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Effectiveness of telerehabilitation in plantar fasciitis: Pilot study

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Abstract
Background: Plantar Fasciitis is a commonest among on musculoskeletal disorder. It is present in wide range of individuals and creates significant burden to quality of life and participation in the physical activity.
Objective: To determine the effectiveness of exercises through tele-rehabilitation in plantar fasciitis.
Methodology: Total 10 participants diagnosed with plantar-fasciitis were included in the study according to the inclusion criteria. They were randomly allocated into two groups as group A and group B by random method. Each group consisted of 5 participants. Experimental group received exercises using the tele-rehabilitation through social media and control group received exercises in conventional mode. Both the groups received intervention for two weeks daily. The outcome measures used in the study were foot ankle disability index (FADI) and patient specific functional scale (PSFS), Numerical pain rating scale was assessed before the intervention at the 6th day and on the 12th day respectively.
Results: When intragroup comparison was done both the groups showed statistically significant improvement in the FADI, PSFS and NPRS at the 6th day and 12th day of the intervention. But between the intergroup group Comparison showed non- significant difference of FADI, PSFS and NPRS score.
Conclusion: The study revealed that both tele-rehabilitation as well as conventional mode of treatment were Effective on pain and function in individuals with plantar fasciitis. Individuals treated with tele-rehabilitation showed significantly more relief in plantar fasciitis on outcomes measures FADI, NPRS and PSFS compared to individuals treated with conventional method.

Keywords: effectiveness, telerehabilitation, plantar fasciitis

Introduction

A continuous interface with our world is served by the foot and ankle [1]. The "foot sole's similar to the palm of the hand". As a superficial fascia, deep fascia and fourth layers of neurovascular bundles, the surface goes in order [2]. The deep fascia in the sole of the foot that covers both the middle and the side of the foot is known as the plantar fascia [3]. Plantar fasciitis (PF) is now referred to as "plantar fasciosis", or in athletes and non-athletes, fasciopathy is normal in heel pain[4]. Plantar heel pain (PHP) is a common musculoskeletal condition characterized by pain in the plantar part of the medial heel, most evident after a duration of inactivity for weight bearing, but often worse after prolonged weight bearing [5]. Other names include painful heel syndrome, heel spur, heel runner, subcal-caneal pain, calcaneodynia, and periostitis for this condition [6]. Heel pain is the most common complaint with which an individual presents the reason for heel pain to the out-patient department, including plantar fasciitis, retrocalcaneal bursitis, 59% of the Indian population with heel pain [7]. Individuals with PHP record low physical activity and greater rates of anxiety, depression and stress, demonstrating the substantial burden of the disorder beyond pain[5.] The prevalence of lifetime is 10% and it generally affects all ages with peak incidence between 40-60 years with an equal predominance, particularly in younger ages, in males and females [8]. This windlass system is a mechanical model that explains the way the plantar fascia supports the foot during weight bearing activities and provides details on the biomechanical stresses exerted on the plantar fascia. According to a recent study, plantar fasciitis is the most common diagnosis, leading to medial plantar heel pain in the first weight-bearing steps following rest [9]. PF-related symptoms are frequently due to inflammation of the plantar fascia, other evidence indicates that degenerative changes are an alternative mechanism to the onset of PF, and microscopic tearing can lead to thickening of the plantar fascia, tenderness of the anterior medial heel, reduced dorsiflexion and tight achilles tendon, limp may be present, before the appearance of symptoms, many patients would have had a sudden rise in their activity level [10, 11]. Overweight, prolonged standing, pronated foot posture, ageing, increased body mass index [BMI] more than 30, tight achilles tendon, weak footwear, high intensity physical activity and repeated trauma, and diabetes, tarsal tunnel syndrome, identified risk factors indicated by most clinical and research experience[12,9]. Electro-therapeutic modalities that are therapeutic ultrasound, interferential current [IFT], shock waves, laser therapy [LT] and extra-corporal shock wave therapy [ESWT] can treat plantar fasciitis. Ice packs are often used to minimize plantar fascia-related inflammation[13] Tele-physiotherapy [TPT] is the provision of virtual physiotherapy facilities using telecommunications technologies, such as video conferencing or telephone conferencing, where an in-person

