. On the other hand, a recent systematic review reported that there is a significant relationship between painful foot pathologies and intrinsic foot muscle weakness such as plantar fasciitis[171].

2.5.4.9.Myofascial Releasing

The Myofascial Release Approach by John F. Barnes is considered to be the final treatment that is steadily effective in producing safe and gentle results. John F. Barnes, PT is an international lecturer, a physiotherapist and author on the Myofascial Release, which has taught to 100,000 physicians and therapists.John F. Barnes begun developing The Myofascial Release Approach and conducting seminars in the 1970s[172].

Fascia is a specifiable system of the body that has a suchlike appearance as a spider web or a sweater. Fascia is very intensive touchingand covering every bone, muscle, nerve, vein and artery, as well as all of the internal organs including the lungs, heart, brain and spinal cord. The most fascinating aspect of fascial system is to separate dressings are not just a system. Indeed, It is the continuous structure that cover from head to toe without any interruption. In this way, every part of the entire body is connected with the all other parts by the fascia[173]. Fascia plays a significant role in the assiting and function of body because of surrounding whole body. In normal healthy condition, it is comfy and wavy in the fascia configuration. It can provide to act without restrictions. When the fascia loses its compliance because of the emotional trauma, physical trauma, scar or inflammation.After that It becomes tensionand narrow for the rest of the body.There are cumulative impressions on the body such as trauma, car accidents,fall, whiplash, surgery or just the repetitive stress injuries and the usual bad stance. Changing in trauma affects the body's fascia system, resulting in comfort and function. Local restraints can cause excessive pressure which leads to all kinds of symptoms that produce headache, pain, or movement restriction. Facial constraints influence stability and flexibility and will depend on stress and ability to perform daily activities is a definitive factor[174].

Myofascial Release is a highly effective and safe applied technique that requires removing the pain and carrying out gentle continuous pressure into the restriction of myofascial connective tissue restoring movement.The pressure must bea few grams of force, and the hands tend to beact in accordance with the direction of fascial restraint, hold the stretch, and letthe fascia to loosen itself. This essential "time-of-day" is related to the difficult flow and piezoelectric phenomenon: a low load (light pressure) is slow with a viscoelastic medium (strip)[175].MFR usuallyincludesslow, maintained pressure (120–300s) carried outindirectly to limited fascia either (indirect MFR technique) or directly (direct MFR technique). The rationale for these techniques can be attributed to various studies that searched viscoelastic, plastic, , and piezoelectric characteristic of connective tissue[176].To Sum,MFR is the application of along duration, low load stretch to the myofascial complex, ensured to regainoptimallength, decrease pain, and improve function. Therefore; the use of MFR leteach patient look at as a unique individual. The individual therapies of treatments are applied by the therapists during the use of a various number of MFR techniques and motion therapy.It encourages the independence of smooth body movement,and mechanics,training for the improving of strength,teaching self-therapy, enhanced flexibility, movement and posture awareness[177]. In fact, MFR direct force to fascial fibroblasts, as well as indirect applied to blood vessels,nerves, muscles and the lymphatic system. Laboratory experiments report that fibroblasts, the primary cell kind of the fascia, adapt the mechanical loading in forms dependent upon the magnitude of strain, frequency and duration[178]. In their in-vitro modeling study showed that the MFR treatment, after repetitive strain injury, concluded in normalization of apoptotic rate, and reduction in production of inflammatory cytokines[179].

Table 2.2. The Expected Effects and Contraindications of Myofascial Releasing[176]

Expected Effects	**Contraindications**
Removing the limitations in soft tissue	Hemodynamic instability
Expansion of theROM	Surgical incision, open wound
Reduce muscle and joint pain	Acute phase of inflammatory diseases
Removing the muscle imbalances	Aneurysm
Decreased survival of neuromuscular tone	Osteoporosis
Increase in microcytotoxic elasticity	Skin hypersensitivity
Increase in functional muscle length	Dermatitis
Relaxation	Do not trust the therapist
	Systemic / local infection
	Healing fracture
	Benign / malign tumors
	Anticoagulant therapy
	Progressive degenerative changes
	Advanced diabetes
	Febril all situations
	Under the influence of alcohol / drugs

Histological evaluations of PF patient'stissuesreported that the findings were more consistent with a failed healing response period, with or without histopathological proof of inflammation. The tissue is qualified histologically by infiltration with macrophages, lymphocytes, and plasma cells;tissue destruction; and restore including fibrosis and immature vascularization. The normal fascia tissue is replaced by an angiofibroblastic hyperplastic tissue which spreads itself along the surrounding tissue creating aselfperpetuating cycle of degeneration[180, 181].The certain mechanisms of the usefullness of MFR in the treatment of PF is not clear, but it can help to reduce of risk factors, such as soleus muscles andstiffnes of the gastrocnemii andlimited ankle dorsiflexion or in strain over the plantar fascia.

A study by Meltzer et al[179]. reported that MFR therapy after repetitious strain injury caused normalization in apoptotic rate, reorientation of fibroblasts,and cell morphology changes. Also, it is possible that pain releasing thanksto MFR is to return the fascial tissue to its normative length by collagen reorganization.It has also been proposed that direct pressure to the sarcomeres, integrated withstretching of the effected muscle or, active contraction can equalize the length of the sarcomeres and reduce the pain [17];on the other hand, this theory has not been scientifically checked out [182]. Also,MFR can be a contributive for the stimulation of afferent pathways and the excitation of A delta fibers that can cause pain modulation at the segmental level as well as modulation by the activation ofpain inhibitingsystems in a descending pathway[183-185].

To Sum, MFR can be a simple and cost effective the non-surgical management of PF. Animportant ratio of individuals with PF can benefit from the usage of MFR[10].

2.5.4.10. Joint and Soft Tissue Mobilization

Mobilization is a hands on therapeutic technique which is planned to increase range of motion(ROM) and restore the mechanical movement following some kinds of trauma or fascial injuries and muscles can restrict the movement and blood flow. Joint mobilization(JM) is used for pain modulation, increasing the ROM, and the reduction of soft tissue swelling, inflammation, and restriction.It includes restrainted joints by applying a sustained or loosening up stiff or oscillatory movement directly into the hedge of a joint, moving the surfaces of actual bone on each other in ways patients cannot move the joint themselves. The therapist gently coaxes joint motion by passive movement within or to the limit of a joint's normal ROM. The therapist's movement of the joint must be accurate and is restrictes by the amount of joint play, which can be less than 1/8th of an inch. Soft tissue mobilisation (STM) is used for breaking up to fibrous tissue of the muscle such as scar tissue, making tissue fluids move such as swelling, and reducing the muscular tension. Also, soft tissue problems can be a primary source of pain. Depending on where your limitations are located, physical therapist will perform different directions of pressure to break down muscle adhesions[186].According to Loudon et al. JM and STM was shown to have positive effects on pain levels and ankle dorsiflexion mobility specific to the ankle complex in participants with post lateral ankle sprains[187].

Reported the association between plantar heel pain and restrictes ankle dorsiflexion, it seems reasonable to use joint and soft tissue mobilization.The mechanism of effectiveness of JM and STM is multifactorial and covers neurophysiological, mechanical, and psycho-emotional effects, all of that benefit for patients with PF[186]. Also, JM and STM has been used as a conservative treatment option for PF in many laststudies, and the randomized clinical trials studies have indicated the JM and STM for improving function in PF patients and the effectiveness of JM and STM on VAS (Visuel Analogue Scale) was equivalent to comparison interventions in despite advancement in self-reported function at the same time points. According to conducted few studies, the recommended treatment techniques for PF patients should contain passive joint mobilization of the ankle and foot; myofascial maneuvers to the plantar fascia and gastro-soleus muscles and; neural mobilization of the tibial nerve; and stretching of the plantar fascia and triceps surae[2, 188-191]. In a 2008 clinical practice guideline (CPG) put by the Orthopaedic Section of the American Physical Therapy Association, JM and STM received a recommendation grading of ‘E,’ showing the theoretical or foundational evidence to promote the utilize of this treatment for PF patients[159]. In just 6 years, the updated and most recent CPG emitted in 2014 now recommends JM and STM in the treatment of PF patients with a grade of ‘A,’ showing a strong advice based on level I and II studies in the literatüre[10, 191].

As a consequence; utilization of JM and STM by physical therapists in the conservative treatment of patients with PF has increased in recent years and providesthe decreased length of care and cost[192].

3. Material and Method

3.1.Subjects

The study included 41 unilateral and 6 bilateralpatients with plantar fasciitis(PF)(29F, 12M; 49,78±11,24 years) admitted to Orthopedics and Traumatology Department of Yeditepe University between November 2017 and May 2018.

The patients who met inclusion criteria were randomly(by computer based random number generator) divided into two groupsas Outpatient Program(Group1, n=23, 50,05±10,76 years) or Home Rehabilitaion Program (Group2, n=24, 49,54±11,88 years).

3.1.1. Inclusion criteria

- Being voluntary to participate to the study
- Being between 18 and 75 years old
- Having PF symptoms for least 6 weeks
- Having infracalcaneal morning pain
- Having plantar and localized pain with palpation on the proximal fascia
- Negative result of tarsal tunel test
- Positive result of windlast test

3.1.2. Exclusion Criteria

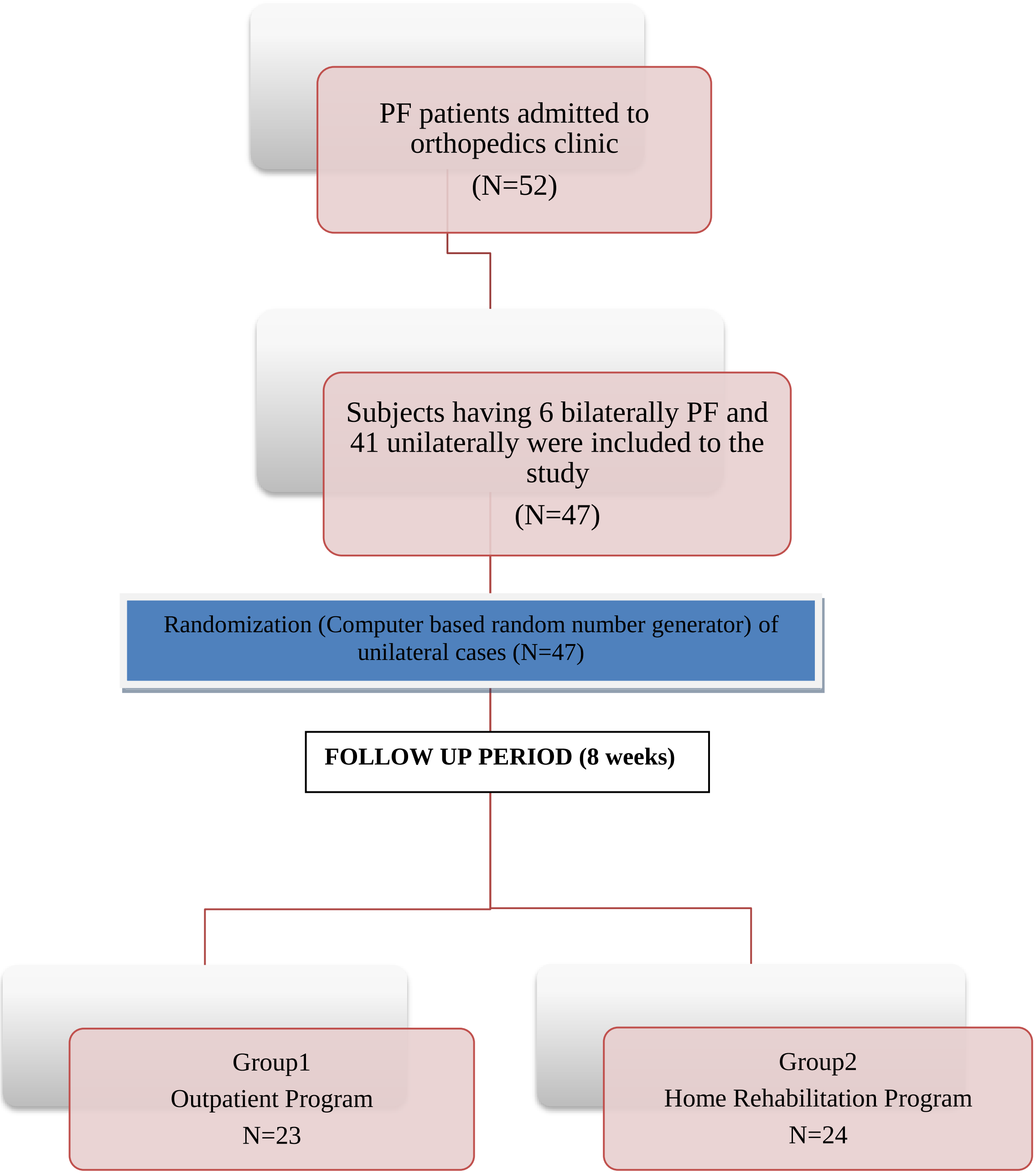
- Receiving local steroid injection or physiotherapy intervention within 6 months
- History of foot and ankle fracture, injury and surgery
- History of systemic disease(e.g.Rheumatoid Arthritis, Diabetes Mellitus)
- The presence of thrombopathy and severe heart conditions
- Pregnancy
- Tumor

The study protocol was approved by the Yeditepe University Ethical Committe at the date of 04.01.2018 and issue number was37068608-6100-1-1409(Appendix 1).Participants involved in the study on a voluntary basis.The aim and plan was explained and informed written consent was obtained from each patient(Appendix 2).

3.1.3. Flow Chart:Study Process

A totally 52 patients were admitted to Orthopedics and Traumatology Department of Yeditepe University.Subjects having 6 bilaterally PF and 41 unilaterally PF were included to the study according to inclusion criteria.Randomization was counducted on all cases which are divided into two groups as Outpatient Program(Group1) or Home Rehabilitaion Program (Group2) by computer based random number generator(Table 3.1). Only unilateral PF cases were statistically analyzed.

