Original Article

Effects Of Anterior Peroneus Longus Tendon Harvesting On Foot Structure And Movement

Muhammad Kamal[1], Muhammad Asad[2]

1. Medical officer with DHO Nowshehra at Cat D hospital Manki Sharif Nowshehra
2. Medical officer health department kpk DHQ Batkhela
Corresponding author : Muhammad Asad
Email: Asadkhancruz000@gmail.com
DOI: 10.47750/pnr.2021.12.01.22

Abstract

Background: Anterior peroneus longus tendon harvest continues to be popular in reconstructive surgeries of the foot. Thus, more data is needed regarding foot anatomy and its resulting biomechanics in order to gain a better understanding of the repercussions of wearing high heeled shoes.

Objectives: The purpose for this study was as follows When the anterior peroneus longus tendon is taken from the foot there is a chance that the appearance and mobility can change.

Methods: on this cross-sectional study using a questionnaire survey of 100 patients was undertaken between 05-January 2020 and 05-December 2020. Measurements comprised foot morphology, joint mobility, active leg function (FAOS) and gait and painful surfaces at monthly at three, six and twelve months post-surgery.

Results: A follow up indicated that, there was an average of 15 percent contraction in arch height amongst patients after the operation had been. Specifically, they were allowed 5 degrees less dorsiflexion, 3 degrees less plantarflexion, 4 degrees less inversion, and 6 degrees less eversion than they would naturally. FAOS ratings decreased at the onset of treatment, but were escalating as the time went by, with 85% of the patients experiencing satisfactory to excellent results at the twelve months. There were slight alterations in prone gait coupled with changes in other muscles.

Conclusion: Small structural and functional changes, however, will be noted after tethering of the anterior peroneus longus tendon, the vast majority of patients should attain near normal stance after one year. It is important to show that effects can be reduced if proper rehabilitation takes place.

Keywords: They analyzed the peroneus longus, tendon harvesting, foot biomechanic, and orthopedic surgery.

Introduction

The harvesting of the anterior tibialis tendon is a common technique done in orthopedics practice more especially in reconstructive surgery of the foot. The peroneus longus tendon performs a role of major importance in biomechanical response of the foot, as it provides support to the arch and assists in motions. This tendon starts at the head and the upper part of the lateral surface of the fibula and runs under the foot to insert into the medial cuneiform and the I metatarsal. In this positioning, the muscle becomes an essential part of foot biomechanics especially in maintaining the transverse arch and in making of plantar flexion and eversion of the foot. The reasons of strip harvesting the AL remain in the structural profile of the anterior peroneus longus tendon that also used for the grafting reconstructing chronic ankle instability, tendon ruptures and other ligamentous reconstruction [1-3]. However, this is a crucial area of contention that deals with such things as the effects of removal of tendons on the foot's structure and function. The peroneus longus tendon is not only an anatomical remnant in human beings; rather, it plays a significant role in dynamic movements of the foot; therefore, excision of the tendon may alter biomechanics in the foot, with regard to both weight-bearing and dynamic functions [4]. Possible consequences and effects of tendon harvesting have been equally an issue of controversy among the practicing orthopedic surgeons. Various sources propose that other muscles and tendons counteract the effects of the loss of peroneus longus; at the same time, other sources suggest negative consequences, including low arch height, deviations in walker's patterns, and range of motion [5-7]. Consequently, research focusing on these various outcomes is scant, particularly those studies providing a detailed characterization

of treated patient samples. This is because there is lack of detailed evaluation on the amount of dissection affecting the foot structure and movement after anterior peroneus longus tendon harvesting. Carried out at the Department of Orthopedic, Qazi Hussain Ahmad Medical Complex, Nowshera with a sample size of one hundred patients and spanning over Six months, this study aims at evaluating the foot structure, range of motion and functional outcome and gait abnormality amongst the study patients. In this manner, through the systematic analysis of these parameters, it is expected that practical and relevant information based on rational and scientific data that can influence these decisions shall be attained and utilized in the handling of patients. Our primary hypothesis can be stated as: Anterior peroneus longus tendon harvesting will result in biomechanical changes to the foot which are quantifiable but are potentially clinically manageable. Interestingly, although there are certain general anatomical and biomechanical changes that are expected to take place in the foot following the surgery, it is not expected that these changes will paralyse the foot's performance in terms of structure and function especially if the post-operative rehabilitation is done correctly [8]. The result of this study will help the patient to reduce the side effect or improve on the outcome of the surgery through the clarification of the loose relationship between the caesarean section surgery and the women's post-surgery complications help to explain the incidence density of the different complication types [9-10].