visit is not a viable choice [14]. According to the American Association of Telemedicine, telemedicine is characterized as the remote delivery of telecommunications technology such as internet, wireless, satellite and telephone media to healthcare services and clinical information[15]. In order to avoid the collapse of national health systems, the 2019 coronavirus disease (COVID-19) pandemic has forced worldwide governments to introduce extreme regulations limiting individual freedom and enforcing social distancing (e.g., closing education, voluntary quarantine, restricting entertainment) [16]. As a result, WCPT has suggested that the paradigm be moved to the online mode. Evidence talks about availability of dates available that describes the effectiveness of conservative treatment for plantar fasciitis but the effectiveness of tele-rehabilitation in musculoskeletal disorders that are not available specifically in the Indian population, so our goal is to find out the effectiveness for the same. The aim of the study is to see the effect of exercises through tele-rehabilitation in plantar fasciitis. Objective to study the effectiveness of home program through tele-rehabilitation and to study the effectiveness of conventional exercises as compared to tele-rehabilitation.

Materials and Method

- **Participants**

The research was carried out in the department of physiotherapy at MGM hospital in Aurangabad, India, from September 2020 to March 2021. Obtain ethical approval from the university's institutional ethical committee. Total 10 participants with age of 30- 45 years of age were identified as eligible to pilot study and randomly method used. All of the eligible participants met the following inclusion criteria**:** 1. Both the gender included. 2. An increase in pain in the morning upon taking a few steps or after prolonged non-weight bearing. 3. Symptoms decreasing with slight levels of activity, such as walking. 4. Pain in the morning or after sitting down for long time. 4. Increasing pain with extended walking or standing for greater than 15 min. Participants were excluded if they reported 1. Concomitant foot injury or pathology. 2. Currently pregnant or breastfeeding. 3. Diabetes or an history of inflammatory systemic diseases. 4. Previous foot surgery. 5. Pervious treatment of the foot; neurological abnormality [e.g., tarsal tunnel syndrome]. 6. Any muscle stress or strain injury. 7. Ankle instability. 8. Have received a corticosteroid injection in the foot during the preceding 6 months. 9. Inability to understand instructions. Study procedure- Participant were briefed about the study, the intervention and written informed consent was obtained through google form group A [telerehabilitation] and group B [conventional exercises] for two weeks intervention. And the specific exercises and instructions was prescribed. The follow up of participants was taken by using phone calls and social media was done, at the end of each session respectively. There was no attrition in this study as all consenting participants completed the study protocol, with no participants lost follow- up. Treatment sessions was given two weeks daily. The outcome measures Foot and ankle disability index [FADI], Patient- specific functional scale [PSFS], NPRS [numerical pain rating scale] assessed pre- and post-treatment sessions for both the groups. Daily exercises are foot toe movement, weight-bearing exercises, towel- pick up, stretching exercises are in phase one and phase two high loading strength training, standing heel raise, balance and reach exercise, self-myofascial release.

Fig 1: Foot and toe movements exercise. [Doming exercises, toe spread, great toe extension, lesser toe extension

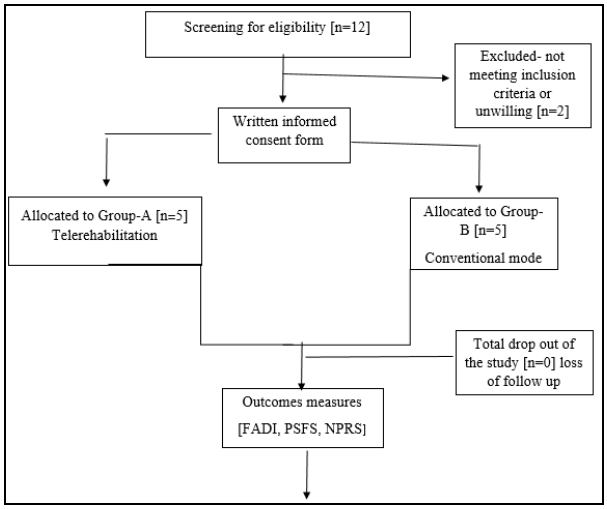

Fig 2: The consort flow diagram.