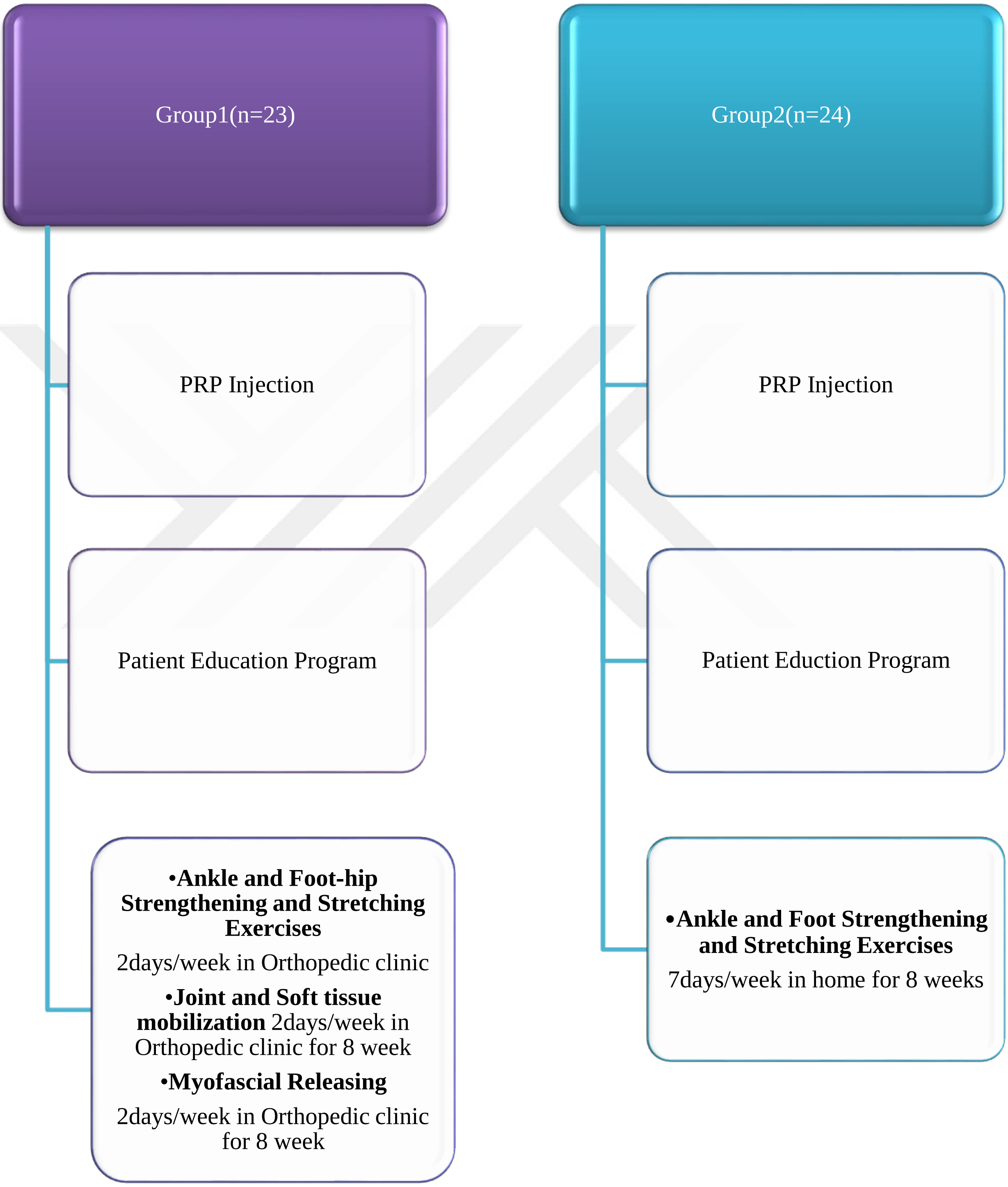
Table 3.1: Flow Chart of Study



3.1.4. Study Protocol

All subjects were applied Platelet-Rich Plasma (PRP) by the Arthrex ACP Double Syringe System.Ten millilitres of autologous blood was received from the antecubital vein with the outer syringe and then placed into syringe system and centrifuged for eight minutes at 1,500 rpm. Whole patients received one injection at the plantar fascia before the management program.Outpatient program(Group1) was taken foot and ankle –hip strengthening and stretching exercises**,** myofascial releasing,joint and soft tissue mobilizationcombined with patient education program for2days/week in Orthopedic clinic for 8 week. Home rehabilitation program(Group2) which were included foot and ankle-hip strengthening and stretching exercises combined with patient education for 7days/week during 8 week.

Table 3.2. Research Protocol in the study



3.2.Evaluation

Patients were evaluated 3 times; pre intervention,4th week and 8th week.All measurements were recorded at 1st, 4th and 8th week (Appendıx 3).

T_0 :preintervention

T_1 :4th week

T_2 :8th week

3.2.1. Structured Questionnaire

The structured questionnaire prepared by researchers applied face to face interviews.The questionnaire included about the age, gender, educational level, occupation, socio-demographic conditions, existing chronic diseases, surgical conditions and injuries, types of shoes used, smoking habits and exercise behaviors of subjects(Appendix 3).

3.2.2. Goniometric measurements

Four separate motion capacities were recorded for each foot of the subjects with the right and left feet.The subject was placed on the back of the examination table (a thin cushion should be placed under the knees during measurement). The probe of the instrument was placed on the first metatarsal of the foot. Dorsal and plantar flexion movement widths were measured(Figure 3.1).

Pivot Point: Lateral malleol

Fixed Arm: Fibula parallel to lateral midline

Moving Arm: Follows the lateral midline of the metatarsal bone.

Inversion and eversion movements were taken in position that the legs hang from the table.

For the inversion;

Pivot Point: 5th metatarsal heads of the feet

Fixed arm: parallel to the lateral midline of the blade

Moving Arm: parallel to the plantar face of the foot[193, 194].

For the eversion;

Pivot Point: shifts in the reverse direction of the inversion motion.

Fixed Arm: parallel to medial midline of stump

Moving Arm: parallel to the plantar face of the foot [193, 194].

Figure 3.1. Goniometric measurements

3.2.3. Pain assessment(VAS)

Visual Analogue Scale(VAS) was used to estimate the severity of participants' first step pain(morning time).It consists of a line, usually 100 mm long, whose ends are labeled as the extremes(no pain and worst pain imaginable);the rest of the line is blank.

The patient is asked to put a mark on the line indicating their pain intensity[195].100 mm at both ends of a line definitions are written to the two extremes of the parameter to beevaluated and patients of their condition on the line where it is appropriate,draw a line, or by putting a dot or mark is asked to specify, where there is no pain from the patient's length of the distance from the mark to the point where the patient's pain symptoms.Testing is recognized and proven in the literature of all the world.A higher score indicates greater pain intensity(Appendix 5).

3.2.4. Foot Function Index(FFI)

Pain, activity restriction and disability were assessed by FFI. The pain subscale, which includes 9 items, measuresfoot pain related to a variety of conditions.Various functional activities depending on foot problems were determined by the disability subscale, which also includes 9 items. Activity restrictions due to foot problems were assessed with an activity limitation subscale containing 5 items[196, 197].Higher scores indicate more pain, disability and limited activity[198].In our study, the patients were asked to markeach category with a score between 0 and 10 about their pain, activity restriction and disability level. All the categorized scores were collected and a total score was noted (Appendix 4).

3.2.5. Evaluation of medial longitudinal arch

The Feiss line was used to evaluate the position of the medial longitudinal arch[199].A line was drawn from center of medial malleoli to navicular tuberosity and another line was drawn from navicular tuberosity to head of first metatarsal. The obtuse angle between these lines is known as longitudinal arch angle (LAA). The normal maximum LAA is between 131^0 and 152^0. Foot with lower LAA is considered to have low-arch and angle greater than 152^0 is considered to be high-arched. If it is high arch the navicular tuberosity is above the arch and in low-arched foot the navicular tuberosity is below the line[199, 200].

3.2.6. Dynamic balance evaluation (Y balance test)

The Y Balance Test (YBT) is a method used for injury risk.The YBT for the lower quarter (LQYBT) based on the Star Excursion Balance Test.LQYBT was preffered in this research. The patient standson one leg while reaching 3 different directions,namely anterior, posteromedial and posterolateral with the collateral side. The 3 reaches yield a “composite reach distance” or composite score used to estimate injury. According to the balance evalution, the difference of dynamic flexibility between the right and left leg indicates asymmetry and also, we could compare Total Dynamic Flexibility Scorewith standard values either in teams or individually. Also, it would be true to see this test as a skill test. If the total scores were lower than the average value, it means that poor balance [201] (Figure3.2).

Figure 3.2. Y balance test

3.2.7. Foot and leg length measurement

Measurements were taken from spina iliaca anterior superior (SIAS) to medial malleolus and from heel to longest finger[193, 200].

3.2.8. Evaluation of ankle proprioception (Electronic goniometer)

The movement and position sense of the various parts of the body is defined as proprioception. The main task of the proprioseption is the coordination of motion integrity and sensory-motor control for balance and joint stabilization. Clinically, usually based on the evaluation of the joint position feeling.Joint position sensation is measured by active ankle reproduction.Reference values for the ankle are 10º dorsiflexion and 15º plantar flexion without visual feedback.The ankle is brought to this target opening and the deviations from the target point were measured with the digital goniometer[202]. To align the goniometers properly, subjects were asked to sit on a sickbed and were to reconstruct ankle angle for the task. With closed eyes, the foot was positioned by the examiner (10º dorsiflexion without visual feedback, 15º plantar flexion). Subsequently, the foot was moved to an angle that positioned by the examiner.This procedure was repeated three times for each movement and the mean difference between desired angles were recorded (Figure 3.3).

Figure 3.3. Evaluation of ankle proprioception

3.2.9. Navicular Drop Test

The navicular drop test measures the flexibility of medial longitudinal arch. The distance from the navicular tubercle to ground in the sitting positionand also, the distance from the navicular tubercle to ground in the standing position (weight bearing) were measured. The difference between the two measurements were noted. When the difference between the two measurements is between 5 and 9 mm, the foot is considered as neutral, 10 mm and more,indicates excessive pronated foot, and less than 5is supinated foot[203](Figure3.4).

Figure 3.4. Navicular Drop Test

3.2.10. Gastrocnemius-Soleus Muscle Flexibility Tests

The elasticity of the calf muscle was determined by measuring with a goniometer. For gastrocnemius muscle, the patient was asked to stand facing a wall and place one leg to the back in a fully extended position and bend the front leg.At this position, the measurement was taken. For soleus muscle, the patient was asked to stand facing a wall and take a lunge position with keeping the front leg relaxed and both feet flat on the ground (full contact with ground), bend the back knee. At this position, the measurement was also taken[204](Figure 3.5).

Figure 3.5. Gastrocnemius-Soleus Muscle Length Tests

3.2.11. Monofilament testing

It is a non-invasive, low cost, fast and easily applicable test. During application,if the patient fails to feel when the monofilament is twisted, the loss of sensation is considered.Considering the description of loss of protective sensation, it is the inability to feel Semmes Weinstein Monofilament with 5.07 / 10 g.The buckling force of this monofilament is 10 grams, felt by the patient. The logarithm of this strength in milligrams is 5.07 for this monofilament[205].In this research, the patient was asked to close their eyes and the monofilament was applied until it bends slightly under each specific area A,B,Cof the foot (Figure. 3.6).

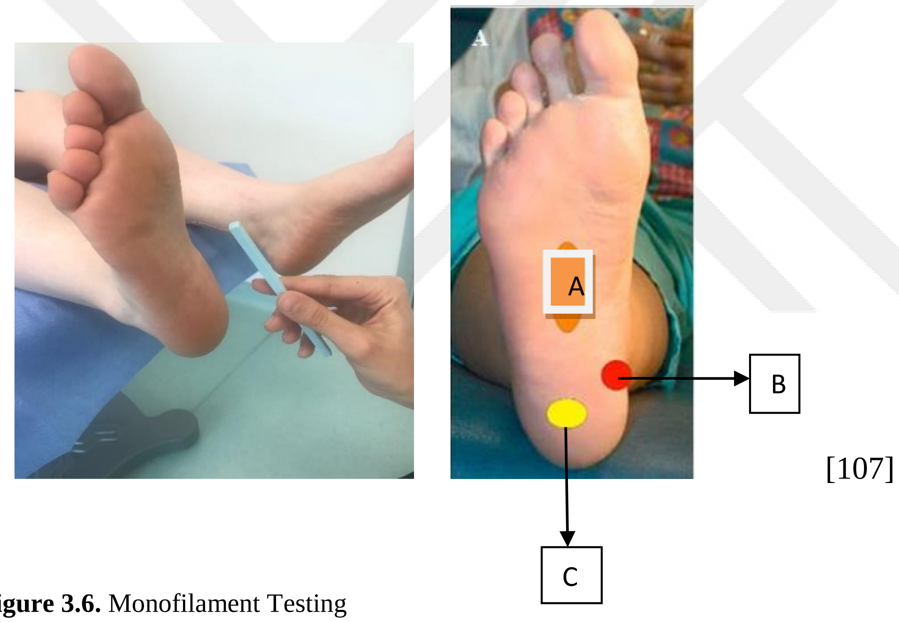


Figure 3.6. Monofilament Testing

3.3.Management Modalities

3.3.1. Patient Education

Before the both program, the patients were informed about plantar fasciitis, symptoms and complications and also the evaluation methods, parameters and tests were explained.Both groups were taken the consulating sheet that includes these followings(Appendıx 6);

1. Use soft heeled shoes.

2. Do not wear shoes and slippers with your bare feet, prefer soft socks.

3. Do not press barefoot on hard floors (concrete, parquet, ceramics).

4. To lose weight, do not prefer walking and running, but prefer swimming and cyclingas exercise.

5. Prefer silicones apparatus to make your heel being soft.

6. Avoid the walking and standing with long times.

7. Do not choose small or large number of the shoes and slippers.

8. Do not choose high heels or heelless shoes and slippers.

9. While applying ice tampon for pain revealing, be aware that application may increase your pain initially.

10. You can apply the ice massage on heel by pulling your toes back for 2-5 minutes with painkillers jel.

3.3.2. PRP Injection

The Arthrex ACP Double Syringe System™ was used to get PRP This system contains one outer 10-ml syringe. The commercially available 5-ml syringe is connected with this outer syringe. Ten millilitres of autologous blood was received from the antecubital vein with the outer syringe and then placed into Syringe System and centrifuged for eight minutes at 1,500 rpm. The system make possible to supernatant (PRP) transfer from the 10-ml outer syringe into the 5-ml syringe under aseptic circumstances. Whole patients received one injection at the plantar fascia before the management programme[206, 207]. Whole injections were done by the same orthopedist. According to Cyriax, the injection point was at the origin of the plantar fascia on the medial tubercle of the calcaneus[208]. Each injection was administered once at baseline.(Figure 3.7).

Figure 3.7. The Arthrex ACP Double Syringe

3.3.3. Foot and Ankle-Hip Stretching and Strengthening Exercises Program

The group1 was given foot and ankle-hip stretching and strengthening exercises program(2days/week in Orthopedic clinic and 5days/week in home for 8 week)while the group2 was only given foot and ankle stretching and strengthening exercises program(7days/week in home for 8 weeks) approximately 4 days after PRP injection. The exercise form describesthe exercises and the schedule prepared for the marking the days(Appendix 6).

The foot and ankle–hip stretching and strengthening exercises therapy including calf muscle stretches, plantar fascia stretching, hamstring-gastro-soleus strecth, Strengthening of the flexor intrinsic muscles, Thera-band strengthening exercises for ankle and hip.

The foot and ankle stretching and strengthening exercises therapy including calf muscle stretches, plantar fascia stretching, hamstring-gastro-soleus strecth, Strengthening of the flexor intrinsic muscles, Thera-band strengthening exercises for ankle.

Patients were asked to do these exercises three times in a day starting from the pre-interventionto 8th week (Table 3.3).

Table 3.3.The Foot and Ankle-Hip Stretching and Strengthening Exercises Program

		WEEK 1.2.3.4.	**WEEK 5.6.7.8.**
1	**Strecthing of M. Gastrocnemius**	Hold for 30 seconds 3 repetition x 3sets	Hold for 30 seconds 3 repetition x 3sets
2	**Strecthing of M. Soleus and Achilles**	Hold for 30 seconds 3 repetition x 3sets	Hold for 30 seconds 3 repetition x 3sets
3	**Stretching of Plantar Fascia**	Hold for a count of 3-5 minutes x 3 sets	Hold for a count of 3-5 minutes x 3 sets
4	**Stretching of Hamstring-Gastro-Soleus**	Hold for 30 seconds 3 repetition x 3sets	Hold for 30 seconds 3 repetition x 3sets
5	**Strengthening of the Flexor Intrinsic muscles**	2 minutes x 3 sets	2 minutes x 3 sets
6	**Strengthening Exercises for Ankle**	10 repetition x 3 sets	15 repetition x 3 sets
7	**Strengthening Exercises for Hip**	10 repetition x 3 sets	15 repetition x 3 sets

Figure 3.8. Strecthing of M. Gastrocnemius **Figure 3.9.** Strecthing of M. Soleus and Achilles

Figure 3.10. Stretching of Plantar fascia **Figure 3.11.**Stretching of Hamstring-gastro-soleus

Figure 3.12. Strengthening of the flexor intrinsic muscles

Figure 3.13. Strengthening exercises for ankle

Figure 3.14. Strengthening exercises for hip

3.3.4. Myofascial Release (MFR), Joint and Soft Tissue Mobilization Treatment Program

The first group was given these interventions providing twice a week for 8 weeks, with a minumum of a 1 day rest between the 2 sessionsapproximately 4 days after PRP injection.; the period of each treatment 30-45 min. Both treatments were carried to the effected side.Outcome measures were recorded at pre intervention, 4th week and 8th week.