Statistical analysis: was done by using descriptive and inferential statistics using student's paired and unpaired t-test and software used in the analysis was SPPS 27.0 version and $p<0.05$ is considered as level of significance.

Results

The study was commenced to investigate the effectiveness of tele-rehabilitation on plantar fasciitis FADI, NPRS, PSFS in participants with plantar fasciitis after intervention at 1st day, 6th day, 12th day, for all outcome measures.

Table 1: Demographics data in Group A and B

Demographic characteristics	Group A	Group B
Age	40.20±3.70	40.20±3.49
Gender [M: F]	2:3	2:3
BMI	26.32±2.31	27.24±3.27

Demographics

A total ten participants with plantar fasciitis were screened for the study as per the inclusion and exclusion criteria. Telerehabilitation group had 5 participants with mean age 40.20±3.70 and BMI mean was 26.32±2.31kg/m^2 and conventional group had 5 Participants 40.20±3.49 years and BMI mean was 27.24±3.27kg/m^2. The mean difference of all data was statistically not significant [$p>0.05$]. Baseline demographic data was comparable. [Table-1 shows].

1. Foot and ankle disability index

Mean FADI score at baseline in group A was 70.81±14.13, at day 6 it was 59.02±18.02 and at day 12 it was 48.94±14.56. By using student's paired t test statistically significant difference was found in mean FADI score between baseline and day 6 ($t=5.33$, $p=0.006$) and between baseline and day 12($t=8.97$, $p=0.001$). Mean FADI score at baseline in group B was 77.01±10.96, at day 6 it was 53.99±4.74 and at day 12 it was 45.73±2.99. By using student's paired t test statistically significant difference was found in mean FADI score between baseline and day 6($t=4.30$, $p=0.013$) and between baseline and day 12($t=6.33$, $p=0.003$). [Table-2]

2. Patient- specific functional scale

Mean PSFS score at baseline in group A was 7.40±0.85, at day 6 it was 5.05±1 and at day 12 it was 2.80±1.08. By using student's paired t test statistically significant difference was found in mean PSFS score between baseline and day 6($t=4.09$, $p=0.015$) and between baseline and day 12($t=6.52$, $p=0.003$). Mean PSFS score at baseline in group B was 6.40±0.85, at day 6 it was 4.45±0.83 and at day 12 it was 2.20±0.75. By using student's paired t test statistically significant difference was found in mean PSFS score between baseline and day 6($t=4.14$, $p=0.014$) and between baseline and day 12($t=13.11$, $p=0.0001$). [Table-2]

3. Numerical pain rating scale

Mean NPRS score at baseline in group A was 6.60±1.14, at day 6 it was 4.80±0.83 and at day 12 it was 2.40±1.14. By using student's paired t test statistically significant difference was found in mean NPRS score between baseline and day 6($t=3.67$, $p=0.021$) and between baseline and day 12($t=11.52$, $p=0.0001$). Mean NPRS score at baseline in group B was 7.60±1.14, at day 6 it was 4.80±1.30 and at day 12 it was 2.40±0.54. By using student's paired t test statistically significant difference was found in mean NPRS score between baseline and day 6($t=14$, $p=0.0001$) and between baseline and day 12($t=10.61$, $p=0.0001$) [table-2]

Table 2: Intra group comparison between A and B

Outcomes measures	Baseline	6th day Mean ±SD	12th Day	t- value	p- value
FADI A	70.81±14.13	59.02±18.02	48.94±14.56	5.33, p=0.006, S	8.97, p=0.001, S
B	77.01±10.96	53.99±4.74	45.73±2.99	4.30, p=0.013, S	6.33, p=0.003, S
PSFS A	7.40±0.85	5.05±1	2.80±1.08	4.09, p=0.015, S	6.52, p=0.003, S
B	6.40±0.85	4.45±0.83	2.20±0.75	4.14, p=0.014, S	13.11, p=0.0001, S
NPRS A	6.60±1.14	4.80±0.83	2.40±1.14	3.67, p=0.021, S	11.22, p=0.0001, S
B	7.60±1.14	4.80±1.30	2.40±0.54	14, p=0.0001, S	10.61, p=0.0001, S

Table 3: Intergroup comparison between A and B

Intergroup comparison	Baseline	6th day	12th day
FADI	t- 0.77, p-0.46 NS	t-0.60, p-0.53NS	t-0.48, p-0.64NS
PSFS	t-1.84, p-0.80NS	t-1.002, p-033NS	t-1.01, p-0.33NS
NPRS	t-1.38, p-0.20NS	t-0, p-1.00NS	t-0, p-1.00NS

On comparing mean FADI score in two groups statistically no significant difference was found in mean FADI score at baseline ($t=0.77$, $p=0.46$), at day 6($t=0.60$, $p=0.53$) and at day 12 ($t=0.48$, $p=0.64$). [table-3] Comparing

mean PSFS score in two groups statistically no significant difference was found in mean PSFS score at baseline (t=1.84, p=0.80), at day 6(t=1.02, p=0.33) and at day 12 (t=1.01, p=0.33). On comparing mean NPRS score in two groups statistically no significant difference was found in mean NPRS score at baseline (t=1.38, p=0.20), at day 6(t=0, p=1.00) and at day 12 (t=0, p=1.00). [table-3]

Discussion

This study was done to evaluate the effectiveness of tele-rehabilitation in the plantar fasciitis on pain, function in individuals with plantar fasciitis. The study revealed that both tele-rehabilitation as well as conventional mode of treatment were effective on pain and function in individuals with plantar fasciitis. The outcome measures used were Foot Ankle Disability Index, Patient Specific Functional Scale and Numerical Pain Rating Scale. The outcome measures were recorded pre, 6th day, 12th day. After screening on the basis of inclusion and exclusion criteria 10 subjects were included in the study. Fraser JJ *et al* 2017 in their study showed that 78 percent of individuals between the age group of 30 to 59 years were seen with plantar fasciitis. Similarly, the mean value of age in group A and B were 40.20±3.70 and 40.20±3.49 respectively [17].

The interventions were given by both conventional as well as tele-rehabilitation in the respective groups. Both the groups showed significant improvement in pain. To evaluate the effect of pain numerical pain rating scale was used[18]. Hjermstad M *et al* in 2010 conducted a study to compare numerical rating scales, verbal rating scales, and visual analogue scales for assessment of pain intensity in adults and concluded that NPRs are standardized measure and are applicable for unidimensional assessment of PI in most settings [19].

In this study there was significant improvement in pain in both the groups experimental group as well as control group that concludes telerehabilitation is as effective in treating pain in individuals with plantar fasciitis as that of conventional method. Similarly, Cottrell MA *et al* in 2016 in their systemic review and metanalysis on real-time telerehabilitation for the treatment of musculoskeletal conditions effectiveness and comparison to standard practice, concluded that real-time telerehabilitation is effective and comparable to conventional methods of health care delivery for the improvement of physical function and pain in a variety of musculoskeletal conditions [20].

Conclusion

The study revealed that both tele-rehabilitation as well as conventional mode of treatment were effective on pain and function in individuals with plantar fasciitis. Individuals treated with tele-rehabilitation showed significantly more relief in plantar fasciitis on outcomes measures FADI, NPRS and PSFS compared to individuals treated with conventional method.

Limitation

Study monitoring of the effect was not conducted for a longer duration. In present study recording qualitative was difficult due to virtual communication.

Ethical approval

The study was approved by the ethics committee MGM Medical college Aurangabad [Letter no. MGM-ECRHS/2021/50].

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