3.3.4.1.Myofascial Release Technique

Myofascial Release for Gastrocnemius

Patient’s position:Prone with feet off the end of the table to let the easy dorsiflexion. Technique1:The patients were applied to use an 90 degree elbow flexed,be contact in the Tendon Achilles, slowly constitute a line of tension in a superior direction with the patient’s passive dorsiflexion and 3 repetition and focus of the releasing on muscles and tendon(Figure 3.15).

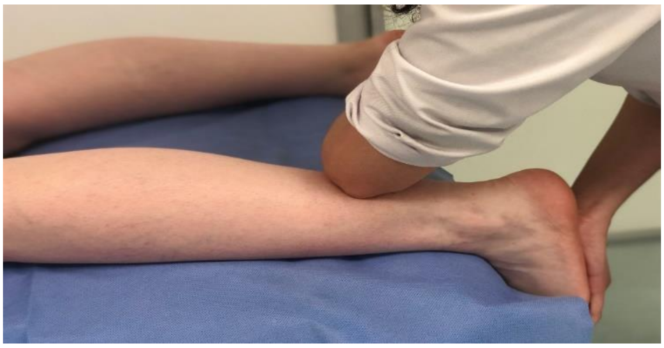


Figure 3.15.MFR for gastrocnemius with using elbow

Technique 2:The patients were applied to use the index, middle fingers of both hands to be get in touch with on the tendons of the gastrocnemii, slowly establish a line of tension in an inferior way with the pressure into popliteal fossa and keep up this down into the superior part of the fibrous portion of the muscle with the patient’s passive dorsiflexion and 3 repetitions(Figure 3.16).

Figure 3.16. Starting finger placements for the releasing of the gastrocnemii

Technique 3:The patients were applied to use the middle, index and ring fingers of both hands to be contact into the lateral and medial sides of the calcaneus.Start the release proximally, slowly put a line of tension in an inferior way with the patient’s passive dorsiflexion with 3 repetitions(Figure 3.17).

Figure 3.17. Initial finger placements for the release of the fascia at the calcaneus

Myofascial Release for soleus

Patient’s position:Prone with feet over a cushion to provide 10-15 degrees of knee flexion.

Technique:The patients were applied to use an elbow to get in touch with the Achilles tendon, carry out pressure progressively through the tendon and fascia layer between the soleus and gastrocnemii and constitute a line of tension in a superior way with the patient’s passive dorsiflexion and 3 repetitions (Figure 3.18).

Figure 3.18. Soleus release with 10-15 degree of knee flexion

Myofascial Release for plantar myofascia

Patient's position: Prone with feet over the end of the sickbed to make easy dorsiflexion.

Technique: The patients were applied to use the knuckles to engage the soft tissue of the anterior calcaneus, put a line of tension in an anterior way with the patient's passive dorsiflexion with 3 repetitions (Figure 3.19).

Figure 3.19. Releasing of the plantar myofascia

3.3.4.2.Joint and Soft Tissue Mobilization Technique

We used the following treatment protocol for the patients of the group1 and the techniques were applied by the same physiotherapist.

Intervention: Plantar fascia and flexor hallucis longus stretch and tissue mobilization

Patient's position: Prone position with knee extended and feet over the end of the sickbed.

Technique: The patients were applied to hold calcaneus in eversion while doing talocrural dorsiflexion.Glide the thumb proximally and distal along the way of the plantar fascia & flexor hallucis longus with patient tolerance depth for approximately 3 minutes(Figure 3.20).

Figure 3.20. Tissue mobilization of plantar fascia

Intervention : Eversion rearfoot mobilization

Patient's position:Side-lying position with feet over the end of the sickbed and stabilized the tibia, fibula and talus against the table.

Technique:The patients were applied the mobilizing force directly through the therapist's thenar eminence of the arm to the medial calcaneus(Figure 3.21).

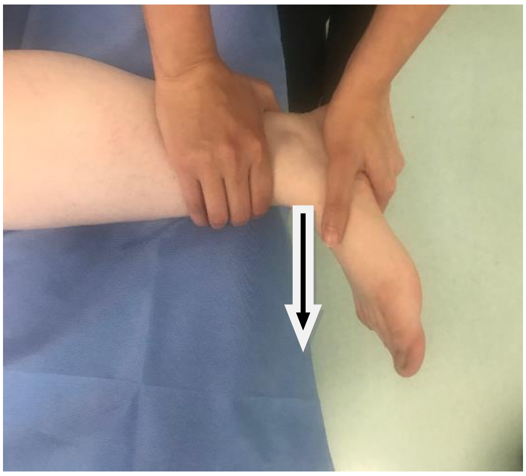


Figure 3.21. Rearfoot mobilization

Intervention: Anterior-to-posterior talocrural mobilization

Patient's position:Supine position with feet over the end of the sickbed and stabilized the lower leg from the malleoli.

Technique: Patients were applied to grasp the medial, anterior and lateral talus and mobilize talus anteriorly to posteriorly (Figure 3.22).

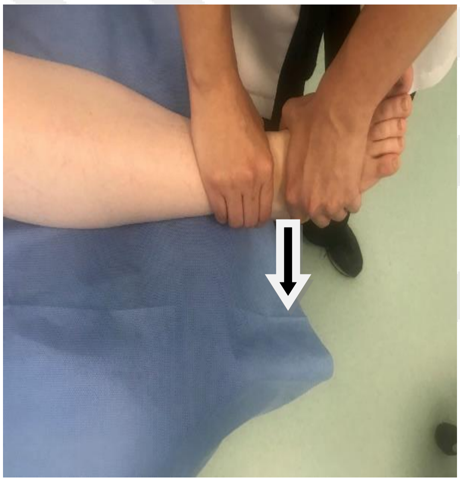


Figure 3.22. Anterior-to-posterior talocrural mobilization

Intervention: Intertarsal mobilization

Patient's position: Prone position with the stabilized the patient's dorsal foot on his/her flexed knee by the therapist.

Technique:The patients were applied plantar to dorsal mobilization to the tarsal bone through the hypothenar eminence of the therapist's arm(Figure 3.23).

Figure 3.23. Intertarsal mobilization

Intervention: Tibialis posterior stretch

Patient's position: Prone position with knee flexed 90°.

Technique:The patients were applied to hold in dorsiflexion and the calcaneus in eversion and maintain a stretch for about 60 seconds (Figure 3.24).

Figure 3.24. The stretching of Tibialis posterior

Intervention: Tibialis posterior nerve mobilization**.**

Patient’s position:Supine position with extended knee.

Technique:The patients were applied by the pushing metatars with straight leg lift (SLR).The leg was brought slightly to abduction, then the leg was slightly moved to the external rotation position.The ankle was brought to the dorsiflexion and the eversion(Figure 3.25).

Figure 3.25. Tibialis posterior nerve mobilization

Data Analysis

Statistical analyzes were performed by using the SPSS (IBM SPSS Statistics 22) Package Program.Descriptive statistics were used to define the features of study groups. The Shapiro-Wilk test was used to test the numerical variables for normality. "Independent Sample-t" test (t-table value) statistics were used to compare two independent groups with normal distribution.Statistical analysis was performed pre intervention, 4th week and 8th week evaluation for parametric with Paired Sample T-test and non-parametric with Wilcoxon test.The significance level was accepted 0.05.

4. RESULTS

The study included 47 Plantar Fasciitis(PF) patientsadmitted to Orthopedics and Traumatology Department of Yeditepe University between November 2017 and May 2018. Only unilateral(N=41,29 F/12 M) PFs were statistically analyzed.

The physical features (age, weight, height and body mass index (BMI) of PF patients are presented in Table 4.1. There were no statistically significant differences in age, weight, height and BMI scores in the groups (p> 0,05).

Table 4.1.Physical Features of Participants

Variable (N=41)	Group 1 (n=19)		Group 2 (n=22)		t p value
	Mean ± S.D.	**Median [Min-Max]**	**Mean ± S.D.**	**Median [Min-Max]**	
Age (year)	50,05±10,76	50,0 [29,0-74,0]	49,54±11,88	51,0 [27,0-76,0]	0,142 ns
Weight (kg)	77,47±12,02	80,0 [55,0-95,0]	76,11±11,69	75,0 [55,0-100,0]	0,366 ns
Height (cm)	164,47±8,34	165,0 [151,0-181,0]	165,04±9,09	163,0 [150,0-185,0]	-0,209 ns
BMI (kg/m²)	28,56±3,40	29,4 [22,0-33,7]	28,19±5,44	27,7 [19,6-40,0]	0,254 ns

Data expressed as mean ±standard deviation, Median [Min-Max], ns: non-significant, BMI:Body mass index, Group 1:Outpatient rehabilitation program, Group 2: Home rehabilitation program.

The gender, laterality, foot morphology, staging of PF, dominant side, first step pain, tenderness and subdivision of BMI in the study groups were given in Table 4.2.There were no statistically differences for gender, laterality, foot morphology, staging of PF, dominant side, first step pain, tenderness and subdivision of BMI in Group1 and Group2(Table 4.2.).

Subdivision of BMI is used to classify, according to World Health Organization, the data showed that 47,4% of Group 1 were found to be obese with BMI of 30or above and 36,4% ofGroup 2 were obese.

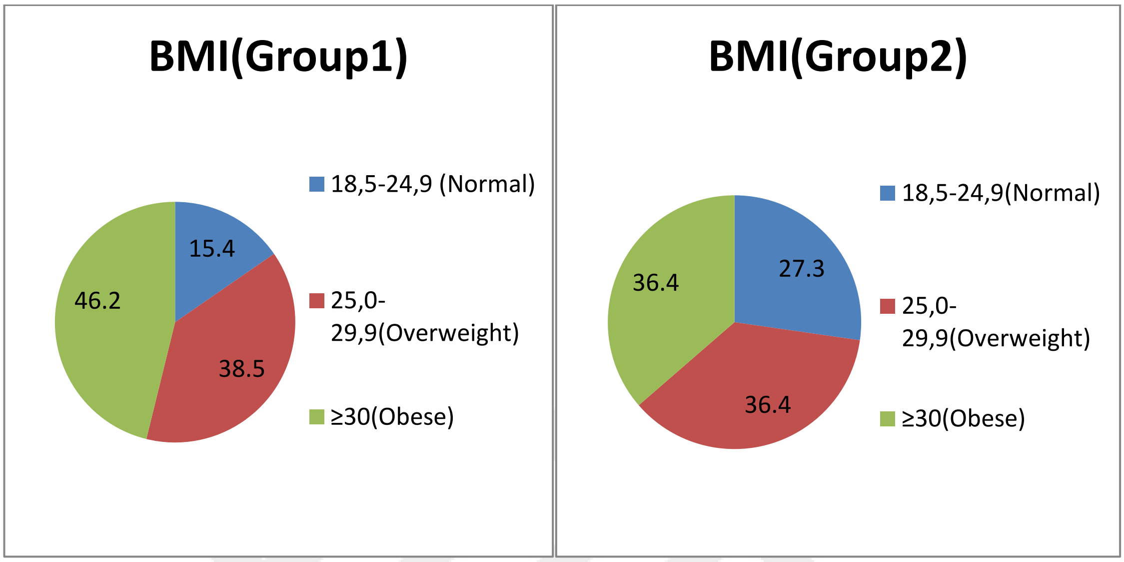
Table 4.2. Descriptive Findings of the study group

	Group 1 (n=19) %(n)	Group 2(n=22) %(n)	λ² p value
Gender			
Female	73,7(14)	68,2(15)	,149
Male	26,3(5)	31,8(7)	ns
BMI			
18,5 – 24,9 (Normal)	15,8(3)	27,3(6)	,711
25,0-29,9(Overweight)	36,8(7)	36,4(8)	ns
≥30 (Obese)	47,4(9)	36,4(8)	
Laterality			
Left	52,6(10)	59,1(13)	,173
Right	47,4(9)	40,9(9)	ns
Foot Morphology			
Pes cavus	36,8(7)	31,8(7)	2,79
Pes planus	0,0(0)	13,6(3)	ns
Normal	63,2(12)	54,5(12)	
Staging of PF			
Acute / 4-12weeks / Subacute	5,3(1)	22,7(5)	3,95 ns
Chronic>3 months	94,8(18)	77,2(17)	
Dominant side			
Right	89,5(17)	86,4(19)	,092
Left	10,5(2)	13,6(3)	ns
First Step Pain (Morning Time) Yes	100(19)	100(22)	
Tenderness Yes	100(19)	100(22)	

Data expressed as %(n),ns: non-significant,BMI:Body mass index, Group 1:Outpatient rehabilitation program,Group2 : Home rehabilitation program, PF:Plantar Fasciitis

The BMI distribution was showed in Graph 4.1.In Group1, totally %84,2 of subjects were classified as overweight and obese.Similarly, the total rate for overweight and obese were %72,8 in Group2(Graph 4.1).

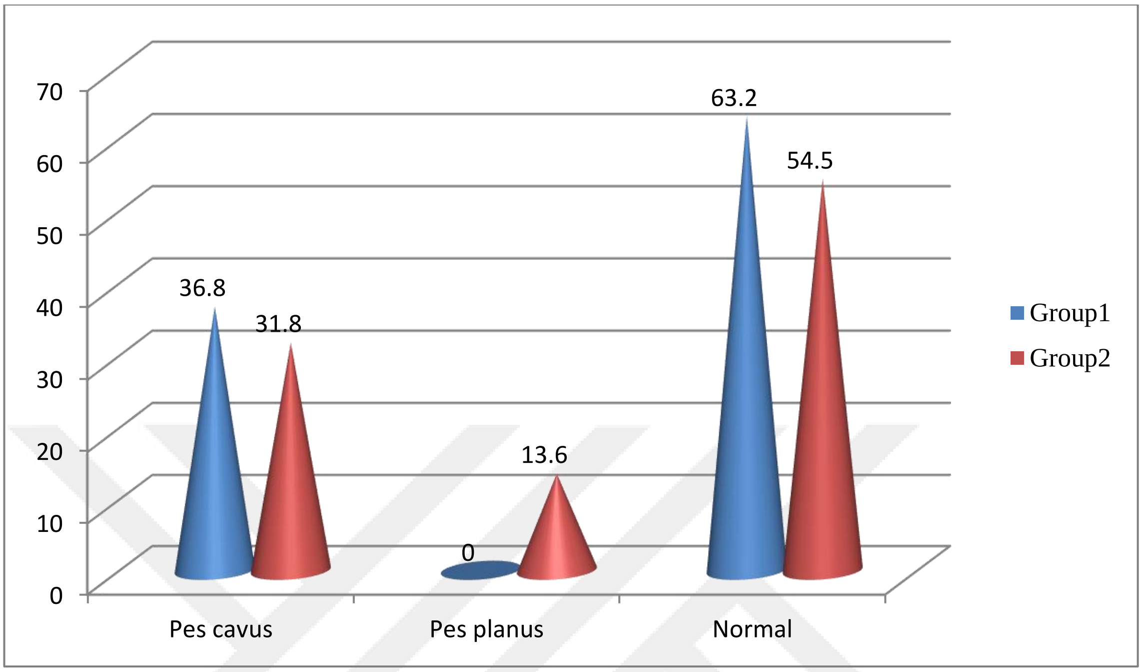
Graph 4.1.The Distribution of BMI index



Data expressed as % .

The foot morphology distributions demonstrated that the ratio of pes cavus was found as %36,8 in the Group1 while the total ratio for pes cavus and pes planus was approximately %45,4 in Group2(Graph 4.2).

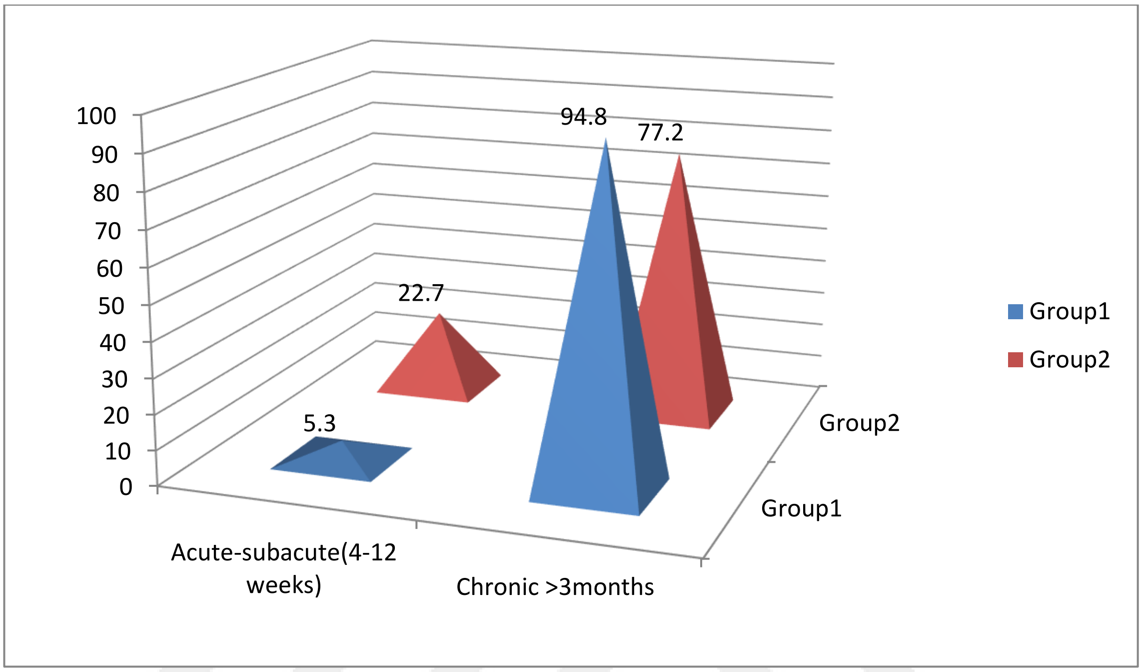
Graph 4.2. The Distribution of Foot Morphology in the study groups



Data expressed as % .

The stages of PF in the study groups were illustrated in Graph 4.3.%94,8 of subjects were categorized in chronic stage, %5,3 of the patients were in acute/subacute stage in Group1. On the other hand, the rate for being in chronic stage was %77,2 in acute-subacute stage was %22,7 in Group2 (Graph 4.3).

Graph4.3. The Distribution of Staging of Plantar Fasciitis in the study groups



Data expressed as % .

Paired t-test were used to compare the means of values for plantarflexion, inversion with normal distribution and Wilcoxon test were used to compare the means of values dorsiflexion, plantarflexion, inversion and eversion with non-normal distribution during pre intervention, 4th and 8th week.The findings showed that the means of dorsiflexion, plantarflexion, inversion and eversion were improved at 8th week compared the results in 4th week and pre intervention ($p<0.05$,Table 4.3).

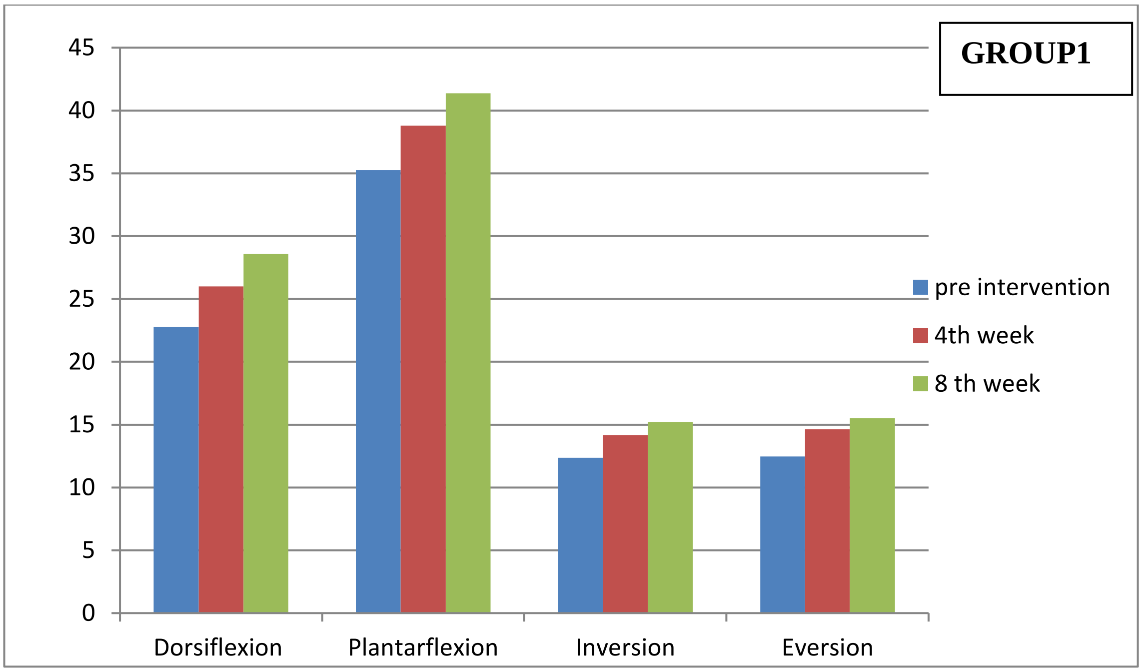
Table4.3. Comparison of Range of Motion(ROM)values for dorsiflexion, plantarflexion,inversion and eversion on pre intervention, 4th week and 8th week

			Group1 mean ± S.D	t/z P value	Group2 mean ± S.D	t/Z P value
ROM Values (°)	**Dorsiflexion (°)**	T_0 T_1	22,79±2,39 26,00±2,24	z=-3,879 **,000**	21,73±2,33 25,14±2,49	z=-4,137 **,000**
		T_0 T_2	22,79±2,39 28,57±1,35	z=-3,844 **,000**	21,73±2,33 27,41±2,91	z=-4,124 **,000**
	Plantarflexion (°)	T_0 T_1	35,26±3,78 38,79±4,00	z=-3,837 **,000**	34,18±4,55 37,04±4,94	t=-7,326 **,000**
		T_0 T_2	35,26±3,78 41,37±3,96	z=-3,849 **,000**	34,18±4,55 38,91±4,82	t=-11,196 **,000**
	Inversion (°)	T_0 T_1	12,37±2,09 14,16±2,27	t=-8,500 **,000**	12,73±5,17 13,32±1,99	z=-3,337 **,001**
		T_0 T_2	12,37±2,09 15,21±2,15	t=-10,205 **,000**	12,73±5,17 14,14±2,10	z=-3,307 **,001**
	Eversion (°)	T_0 T_1	12,47±1,84 14,63±2,19	z=-3,762 **,000**	12,41±1,99 14,09±2,43	z=-3,820 **,000**
		T_0 T_2	12,47±1,84 15,53±2,41	z=-3,847 **,000**	12,41±1,99 15,14±2,36	z=-4,042 **,000**

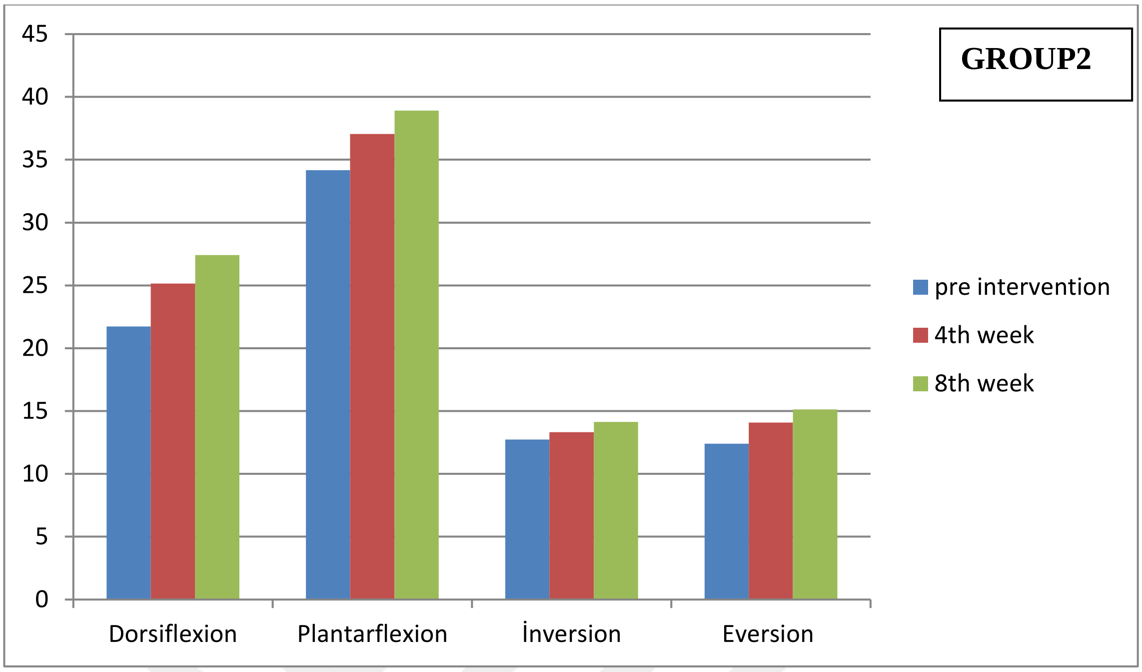
Data expressed as mean ±standard deviation,T_0:pre-intervention, T_1:4th week evaluation, T_2:8th week evaluation, ROM:Range of Motion.

The improvement of the findings for dorsiflexion, plantarflexion, inversion and eversion ROM were illustrated in Graph 4.4.We found the statistically significant improvements in dorsiflexion, plantarflexion, inversion and eversion ROM measurements for 4th and 8th week evaluation in the study groups (Graph 4.4.).

Graph4.4.The Improvemens of Range of motion Valuesfor dorsiflexion, plantarflexion,inversion and eversion on pre intervention, 4th week and 8th week



Data expressed as mean.



Data expressed as mean.

Paired t-test was used to determine the differences in proprioceptive deviation from target angle on pre intervention, 4th and 8th week. The results showed that the mean of proprioceptive deviations were decreased in 4th week and 8th week ($p<0.01$,Table 4.4).

Table 4.4. Comparison of proprioceptive results on pre intervention, 4th week and 8th week

			Group1 mean ± S. D	t P value	Group2 mean ± S. D	t P value
Proprioception Assessment *(Deviation from target angle)*	**Dorsiflexion (10°)**	**T_0** **T_1**	2,91±0,71 1,83±0,81	t=6,994 **,000**	4,15±1,13 2,54±0,76	t=8,68 **,000**
		T_0 **T_2**	2,91±0,71 1,15±0,36	t=13,681 **,000**	4,15±1,13 1,78±0,77	t=13,48 **,000**
	Plantarflexion (15°)	**T_0** **T_1**	2,90±0,95 1,75±0,75	t=5,388 **,000**	3,55±1,09 2,42±0,91	t=8,68 **,000**
		T_0 **T_2**	2,90±0,95 1,06±0,42	t=8,316 **,000**	3,55±1,09 1,59±0,70	t=9,48 **,000**

Data expressed as mean ±standard deviation, T_0:pre-intervention, T_1:4th week evaluation,

T_2:8th week evaluation.

According to paired t-test, the findings showed that the means of Ybalance scores were improved at 4th and 8th weekcomparing pre intervention in the study groups (p<0.01, Table 4.5).

Table 4.5. Comparison of Y balance resultson pre intervention, 4th week and 8th week

		Group1 mean ± S. D	t P value	Group2 mean ± S. D	t P value
Y balance Score (%)	T_0 T_1	60,16±12,49 71,31±13,90	t=-6,071 **,000**	62,41±11,13 70,16±12,60	t=-7,955 **,000**
	T_0 T_2	60,16±12,49 78,91±15,73	t=-7,833 **,000**	62,41±11,13 74,43±12,85	t=-9,606 **,000**

Data expressed as mean ±standard deviation, T_0:pre-intervention, T_1:4th week evaluation,

T_2:8th week evaluation.

Composite reach distance:Sum of three directions.

• Normalized reach distance: (Direct reach distance/ low limb length) × 100

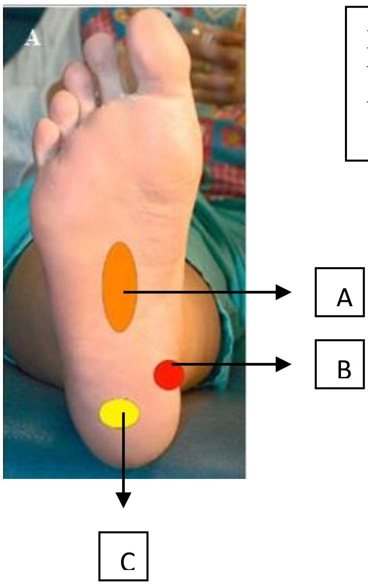
• Global result(Y balance Score): (Composite reach distance/3 times low limb length) × 100

A paired t-test and Wilcoxon test was performed comparing the pre intervention, 4th week and 8th week results forthe study groups (n=41). The monofilament values in specificially each areas as A,B,C were statistically decreased in the study groups for 8th week (p<0.05,Table 4.6).

Table 4.6. Comparison of Monofilament values on pre intervention, 4th week and 8th week

			Group1 mean ± S.D	t/Z P value	Group2 mean ± S.D	t/Z P value
Monofilament Values *(Assessment from target area) (mg)*	**A**	**T_0** **T_1**	4,21±0,27 3,92±0,27	z=-3,834 **,000**	4,26±0,39 4,18±0,41	t=3,968 **,001**
		T_0 **T_2**	4,21±0,27 3,70±0,32	z=-3,841 **,000**	4,26±0,39 4,07±0,44	t=5,729 **,000**
	B	**T_0** **T_1**	4,12±0,31 3,93±0,26	z=-2,950 **,003**	4,20±0,37 4,13±0,36	t=3,207 **,004**
		T_0 **T_2**	4,12±0,31 3,70±0,28	z=-3,831 **,000**	4,20±0,37 4,03±0,43	**t=**4,327 **,000**
	C	**T_0** **T_1**	4,56±0,31 4,31±0,23	z=-3,736 **,000**	4,64±0,50 4,57±0,48	z=-2,371 **,001**
		T_0 **T_2**	4,56±0,31 4,15±0,25	z=-3,827 **,000**	4,64±0,50 4,49±0,45	z=-4,143 **,000**

Data expressed as mean ±standard deviation, T_0:pre-intervention, T_1:4th week evaluation, T_2:8th week evaluation,*mg* :milligrams, *A:plantar fascia, B: on medial tuberositas, C:on calcaneal tuberositas*



plantar fascia (orange), on medial tuberositas (red), on calcaneal tuberositas (yellow)

Table 4.7. showed that the means of flexibility for gastrocnemius and soleus scores were improved at 8th week and 4th week comparing to pre intervention ($p<0.01$, Table 4.8).

Table 4.7. Comparison of flexibility on pre intervention, 4th week and 8th week

			Group1 mean ± S.D	**t/Z P value**	**Group2 mean ± S.D**	**t/Z P value**
Flexibility (°)	**Gastrocnemius (°)**	**T_0** **T_1**	27,58±3,11 31,79±3,74	t=-13,95 **,000**	25,54±3,3 28,77±3,32	z=-4,05 **,000**
		T_0 **T_2**	27,58±3,11 34,79±2,95	t=-17,95 **,000**	25,54±3,3 31,00±3,06	z=-4,14 **,000**
	Soleus (°)	**T_0** **T_1**	30,05±2,80 33,00±2,77	t=-9,49 **,000**	27,86±3,68 30,54±3,45	t=- 8,81 **,000**
		T_0 **T_2**	30,05±2,80 34,74±2,88	t=-9,335 **,000**	27,86±3,68 32,27±3,68	t=-14,07 **,000**

Data expressed as mean ±standard deviation,T_0:pre-intervention, T_1:4th week evaluation, T_2:8th week evaluation.

The paired t-test and Wilcoxon test were used to determine the mean scores of FFI and VAS in regard to pre intervention, 4th week and 8th week.The pre interventions of FFI and VAS scores were higher than the 4th and 8th week scores in the study group ($p<0.01$,Table4.8).

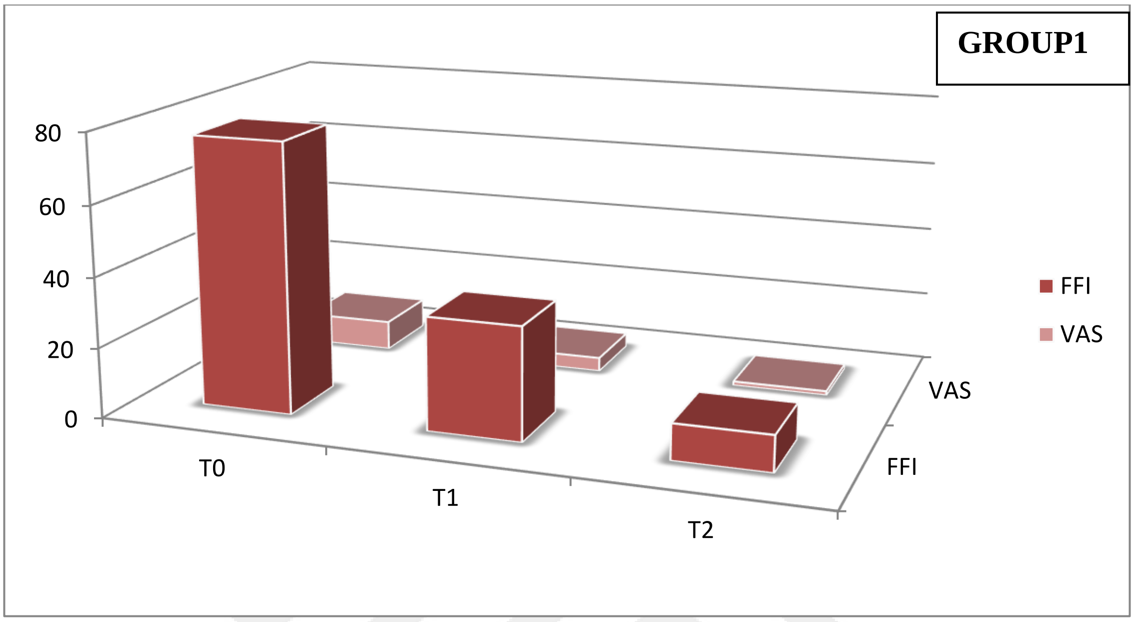
Table 4.8. Comparison of Foot Function Index(FFI) and Visual analog scale Scores(VAS) on pre intervention, 4th week and 8th week

		Group1 mean ± S.D	t/Z P value	Group2 mean ± S.D	t/Z P value
Foot Function Index Score	**T_0** **T_1**	76,90±12,64 32,16±13,78	z= -3,823 **,000**	60,21±20,28 43,90±18,58	t=8,209 **,000**
	T_0 **T_2**	76,90±12,64 10,24±11,58	z= -3,824 **,000**	60,21±20,28 33,33±15,89	t=10,087 **,000**
Visual Analog Scale Score	**T_0** **T_1**	8,47±1,50 4,00±1,70	z=-3,897 **,000**	6,77±2,26 4,86±1,98	t=9,721 **,000**
	T_0 **T_2**	8,47±1,50 1,16±1,17	z=-3,844 **,000**	6,77±2,26 3,64±1,73	t=10,581 **,000**

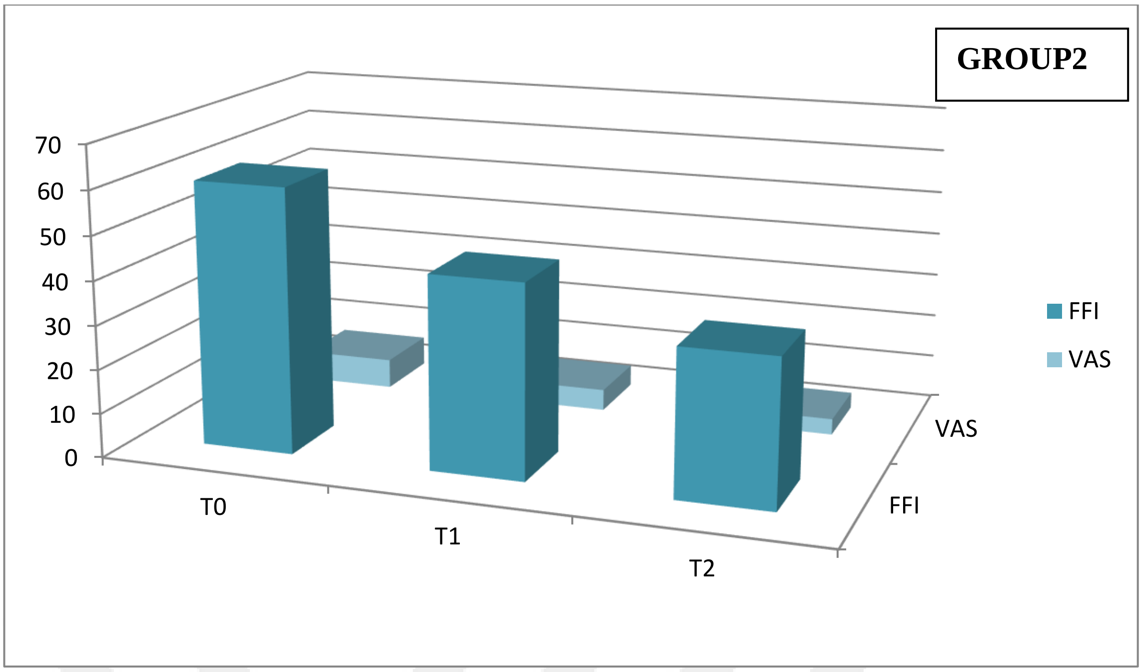
Data expressed as mean ±standard deviation**,** T_0:pre-intervention, T_1:4th week evaluation,T_2:8th week evaluation.

The mean scores of FFI and VAS were decreased in both study groups in regard to 4th week and 8th week.The differences between pre intervention and 4th week, pre interventionand 8th week were at statistically significance degree (p<0.01,Graph 4.5).

Graph4.5.The Distribution of Foot Function Index (FFI) and Visual Analog Scale scores on pre intervention, 4th week and 8th week



Data expressed as mean ±standard deviation, T0:pre-intervention, T1:4th week evaluation, T2:8th week evaluation.



Data expressed as mean ±standard deviation, T0:pre-intervention, T1:4th week evaluation, T2:8th week evaluation.

Independent t-test and Mann Whitney-U test were used to compare of variables between subjects of Group1 and Group2, pre and post intervention.As it was seen in Table 4.9. we observed that the differences between pre and post measurements of ROM for plantarflexion, proprioception for dorsiflexion, Y balance score,monofilament for target values as A,B,C, flexibility for gastrocnemius,FFI and VAS scores among group1comparing with group2 ($p<0.05$,Table 4.9).

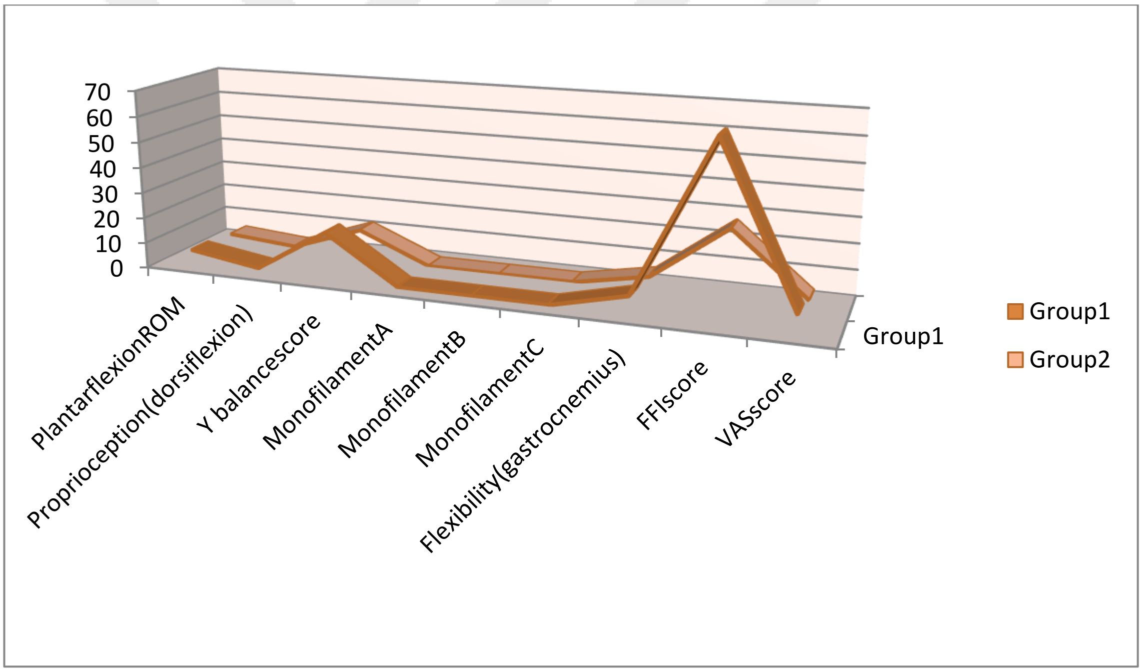
Table 4.9.Comparison of Differences between Preand Post Measurements of IntergroupVariables

			Group1 mean ± S.D	Group2 mean ± S.D	t/Z P value
ROM Values (°)	**Dorsiflexion (°)**	Δ T_0- T_2	5,78±1,51	5,68±1,72	z=-,279 **ns**
	Plantarflexion (°)	Δ T_0- T_2	-6,10±1,76	-4,72±1,98	z=-2,204 **,028**
	Inversion (°)	Δ T_0- T_2	-2,84±,1,21	-1,40±,6.25	z=-,540 **ns**
	Eversion (°)	Δ T_0- T_2	3,05±1,87	2,72±1,31	z=-,161 **ns**
Proprioception Assessment *(Deviation from target angle)*	**Dorsiflexion (10°)**	Δ T_0- T_2	1,75±,56	2,36±,82	t=-2,728 **,009**
	Plantarflexion (15°)	Δ T_0- T_2	1,83±,96	1,96±,97	t=1,419 **ns**
Y balance Score (%)		Δ T_0- T_2	-18,75±10,43	-12,01±5,86	t=-2,594 **,013**
Monofilament Values *(Assessment from target area) (mg)*	**A**	Δ T_0- T_2	,50±,26	,19±,15	z=-4,624 **, 000**
	B	Δ T_0- T_2	,41±,23	,16±,17	z=-3,455 **,001**
	C	Δ T_0- T_2	,41±,32	,15±,14	z=-3,060 **,002**
Flexibility (°)	**Gastrocnemius**	Δ T_0- T_2	-7,21±1,75	-5,45±1,53	t=-3,423 **,001**
	Soleus	Δ T_0- T_2	-4,68±2,18	-4,40±1,46	t=-,479 **ns**
Foot Function Index Score		Δ T_0- T_2	66,65±15,40	26,88±12,50	t=9,124 **,000**
Visual Analog Scale Score		Δ T_0 - T_2	7,31±1,41	3,13±1,39	t=9,516 **,000**

Data expressed as mean ±standard deviation, T_0:pre-intervention,T_2:post-intervention, Δ :Post values minus pre values, ns: non-significant.

Graph 4.6. was shown the differences of ROM for plantarflexion, proprioception for dorsiflexion, Y balance score,monofilament for target values as A,B,C, flexibility for gastrocnemius,FFI and VAS scores between pre and post measurements to calculate intergroup differences (Graph 4.6).

Graph 4.6.Comparison of Differences between Pre and Post Measurements of IntergroupVariables



Data expressed as mean.

5. DISCUSSION

It was indicated that plantar fasciitis(PF) is the most common foot condition[10]. It has been estimated that PF affects as much as 10% of the general population over the lifetime [5]. It is frequently observed in women, especially in the 40-60 age group. The pain is most common symptom of the PF patients.Visual analogue scale(VAS) and foot function index(FFI) are generally preferred. Additionally, FFI which has commonly easy tool is used to determine the status of pain for the patients with PF in the literature.

It is important to staging of PF for deciding the therapeutic approaches. According to the duration of symptoms; PF phases is categorized as acute, subacute and chronic. Acute PF is generally present for 4 to 6 weeks after beginning, subacute PF refers to approximately 6 to 12 weeks and chronic PF is present more than 3 months[84]. Alvarez et al.[209]reported that %29,7 of the study group had the symptoms between 6 and 12 months, %37,7 was between 12 and 24 months. Additionally, having symptoms more than 24 months was demonstrated as in their study. In our research, we found that %85,4 of patients were in >3 months as chronic stage , % 14,6 were in 4-12 weeks as acute-subacute stages (Table 4.2).

The etiology of PF has not been fully understood yet and is presumably multifactorial [84, 210, 211]. Etiologic factors can be classified as anatomical (pes planus, pes cavus, height difference of the lower extremities), biomechanical (excessive external rotation of the lower limbs, increased pronation at the subtalar joint, short Achilles tendon, weak plantar flexors) and anthropometricprofile(increased body mass index(BMI), sedentary lifestyle as well as excessive athletic activities) [3, 6, 84].

There were published studies on the relationship between anatomical features and PF in the literature. Taunton et al. [212] concluded that pes cavus ratio was %10,1 while %54,7 of population had excessive foot pronation. As a controversion, Kaya et al. [213]reported that lower incidence rate for pes planus was found to be 24%. According to our results, the frequency of pes cavus was found as %68,6, pes planus was seen for %13,6 in the study group (Table 4.2),(Graph 4.2).

In the another study, William et al.[214] investigated the related factorsfor PF that demonstrated the obesity rate was showed as 40% for men as well as % 90 in female gender. Also, the obesity rate was reported the study conducted by Çınar et al. [215] they found that 75% of females and 54% of males were obese.Whilein our study, the means of BMI was 28,56±3,40 kg/m^2 for outpatient rehabilitation group(Group1), 28,19±5,44 kg/m^2 for home rehabilitation group(Group2),(Table 4.1). Additionally, the frequency of overweight was found as %36,6 while the obese individuals ratio was % 41,4 (Table 4.2.),(Graph 4.1).

Matheson et al. [216] examined the most common overuse injuries for athletes and they reported that %71,4 of the subjects with PF were 50 years and above.The mean age of the our patients was found to be 49,78±11,24 (years) similar to previous studies(Table 4.2).As a result, according to the physical characteristic of subjects, it was examined %.78 overweight andobese, %.70,7female, %.70,7 aged between 40-60 years. Therefore, that results might concluded that our subjects profile seems to similar the literature results.

The major options for treatment of PF is conservative therapy which contains rest, ice massage, NSAIDs, stretching and strengthening exercises, electhrotherapy modalitiessuch aslow level laser, ıontophoresis, phonophoresis, extracorporeal shock wave therapy(ESWT), appropriate foot wear and biomechanical support, orthotic devices, taping, corticosteroid injection, Platelet Rich Plasma(PRP), myofascial releasing, joint and soft tissue mobilization[89, 210].

The stretching exercises can be used to cause the pain relief and improvement in calf muscle flexibility[10]. Most of the patients with PF suffer from tightness of posterior muscle of the lower limb[71, 217]. Therefore; it was recommended that patients should be instructed stretching exercises for the triceps surae in the literature [71, 84]. According to the results of systematic reviews, stretching exercises for the ankle and foot had beneficial effect for short term period among individuals with PF[10].

The systematic review by Sweeting et al. [15] indicated that the major pain relieving because of the stretching exercises occurs within 2 weeks and for 4 months. A prospective, randomized study investigated the effects of two different stretching protocol forchronic plantar heel pain(PHP). The study group were divided into two groups as a plantar fascia tissue stretching program or an Achilles tendon stretching program. They found that patients performing plantar fascia-specific stretching exercises had superior results for reducing pain in terms of FFI scores[155]. Mohamed et al. [218]observed that only stretching exercises of lower extremity, especially for Gastrosoleus-Achilles. They demostreted that % 91 of PF patients had gained significant improvement according to FFI scores in their study.

Stretching exercises could be suggested as key componenent of treatment protocolfor the PF patients. Digiovanni et al. [219] also counducted research on PF patients which were divided into two groups and were given different stretching exercises as plantar fascia-stretching protocol or an Achilles tendon-stretching protocol. The patients were assessed after 8 weeks and 2 years later by using the FFI for pain severity and functional status. It was indicated that there was a significant decreasing in the pain level for both groups and the tissue-specific plantar fascia-stretching protocol suggested as major component of treatment in their study. The authors point out thatdifferent stretching protocols should be examined according to the severity of the equine deformity and patient preferences for future studies. Therefore; there is no aggrement to prescription of frequency and repetitions and there were few studies published on using stretching exercises protocol on patients with PF [84]. In the present study, our study group performed the stretching exercise of foot and ankle combined with hip region. Our statistical analysis showed significant improvements in FFI and VAS scores on 4th and 8th week comparing pre intervention assessment in the two groups ($p<0.01$),(Table 4.8).The means of the FFI, VAS, proprioception scores for two goups were lower than comparig the post measurements of 4th week and 8th week. In addition range of motion (ROM) measurements (dorsiflexion, plantarflexion, inversion, eversion), flexibility of gastrocnemius and soleus and Y balance scores were increased duringpost measurements (4th and 8th week). ($p<0.05$), (Table 4.3,Table 4.5, Table4.7). We can conclude that stretching exercises for foot and ankle-hip should be one of the interventions incorporated into the management program for patients with PF.

Strengthening exercises of the plantar flexors and abductor hallucis, the external rotator and abductor muscles of the hips are recommendedfor the PF management in few studies [155-158]. Rathleff et al.[4] investigated the results of the strengthening exercises protocol and shoe inserts vs plantar stretching exercises and shoe inserts for patients with PF. The outcomes at 3 months had more significant reduction in pain according to FFI but, there were no statistically differences between both groups at first and sixth months in terms of FFI. In a study conducted by Kamonseki et al. [14], 83 PF patients were divided into 3 groups. The extrinsic and intrinsic foot muscles strengthening exercises were given to the first group, the abductor and external rotator muscles strengthening exercises were given for the second group and third goup performed only stretching exercises. They showed that improvements were determined in all groups in terms of VAS, activities of daily living, quality oflife, foot and Ankle Outcome Score and Star Excursion Balance Test score in all study groups,however; strengthening exercises of the intrinsic and extrinsic muscles and the abductors and external rotators combined with stretching exercises had no superior results in comparison to only stretching exercises.

Due to the important role of the intrinsic and extrinsic muscles of the foot as well as the abductors and external rotators of the hips in terms of the stabilization of the plantar arches and postural control, the strengthening exercises protocol for these muscles were expected to lead to greater improvements in terms of pain and function compared with only stretching exercises program for the PF patients [163, 168]. However, the impacts of strengthening exercises for PF are not fully comprehended yet[163-165].

It was needed the studies on explaining the management of physiotherapy modalitiessuch as strengthening exercises whether it is more beneficial for PF patients[84]. Srentgethening exercise for foot and ankle - hip were instructed for group 1 (outpatient group) although Srentgethening exercise foot and ankle exercises for group 2(home rehabilitation). According to our initial assesment, we found during 8th week measurements that flexibility degree of gastrocnemius and soleus, proprioception and Y balance scores are statistically improved than pre intervention in both groups. ($p<0.05$),(Table 4.4, Table 4.5, Table 4.7).Morever, the VAS scores were decreased in both groups during 8th week ($p<0.05$, Table 4.8).We may recommend that foot, ankle and hip combined strengthening exercises for patient with PF thanks to the improvements on balance, proprioception, flexibility and VAS scores($p<0.05$),(Table 4.9).

It was reported the association between plantar heel pain and restrictives ankle dorsiflexion, Recently it has claimed that using of joint mobilization(JM) and soft tissue mobilization(STM) for decreasing the limitation. Furthormere, joint mobilization (JM) and soft tissue mobilization (STM) were recommended for management of PF patients with "A" level grade which are showed with level I and II studies in the literatur [10, 191]. Bialosky et al. [186]indicated that the mechanism of JM and STM is multifactorial and covers neurophysiological, mechanical, and psycho-emotional effects for patients with PF. Cleland et al.[2]claimed that manual physical therapy (MT)and exercise should be major treatment options for individuals with PHP at long and short term follow-ups. In a study reviewed by Fraser et al. [191], they searched the effiency of MT on heel pain, plantar fasciosis and PF. It was demonstrated that MT can clearly improve function and be associated with pain revealing in PF patients. It was highlighted that physiotherapist should use both JM and STM techniques combining with stretching and strengthening exercises for PF patients ın their study.

In our research,we showed that dorsiflexion of ROM in group1 and group2 as pre intervention measurements which meant limited ankle dorsiflexion paralell to literature (Table 4.3). Additionally, the 8th week measurements of ROM values(plantarflexion), flexibility of gastrocnemius, proprioception(dorsiflexion) and scores of Y balance, FFI and VAS were improved than pre intervention($p<0.05$) and there were statistically differences between group1 and group2 (Table 4.9). Although there is no consensus on pain reliefing in the literature, we found that the differences between pre intervention and 8th week were at statistically significance degree in the study group which was applied JM and STM by the physiotherapist. We may recommend to use JM and STM techniques combining with the other modalities in the management of PF for increasing function and decreasing pain.

Theother suggested management modality for PF is Myofascial Releasing(MFR) due to causing reduction of the pain and stiffnes of the gastroc-soleus muscles and help to increase the ankle dorsiflexion[10]. In addition, MFR provide to return fascial tissue's normative length by collagen reorganization. There is still minimal evidence to support the use of MFR and so, it is needed to study the appropriateness and comparative effectiveness on PF patients[10]. Ajimsha et al. [5] investigated MFR effectiveness on 66 patients with PHP. They found that the patients in both MFR and control groups receiving sham ultrasound therapy had significant reductions in terms of pain and functional disability. Also, MFR group had superior results than the control group in 4 and 12 weeks.In the systematic review, Piper et al.[220]searched six databases from 1990 to 2015 and they found that MFR was effective treatment strategy on PF patients in terms of pain revealing. In our study, total scores of FFI and VAS, proprioception and monofilament measurements were decreased and flexibility measurements were increased in group1 after interventions ($p<0.05$, Table 4.4., Table 4.5., Table 4.6., Table 4.7., Table 4.8). Furthermore, the differences between pre and post measurements for FFI and VAS, proprioception, flexibility and monofilament scores in group1 have been shown statistically significant decreasing comparing with group2 ($p<0.05$, Table 4.9). As a result, Individuals with PF might benefit from the use of MFR ın our study group (outpatient rehabilitation group). We can consider that physical therapist are advised to MFR as an adjunct to their conservative managements for the treatment of PF.

The main results of our study is that both group had statiscally significant improvement in measurements of ROM, balance, flexibility, proprioception, monofilament and scores of FFI and VAS ($p<0.05$, Table 4.3, Table 4.4, Table 4.5, Table 4.6, Table 4.7, Table 4.8). Additionally, consistent with hypothesis, outpatient rehabilitation program applied by physiotherapist involving foot and ankle-hip stretching and strengthening exercises, myofascial releasing, joint and soft tissue mobilization compared with home rehabilitation program including foot and ankle exercises can lead to greater improvement in terms of ROM, balance, flexibility, proprioception, monofilament values and reduction in FFI and VAS scores according to statistical analysis ($p<0.05$, Table 4.9).

The literature suggested to decrease pain and improve function for the PF patients and indicated that the treatment modalities can be more effective if they should be combined with each other as parelell to our hypothesis[3, 10, 84]. In the literature, there is a gap regard to which treatment protocol is more effective and how to optimize it. Furthermore, many researches conducted on the patients with PHP instead of PF patients and also, there is a limited evidences for efficiency of the myofascial releasing, joint and soft tissue mobilization.Additionally, there is no studies published to investigate the effectiveness of combined treatment strategies which are included patient education, stretching and strengthening exercises, myofascial releasing, joint and soft tissue mobilization regard to ROM, flexibility, balance, proprioception, sensory of the foot, FFI and VAS for the patients with PF and to our knowlege, there is also no studies published to evaluate propriception and sensory of the foot for the PF patients.For that reasons, we investigated combined tretament strategies for the patients with PF.

We would like to point out that patient education, ankle and foot- hip stretching and strengthening exercises, myofascial releasing, joint and soft tissue mobilization protocol can be more effective for improving function, joint position and foot sense and decreasing pain than ankle and foot stretching and strengthening exercises protocol. Additionally, myofascial releasing may be more contributive treatment modality for improving foot sense and decreasing pain.

The limitations of our study;

-we included a small size of the study (n=41)

-The long follow –up results were needed to evaluate the long term effects of combined treatment modalities.

CONCLUSION AND SUGGESTIONS

- The combination of physiotherapeutic approches including patient education, foot and ankle – hip stretching and strengthening exercises, myofascial releasing, joint and soft tissue mobilization are more effective than compared to foot and ankle stretching and strengthening exercises in terms of ROM, proprioception, balance, foot sense, flexibility, FFI and VAS scores.
- Functional capacity, flexibility, balance, joint position and foot sense can be improved and pain can be decreased with foot and ankle – hip stretching and strengthening exercises combine with myofascial releasing, joint and soft tissue mobilization.
- Foot and ankle stretching and strengthening exercises may also recommend the improve measurements of ROM, balance, and flexibility.
- Foot and ankle – hip stretching and strengthening exercises protocol might be preferred instead of foot and ankle exercises protocol for the patients with PF.
- Myofascial Release may be more contributive modality for pain reliefing and foot sense.
- We suggested that each physiotherapeutic approches may be compared with each other for determining the which treatment protocol is more effective for PF management. It is also important to understand the relationship between treatment protocol and physical parameters in terms of ROM, proprioception, balance, flexibility, and monofilament values, VAS and FFI scores.
- Limited dorsiflexion range of motion may be the inclusion criteria for the future investigations.
- Further researches should investigate the impairment-based physical therapy for plantar fasciitis in large size of the study with long term follow –up.
- We claim that patient education, foot and ankle–hip stretching and strengthening exercises combine with myofascial releasing, joint and soft tissue mobilization therapy protocol is to play an important role in the management of patients with plantar fasciitis.

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APPENDIX 1. ETHICAL COMMITTEE APPROVAL

T.C. YEDİTEPE ÜNİVERSİTESİ

Sayı : 37068608-6100-15-1409 **04/01/2018**
Konu: Klinik Araştırmalar
Etik kurul Başvurusu hk.

İlgili Makama (Elif Tuğçe Çil)

Yeditepe Üniversitesi Fizik Tedavi ve Rehabilitasyon Bölümü Prof. Dr. Feryal Subaşı'nın sorumlu olduğu **"Plantar Fasiitte Egzersiz, Miyofasyal Gevşeme ve Mobilizasyon Tekniklerinin Etkinliği"** isimli araştırma projesine ait Klinik Araştırmalar Etik Kurulu (KAEK) Başvuru Dosyası (**1382** kayıt Numaralı KAEK Başvuru Dosyası), Yeditepe Üniversitesi Klinik Araştırmalar Etik Kurulu tarafından **03.01.2018** tarihli toplantıda incelenmiştir.

Kurul tarafından yapılan inceleme sonucu, yukarıdaki isimi belirtilen çalışmanın yapılmasının etik ve bilimsel açıdan uygun olduğuna karar verilmiştir (**KAEK Karar No: 773**).

Prof. Dr. Turgay ÇELİK
Yeditepe Üniversitesi
Klinik Araştırmalar Etik Kurulu Başkanı

Yeditepe Üniversitesi 26 Ağustos Yerleşimi, İnönü Mahallesi Kayışdağı Caddesi 34755 Ataşehir / İstanbul
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APPENDIX 2. INFORMED WRITTEN CONSENT

Grup1 Katılımcı Onam Formu

ARAŞTIRMAYA KATILIM ONAM FORMU

Bu çalışma Yeditepe Üniversitesi Tıp Fakültesi Ortopedi ve Travmatoloji Ana Bilim Dalı ve Sağlık Bilimleri Fakültesi Fizyoterapi ve Rehabilitasyon Bölümü tarafından yürütülen **"Plantar Fasiitte Egzersiz, Miyofasyal Gevşeme ve Mobilizasyon Tekniklerinin Etkinliği"** başlıklı araştırma kapsamında planlanmıştır. Bu çalışmanın amacı, Plantar fasciitis tanısı konmuş bireylerde Egzersiz, Miyofasyal Gevşeme ve Mobilizasyon Tekniklerinin Etkinliğinin araştırılmasıdır**.** Çalışmamıza katılmayı kabul eden gönüllü bireylerin ; yaşı, cinsiyeti, eğitim düzeyi, mesleği, sosyo-demografik koşulları, kronik hastalıkları, geçirilen operasyonları ve yaralanmaları, kullanılan ayakkabı çeşitleri, sigara-alkol alışkanlıkları, egzersiz davranışları ve ayak fonksiyonel durum değerlendirmesi yapılacaktır.Ayak bileği normal eklem hareket açıklığı (NEH) ve gastroknemius-soleus kaslarınızın esneklik değerleri gonyometre kullanılarak ölçülecektir. Propriosepsiyon değerlendirmesi, açı reprodüksiyon testi ile dorsifleksiyon ve plantar fleksiyon yönünde yapılarak sapmalar kaydedilecektir. Dinamik denge değerlendirmesi Y denge testi ile belirlenecek olup ayak duyusu, ağrı hassasiyet bölgeleri baz alınarak monofilament testi ile ölçülecektir. Ağrı, yetersizlik, aktivite kısıtlılığı ise ayak fonksiyon indeksi (AFİ) ve sabah ilk adım ağrısı vizual analog skala (VAS) ile değerlendirilecektir. Değerlendirmeler çalışma başlangıcında(ilk değerlendirme), 4. hafta ve 8. hafta sonunda tekrarlanıcaktır. Çalışmamızda olgular randomize olarak iki gruba ayrılacaktır. Bu grubuna(Grup1) Platelet-Rich Plasma(PRP) enjeksiyonu1 kez uygulanacak olup ayak-ayak bileği ve kalça egzersizleri, miyofasyal gevşetme, eklem ve yumuşak doku mobilizasyonu haftada 2 kez 8 hafta uygulacaktır.

Araştırmada yapılan değerlendirmelerin sonuçları yalnızca araştırma kapsamındaki çalışmalarda kullanılacaktır.Kişisel bilgileriniz herhangi bir amaçla, kurum yöneticileri veya üçüncü kişilerle paylaşılmayacaktır.

Katılımınız için teşekkür ederiz.

Sorumlu Araştırmacı:

Fzt. Elif Tuğçe Çil -0554 481 1092 (24 saat ulaşılabilecek kişi)

"Plantar Fasiitte Egzersiz, Miyofasyal Gevşeme ve Mobilizasyon Tekniklerinin Etkinliği"ni incelemek amacıyla yapılan bu çalışmaya hiçbir baskı olmaksızın kendi rızamla katılmayı kabul ediyorum.

Gönüllünün Adı /Soyadı /İmzası /Tarih

Açıklama Yapan Kişinin Adı /Soyadı /İmzası /Tarih

Grup2 Katılımcı Onam Formu

ARAŞTIRMAYA KATILIM ONAM FORMU

Bu çalışma Yeditepe Üniversitesi Tıp Fakültesi Ortopedi ve Travmatoloji Ana Bilim Dalı ve Sağlık Bilimleri Fakültesi Fizyoterapi ve Rehabilitasyon Bölümü tarafından yürütülen **"Plantar Fasiitte Egzersiz, Miyofasyal Gevşeme ve Mobilizasyon Tekniklerinin Etkinliği"** başlıklı araştırma kapsamında planlanmıştır. Bu çalışmanın amacı, Plantar fasciitis tanısı konmuş bireylerde Egzersiz, Miyofasyal Gevşeme ve Mobilizasyon Tekniklerinin Etkinliğinin araştırılmasıdır**.** Çalışmamıza katılmayı kabul eden gönüllü bireylerin ; yaşı, cinsiyeti, eğitim düzeyi, mesleği, sosyo-demografik koşulları, kronik hastalıkları, geçirilen operasyonları ve yaralanmaları, kullanılan ayakkabı çeşitleri, sigara-alkol alışkanlıkları, egzersiz davranışları ve ayak fonksiyonel durum değerlendirmesi yapılacaktır.Ayak bileği normal eklem hareket açıklığı (NEH) ve gastroknemius-soleus kaslarınızın esneklik değerleri gonyometre kullanılarak ölçülecektir. Propriosepsiyon değerlendirmesi, açı reprodüksiyon testi ile dorsifleksiyon ve plantar fleksiyon yönünde yapılarak sapmalar kaydedilecektir. Dinamik denge değerlendirmesi Y denge testi ile belirlenecek olup ayak duyusu, ağrı hassasiyet bölgeleri baz alınarak monofilament testi ile ölçülecektir. Ağrı, yetersizlik, aktivite kısıtlılığı ise ayak fonksiyon indeksi (AFİ) ve sabah ilk adım ağrısı vizual analog skala (VAS) ile değerlendirilecektir. Değerlendirmeler çalışma başlangıcında(ilk değerlendirme), 4. hafta ve 8. hafta sonunda tekrarlanıcaktır. Çalışmamızda olgular randomize olarak iki gruba ayrılacaktır. Bu grubuna(Grup2) Platelet-Rich Plasma(PRP) enjeksiyonu 1 kez uygulanacak olup ayak-ayak bileği egzersizleri haftada hergün 8 hafta boyunca yapılacak şekilde verilecektir.

Araştırmada yapılan değerlendirmelerin sonuçları yalnızca araştırma kapsamındaki çalışmalarda kullanılacaktır.Kişisel bilgileriniz herhangi bir amaçla, kurum yöneticileri veya üçüncü kişilerle paylaşılmayacaktır.

Katılımınız için teşekkür ederiz.

Sorumlu Araştırmacı:

Fzt. Elif Tuğçe Çil -0554 481 1092 (24 saat ulaşılabilecek kişi)

"Plantar Fasiitte Egzersiz, Miyofasyal Gevşeme ve Mobilizasyon Tekniklerinin Etkinliği"ni incelemek amacıyla yapılan bu çalışmaya hiçbir baskı olmaksızın kendi rızamla katılmayı kabul ediyorum.

Gönüllünün Adı /Soyadı /İmzası /Tarih

Açıklama Yapan Kişinin Adı /Soyadı /İmzası /Tarih

APPENDIX 3. STRUCTURED QUESTIONNAIRE

Yeditepe Üniversitesi Sağlık Bilimleri Fakültesi

Fizyoterapi ve Rehabilitasyon Bölümü

Bölüm 1. Demografik Özellikler **Tarih :…/….. /……**

1) Adı Soyad…………………… Telefonu

2)Yaş

3) ( ) Kız ( ) Erkek

4) Boy

5) Ağırlık

6)Vücut Kitle İndeksi

7) Dominant taraf

( ) sağ ( ) sol

8) Eğitim durumunuz

- Okuryazar değil ☐
- İlköğretim ☐
- Lise ☐
- Üniversite ve üzeri ☐

9) Çalışıyor musunuz ?

( ) Evet ________________ ( ) Hayır

10)Günde kaç saat oturarak çalışıyorsunuz ?

- 1-2 saat
- 2-3 saat
- 3-4 saat
- Diğer ______

11)Gün içerisinde mola verdiğiniz süre dilimini işaretleyiniz.

- 5-45 dk
- 45-60dk
- 1-3 saat
- Diğer ____

12)Sigara kullanıyor musunuz?

( )Hiç içmedim ( ) İçtim ama bıraktım ( )Halen içiyorum

Günde kaç adet sigara içiyorsunuz?......................adet/gün

13)Alkol kullanıyor musunuz?

( ) Evet ( ) Hayır

14) Kronik bir hastalığınız var mı? Varsa hangileri?

( ) Sürekli bir hastalığım yok

( ) Diabetes Mellitus

( ) Hipertansiyon

( ) Kalp

( )Rheumatoid Arthritis(RA)

( ) Osteoarthritis (OA)

( ) Diğer (Morton , halluks valgus .. vb.)

15) Aile öyküsü : Lütfen aşağıdaki ciddi rahatsızlıklardan aılenızde olanı kontol edınız ve aılenızde görüldüğü kişiyi daire içine alınız . (A: anne B : baba K : kardeşAA: anneannne D:dede BA : babaanne D : dede)

( ) Artirit : A B K AA D BA D

( ) Yüksek kolestrol : A B K AA D BA D

( ) Kanser : A B K AA D BA D

( ) Hipertansiyon : A B K AA D BA D

( ) Diyabetus Mellitus : A B K AA D BA D

( ) Bobrek rahatsızlıkları :A B K AA D BA D

( ) kalp rahatsızlıkları : A B K AA D BA D

16)Herhangi bir ameliyat geçirdiniz mi ?

( ) Hayır ( ) Evet

Evet ise lütfen belirtiniz

( ) ayak bileği ( ) diz ( ) kalça ( ) diğer ________

17) Herhangi bir yaralanma geçirdiniz mi ?

( ) Hayır ( ) Evet

Evet ise lütfen belirtiniz

( ) ayak bileği ( ) diz ( ) kalça ( ) diğer ________

18)İlk adım ağrınız var mı ?

( ) Hayır ( ) Evet ise lütfen belirtiniz ______________

19)Topuk ağrısı bölgesinde dokunmaya karşı hassasiyetiniz var mı ?

( ) evet ( ) hayır

20) Ne kadar süredir bu probleme sahipsiniz ?

______( ) gün

______( )hafta

______( ) ay

______( )yıl

21)Daha önce topuk ağrınız için bir tedavi aldınız mı ?

( ) Hayır ( ) Evet ise lütfen belirtiniz ______________

22) Sıklıkla giymeyi tercih ettiğiniz ayakkabı türü ?

( ) spor ayakkabısı ( ) köseli ayakkabı

( )yüksek topuklu ayakkabı ( ) dar burunlu ayakkabı

23)Yüksek topuklu ayakkabıyı ne sıklıkla giyiyorsunuz ?

( ) Her gün

( ) Haftada birkaç defa

( ) Nadiren

( )Hiç giymem

24) Spor yapıyor musunuz? Yapıyorsanız ne sıklıkta?

( ) Yapmıyorum

( )Ayda 1-2

( )Haftada 1 kez

( )Haftada 2-3

( )Haftada 4-5

( )Her gün

25)Yapmayı tercih ettiğiniz spor hangileri işaretleyiniz

Yürüyüş ( ) Zıplamalı sporlar ( ) Tenis ( ) Koşu( ) Yüzme ( ) Salon Sporları ( )

Diğer ( ) ______________________

(Egzersiz yapanlar için) Yaptığınız egzersiz her seferinde kaç dakika sürüyor?

( )20 dk az
( )20-30 dk
( )30 – 60 dk
( )60 dk. dan fazla

( ) hafif
( ) orta
( ) şiddetli

Bölüm 2.ROM Değerleri

SOL

	İlk	4.hafta	8.hafta
Ankle DF			
Ankle PF			
Ankle inversiyon			
Ankle Eversiyon			

SAĞ

	İlk	4.hafta	8.hafta
Ankle DF			
Ankle PF			
Ankle inversiyon			
Ankle Eversiyon			

Bölüm 3. Proprioception Değerlendirmesi

	Sol			Sağ		
	İlk	**4. hafta**	**8. hafta**	**İlk**	**4. hafta**	**8. hafta**
DF açısı						
PF açısı						

Bölüm 4.

	İlk	**4.hafta**	**8.hafta**
Windlast test			
Tarsal tunel test			
Feiss çizgisi			
Y balance anterıor sağ			
Y balance posterıolateral sağ			
Y balance posterımedıal sağ			
Y balance anterıor sol			
Y balance posterıolateral sol			
Y balance posterımedıal sol			

Bölüm 6.

	İlk	4. hafta	8.hafta
ND sol			
ND sağ			
Ayak uzunluğu sağ			
Ayak uzunluğu Sol			
Extremite uzunluğu sağ			
Extremite uzunluğu sol			

Bölüm 7. Monofilament testi

	SOL	SAĞ
A		
B		
C		

Bölüm 8. Esneklik Ölçümleri

	1.	2.	3.	Ortalama	1.	2.	3.	Ortalama
Gastrocnemius								
Soleus								

APPENDIX 4 . FOOT FUNCTION INDEX (FFI)

FOOT FUNCTION INDEX

Ayak Fonksiyon İndeksi

Bu sorgu formu ayak ağrınızın günlük yaşamda yapabileceklerinizi nasıl etkilediğine dair doktorunuza bilgi vermek için oluşturulmuştur. Aşağıdaki soruları (GEÇEN HAFTA BOYUNCA ayağınızı en iyi tarif edecek şekilde) cevaplamanızı ve her bir soruya skala üzerinde 0 (ağrı veya zorluk yok) ile 10 (hissedilebilecek en şiddetli ağrı veya yapılamayacak kadar zor) arasında puan vermenizi istiyoruz. Lütfen her soruyu okuyunuz, seçtiğiniz numarayı tablo üzerinde X ile işaretleyiniz. Sağ ve sol ayak şikayetleriniz farklı ise takip eden kutulara 0 ile 10 arasında bir puan veriniz.

AĞRI: AYAK AĞRINIZ NE KADAR ŞİDDETLİ?

1. Ayak ağrınız en fazla olduğunda ne kadar şiddetli?

Ağrı yok	0 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	8 ☐	9 ☐	10 ☐	Olabilecek en şiddetli ağrı	SAĞ	SOL

2. Sabahları ayak ağrınız ne kadar şiddetli?

Ağrı yok	0 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	8 ☐	9 ☐	10 ☐	Olabilecek en şiddetli ağrı	SAĞ	SOL

3. Yalın ayak yürürken ağrınız ne kadar şiddetli?

Ağrı yok	0 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	8 ☐	9 ☐	10 ☐	Olabilecek en şiddetli ağrı	SAĞ	SOL

4. Yalın ayak ayakta dururken ağrınız ne kadar şiddetli?

Ağrı yok	0 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	8 ☐	9 ☐	10 ☐	Olabilecek en şiddetli ağrı	SAĞ	SOL

5. Ayakkabı ile yürürken ağrınız ne kadar şiddetli?

Ağrı yok	0 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	8 ☐	9 ☐	10 ☐	Olabilecek en şiddetli ağrı	SAĞ	SOL

6. Ayakkabı ile ayakta dururken ağrınız ne kadar şiddetli?

Ağrı yok	0 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	8 ☐	9 ☐	10 ☐	Olabilecek en şiddetli ağrı	SAĞ	SOL

7. Tabanlıkla yürürken ağrınız ne kadar şiddetli? (Tabanlık kullanmıyorsanız BOŞ bırakınız)

Ağrı yok	0 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	8 ☐	9 ☐	10 ☐	Olabilecek en şiddetli ağrı	SAĞ	SOL

8. Tabanlıkla ayakta dururken ağrınız ne kadar şiddetli? (Tabanlık kullanmıyorsanız BOŞ bırakınız)

Ağrı yok	0 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	8 ☐	9 ☐	10 ☐	Olabilecek en şiddetli ağrı	SAĞ	SOL

9. Akşam saatlerinde ağrınız ne kadar şiddetli?

Ağrı yok	0 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	8 ☐	9 ☐	10 ☐	Olabilecek en şiddetli ağrı	SAĞ	SOL

YETERSİZLİK: NE KADAR ZORLUK ÇEKİYORSUNUZ?

1. Evin içinde yürürken ne kadar zorluk çekiyorsunuz?

Zorluk yok	0 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	8 ☐	9 ☐	10 ☐	Yapılamayacak kadar zor	SAĞ	SOL

2. Dışarıda düzgün olmayan yüzeylerde yürürken ne kadar zorluk çekiyorsunuz?

Zorluk yok	0 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	8 ☐	9 ☐	10 ☐	Yapılamayacak kadar zor	SAĞ	SOL

3. 300 metre yol yürüdüğünüzde ne kadar zorluk çekiyorsunuz?

Zorluk yok	0 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	8 ☐	9 ☐	10 ☐	Yapılamayacak kadar zor	SAĞ	SOL

4. Merdiven çıkarken ne kadar zorluk çekiyorsunuz?

Zorluk yok	0 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	8 ☐	9 ☐	10 ☐	Yapılamayacak kadar zor	SAĞ	SOL

5. Merdiven inerken ne kadar zorluk çekiyorsunuz?

Zorluk yok	0 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	8 ☐	9 ☐	10 ☐	Yapılamayacak kadar zor	SAĞ	SOL

6. Ayak parmaklarınızın ucunda dururken ne kadar zorluk çekiyorsunuz?

Zorluk yok	0 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	8 ☐	9 ☐	10 ☐	Yapılamayacak kadar zor	SAĞ	SOL

7. Sandalyeden kalkarken ne kadar zorluk çekiyorsunuz?

Zorluk yok	0 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	8 ☐	9 ☐	10 ☐	Yapılamayacak kadar zor	SAĞ	SOL

8. Kaldırımdan çıkarken ne kadar zorluk çekiyorsunuz?

Zorluk yok	0 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	8 ☐	9 ☐	10 ☐	Yapılamayacak kadar zor	SAĞ	SOL

9. Hızlı yürürken ne kadar zorluk çekiyorsunuz?

Zorluk yok	0 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	8 ☐	9 ☐	10 ☐	Yapılamayacak kadar zor	SAĞ	SOL

AKTİVİTE KISITLILIĞI: ZAMANINIZIN NE KADARINI HARCADINIZ?

1. Ayak sorunlarınız nedeniyle zamanınızın ne kadarında tüm gün boyunca evde oturmak zorunda kalıyorsunuz?

Hiçbir zaman	0 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	8 ☐	9 ☐	10 ☐	Her zaman	SAĞ	SOL

2. Ayak sorunlarınız nedeniyle zamanınızın ne kadarında yatarak istirahat etmek zorunda kalıyorsunuz?

Hiçbir zaman	0 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	8 ☐	9 ☐	10 ☐	Her zaman	SAĞ	SOL

3. Ayak sorunlarınız nedeniyle günlük yaşam aktiviteleriniz kısıtlanıyor mu?

Hiçbir zaman	0 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	8 ☐	9 ☐	10 ☐	Her zaman	SAĞ	SOL

4. Zamanınızın ne kadarında iç mekanlarda yürüme yardımcısı (baston, yürüteç, koltuk değneği) kullanıyorsunuz?

Hiçbir zaman	0 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	8 ☐	9 ☐	10 ☐	Her zaman	SAĞ	SOL

5. Zamanınızın ne kadarında dış mekanlarda yürüme yardımcısı (baston, yürüteç, koltuk değneği) kullanıyorsunuz?

Hiçbir zaman	0 ☐	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	8 ☐	9 ☐	10 ☐	Her zaman	SAĞ	SOL

APPENDIX 5. VISUEL ANALOGUE SCALE (VAS)

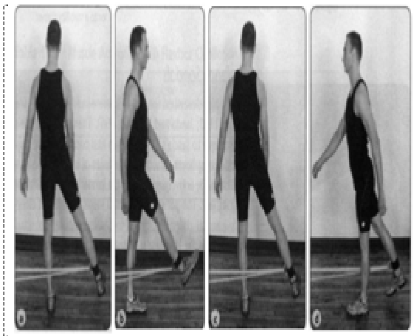
VİZUEL ANALOG SKALA (VAS)

Adınız Soyadınız: ________________________________ Tarih: ________________

Ağrı şiddetinizi aşağıdaki ölçek üzerinde işaretleyin.

Hiç ağrı olmaması   En dayanılmaz ağrı

APPENDIX 6. EXERCISES AND EDUCATION BROCHURE

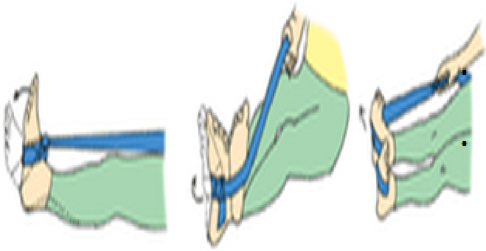


Tekrar : 10-15 kez
Günde 3 kez

YEDİTEPE ÜNİVERSİTESİ

BUNLARA DİKKAT EDİNİZ !

- Yumuşak topuklu ayakkabı kullanın.
- Çıplak ayak ile ayakkabı ve terlik giymeyin, yumuşak çorap tercih ediniz .
- Yalınayak sert zemine (beton, parke, seramiğe) basmayınız



- Zayıflamak için egzersiz olarak yürüme ve koşmayı değil, yüzme ve bisiklete binmeyi tercih ediniz.
- Ayakkabı veya terliğinizin topuğunu yumuşatacak silikon aparatları tercih ediniz .
- Uzun yürüyüşlerden kaçınınız , ayakta kalmamaya dikkat ediniz.

Tekrar : 10 – 15
Günde 3 Kez

- Numarası küçük veya büyük ayakkabı ve terlik tercih etmeyiniz
- Yüksek topuklu veya topuksuz ayakkabı ve terlik tercih etmeyiniz .
- Çok ağrılı durumlarda buz tamponu uygulamak ağrıyı hafifletirken, sıcak uygulama erken dönemde ağrıları artırabilir dikkat ediniz .
- Masaj uygulamasını ayak parmaklarınızı geriye çekerek topuk üzerine 2-5 dakika boyunca soğuk uygulaması yapabilirsiniz.

APPENDIX 7. CV

KİŞİSEL BİLGİLER		
Akademik Ünvanı	Fzt.	
Ad – Soyad	ELİF TUĞÇE ÇİL	
Doğum Yeri	Ankara	
Doğum Tarihi	03.03.1992	
E-Posta Adresi	tugce.cill@gmail.com	
Askerlik Bilgisi		
Cep Telefonu	0554 481 10 92	
İkamet Edilen Adres: Sahrayıcedid Mah. Güzide Sok. Betakent 2 sitesi E blok Daire :8 Kadıköy/İstanbul		

EĞİTİM BİLGİLERİ	
Profesörlük Bilgileri	
Profesörlük Kadrosuna Atanma Tarihi:	
Profesörlük Kadrosuna Atandığı Üniversite Adı :	Bulunduğu Şehir /Ülke:
Doçentlik Bilgileri	
Doçentlik Belgesini Aldığı Tarih:	
Doçentlik Kadrosuna Atandığı Üniversite Adı :	Bulunduğu Şehir /Ülke:
Doçentlik Kadrosuna Atanma Tarihi :	
Doktora - Tıpta Uzmanlık Bilgileri	
Üniversite / Tıpta Uzmanlık Eğitimini Aldığı Hastane Adı:	Bulunduğu Şehir /Ülke:
Bölüm /Anabilim Dalı Adı:	
Not Ortalaması:	Mezuniyet Tarihi:
Yüksek Lisans Bilgileri	
Üniversite Adı: Yeditepe Üniversitesi	Bulunduğu Şehir /Ülke: İSTANBUL/TÜRKİYE
Bölüm Adı: Fizyoterapi ve Rehabilitasyon	

Not Ortalaması: 3.76	Mezuniyet Tarihi:
Lisans Bilgileri	
Üniversite Adı: Yeditepe Üniversitesi	Bulunduğu Şehir /Ülke: İSTANBUL/TÜRKİYE
Bölüm Adı: Fizyoterapi ve Rehabilitasyon	
Not Ortalaması: 3.38	Mezuniyet Tarihi: 2016
Lise Bilgileri	
Okul Adı: Hulusi Uçaçelik Anadolu Lisesi	Bulunduğu Şehir /Ülke:Ödemiş/ İzmir/TÜRKİYE
Bölüm Adı: Fen Bilimleri	
Not Ortalaması: 88	Mezuniyet Tarihi: 2010
Ortaokul / İlköğretim Okul Bilgileri	
Okul Adı: Mehmet Bülent Özyürek İ.Ö.O	Bulunduğu Şehir /Ülke:İnebolu/ Kastamonu/TÜRKİYE
Not Ortalaması: 5.00	Mezuniyet Tarihi: 2006
İlkokul Bilgileri	
Okul Adı: Atatürk İ.Ö.O	Bulunduğu Şehir /Ülke:Didim/ Aydın/TÜRKİYE
Not Ortalaması: 5.00	Mezuniyet Tarihi: 2003
Yabancı dil	**ileri seviye**
Var İse Bilinen Diğer Yabancı Dillere Dair Açıklama : İspanyolca (4 kur yeditepe Üniversitesi)	

Girilen Başka Sınavlar Var ise Belirtiniz :	
İŞ DENEYİMLERİ	
1. İş Deneyimi	
Çalışılan Kurum Adı: Yeditepe Üniversitesi	Bulunduğu Şehir /Ülke: İSTANBUL/TÜRKİYE
Kurumdaki Ünvanınız/ Göreviniz: Fizyoterapist / Lisansüstü Bursiyer (Asistan)	
Çalışma Şekli:	
İşe Başlama Tarihiniz: 2016	İşten Ayrılma Tarihiniz:
İşten Ayrılış Nedeniniz :	
SAHİP OLUNAN SERTİFİKA BİLGİLERİ	
1. Sertifika : Diagnosis and Treatment Course on Lumbosacral and Hip Joint Disorders Course	
Sertifika Alınan Kurum/ Üniversite Adı : Michel Puylaert,Msc,Osteopath DO, İSTANBUL	
Sertifika Yılı : 2017	
2.Sertifika : Manual Lymph Drainage (Vodder Technique) and Complete Decongestive Therapy	
Sertifika Alınan Kurum/ Üniversite Adı :Academy of Lympatic Studies	
Sertifika Yılı : 2017	
3. Sertifika : Yara Bakımı	
Sertifika Alınan Kurum/ Üniversite Adı :Elsa Ortopedi- Medi Turk,İstanbul	
Sertifika Yılı : 2017	
4. Sertifika : Australian Physiotherapy & Pilates Institute modified matwork level 1 pilates course	
Sertifika Alınan Kurum/ Üniversite Adı: Australian Physiotherapy & Pilates Institute, Melanie Bryant & Uzm.Fzt. Özlem Üstünkaya	
Sertifika yılı : 2017	
5.Sertifika Adı : Rehabilitation in Autism Spectrum Disorder, Traning Course, Aiesec,China	
Sertifika Alınan Kurum/ Üniversite Adı :Chongqing Autistic Children Rehabilitation Center, Mainland of China	
Sertifika Yılı : 2015	

6.Sertifika Adı : JZK8-385F-72VK-6L5A,Let me Tell You a Story,Erasmus + Training Course
Sertifika Alınan Kurum/ Üniversite Adı : Stowarzy Szenie Zamojskıe Centrum Wolontarıatu,Poland
Sertifika Yılı : 2015
7.Sertifika Adı : KC5P-PMEF-ECNK-DEJN, Time Understanding and Efficiency in Youth work,Be on Time, Erasmus+Training Course
Sertifika Alınan Kurum/ Üniversite Adı : Ex-ducolab Associazione, Italy
Sertifika Yılı : 2014
8.Serttifika Adı : Akuaterapi Atölye Çalışması: Halliwick Yöntemi ile Suda Eğitim
Sertifika Alınan Kurum/ Üniversite Adı : Yeditepe Üniversitesi
Sertifika Yılı : 2014
9.Sertifika Adı :Supporting Orphans Awareness Project
Sertifika Alınan Kurum/ Üniversite Adı : Minister De AMOR, New Mexico -MEXICO
Sertifika Yılı : 2014
10.Sertifika Adı : RK-HIV-AIDS Awareness Project , Mumbai , India
Sertifika Alınan Kurum/ Üniversite Adı : RK- Health Care Center,Indıa
Sertifika Yılı : 2013
11.Sertifika Adı :Yeni Yüzyılda İnovasyon Odaklı Liderlik ve Girişimcilik Eğitimi
Sertifika Alınan Kurum/ Üniversite Adı : İstanbul Ticaret Üniversitesi
Sertifika Yılı : 2012
12.Sertifika Adı : ispanyolca 4 Kur Dil eğitim Kursu,Istanbul.
Sertifika Alınan Kurum/ Üniversite Adı : Yeditepe Üniversitesi , Yabancı Diller Yüksekokulu
Sertifika Yılı: 2012-2014
BİLİMSEL YAYINLARINIZ , ESERLERİNİZ VE ÇALIŞMALARINIZ
Çil E. T, "The Effectiveness of Exercises, Myofascial Releasing and Mobilization Techniques in Plantar Fasciitis" Yeditepe Üniversitesi, Sağlık Bilimleri Enstitüsü, Fizyoterapi ve Rehabilitasyon Anabilim Dalı, Yüksek Lisans Tezi, Istanbul, Devam etmekte.

Çil E.T. , Demirbaş Ş. "Temporomandibular Eklemi Disfonksiyonu Problemlerinin Boyun Ağrısı ve Fonksiyonelliği ile Kinezyofobi Arasındaki ilişkinin İncelenmesi" Istanbul.
Ceren D.,Demirbaş Ş., Akbuğa E. , Çil E.T." Investigation of effects of connective tissue manipulation on the fine motor ability". Yeditepe University, Faculty of Health Sciences, Department of Physiotherpy and Rehabilitation.2018.
Subaşı F. , Akbuğa E. , Çil E.T. Consultation and Coordination Center for Students with Disabilities (CCOSD) .Istanbul
Milli Eğitim Bakanlığı Celal Yardımcı İlköğretim Okulu'nda " Özel İhtiyacı Olan Çocuklarda Rekreasyonel Çalışmalar " başlıklı çalışma Yeditepe Üniversitesi Eğitim Fakültesi ve Kadıköy Belediyesi Engelliler Birimi ,Yönetici: Feryal Subaşı ,Araştırmacılar ve Eğitmenler: Elif Tuğçe çil 2017- (devam etmekte)
Şaylı U. , Demirbaş Ş. , Subaşı F. , Akbuğa E. , Çil E.T. , Akyol T ., Biros J ., Yeral A . "CHRONIC ANKLE INSTABILITY AND ASSOCIATED FACTORS: PRELIMINARY DATA OF A CROSS SECTIONAL STUDY "
Arslan G., Subaşı F., Çörekçi A., Çil E.T., Yağcıoğlu A." Tip II Diyabetik Nöropatili Hastalara Uygulanan Egzersizlerin Propriyoseptif Duyu, Aerobik Kapasite ve Yaşam Kalitesi Üzerine Etkilerinin Karşılaştırılması '' başlıklı projesi . 14.02.2017 –(devam etmekte)
Takinacı Z., Demirbaş Ş., Akbuğa E., Çil E.T., Baştürk P., et al. Physiotherapy and Rehabilitation Dictionary Book, 2017, Istanbul
"HEALING MASSAGE- An A-Z Guide for More Forty Medical Conditions" Book Turkish Translation- Çeviri Bölüm Yazarlığı
HAKİM OLDUĞUNUZ BİLGİSAYAR PROGRAMLARI
Microsoft Office, SPSS
REFERANSLAR
Ad-Soyad: Prof. Dr. Feryal SUBAŞI **Şirket - Unvan - İş Pozisyonu: Yeditepe Üniversitesi- Profesör Dr.- Bölüm Başkanı** **Telefon Numarası: 0533 275 95 95**
Ad-Soyad: Prof. Dr. H. Serap İNAL **Şirket - Unvan - İş Pozisyonu: Bahçeşehir Üniversitesi- Profesör Dr.- Bölüm Başkanı** **Telefon Numarası: 0532 557 33 54**