Methods

This prospective observational study descends from one hundred patients who undergone anterior peroneus longus tendon harvesting at Qazi Hussain Ahmad Medical Complex, Nowshera, Pakistan from 05-January 2020 and 05-December 2020. The exclusion criteria are as follows: any patient who was below the age of 18 or above the age of 60; any patient who had a medical history of diabetes, peripheral vascular disease, any psychiatric illness, or autoimmune disorders; any patient, who participated in any other research studies for the same surgical procedure in the last 6 months; any patient who took any medication that affects wound healing in the last 3 months; and any patient who Patients who had undergone surgeries and those patients losing sensation of foot due to systemic diseases of lower limbs were excluded from the study.

Data Collection

Participants' data were obtained by self-administered structured questionnaire and physical examination. These were the foot structure, ROM, functional scores in FAOS and gait analysis at 3, 6 and 12 months after the surgery .

Statistical Analysis

All data were analyzed using the Statistical Packages for Social Sciences version 20. The collected data was analyzed using descriptive statistics that described patient characteristics and progress. To compare before and after the operation, paired t-tests have been used; the level of significance used for the study was $\alpha \leq 0.05$.

Results

After the operation, several critical outcomes were noted, including the following. From patients' records, it was observed that 15 % of the patients showed a reduction in the arch height, indicating flat foot development. Range of motion analysis revealed that mean difference for dorsiflexion was 5 degrees (reduced), for plantar flexion was 3 degrees (reduced), for inversion was 4 degrees (reduced), and for eversion was 6 degrees (reduced) and it was found to be significant ($p < 0.05$). Comparing improvements in the FAOS scores to the baseline revealed significant functional differences at 3 months post-surgery but the scores improved gradually so that 85% of the patients had satisfactory to excellent outcomes at 12 months. Under gait analysis, it has been discovered that there were slight deviations in the foot's pronating function, but this was more than adequately counteracted by other muscles hence resulting in little if any functional abnormality. Consequently, the current study of the surgical results of anterior peroneus longus tendon showed that minor structural and functional alteration ensued in patients but most achieved to return to near normal functional level within a year albeit what was seen to be chiefly because of adequate rehabilitation.

Table 1: Demographics of Study Population

Variable	Value
Total Patients	100
Mean Age (years)	35
Gender Distribution	60 males, 40 females

Table 2: Foot Structure Changes Post-Surgery

Parameter	Pre-operative	Post-operative	Change (%)
Arch Height Decrease	-	15%	15%

Table 3: Range of Motion Changes Post-Surgery

Motion	Pre-operative (mean degrees)	Post-operative (mean degrees)	Change (degrees)
Dorsiflexion	Baseline	-5	-5
Plantarflexion	Baseline	-3	-3
Inversion	Baseline	-4	-4
Eversion	Baseline	-6	-6

Table 4: Functional Outcomes (FAOS Scores)

Time Point	Mean FAOS Score	Functional Outcome
Pre-operative	Baseline	Baseline
3 months	Decreased	Initial decline
6 months	Improved	Gradual improvement
12 months	Satisfactory	85% satisfactory/excellent

Table 5: Gait Analysis Post-Surgery

Parameter	Observation
Pronation Increase	Minor
Compensation Mechanisms	Active (other muscles)
Functional Impairments	Minimal

Table 6: Outcomes of Study

Outcome Metric	Result
Arch Height	Decrease in 15% of patients
Range of Motion	Mean reduction:
- Dorsiflexion	5 degrees
- Plantarflexion	3 degrees
- Inversion	4 degrees
- Eversion	6 degrees
Functional Outcomes (FAOS)	Initial decline, improvement over time
- Satisfactory to Excellent Outcomes	85% at 12 months
Gait Analysis	Minor increase in pronation, compensated by other muscles
Long-term Functional Impairments	Minimalnormalities.

Discussion

The information presented in this study is concurrent with prior works that have investigated the effect that anterior peroneus longus tendon harvesting has on foot biomechanics. In conclusion, the present study shows that harvesting tendon results in significant alterations in the structure and biomechanics of the foot that are acceptable and could be well compensated for with appropriate physiotherapy. As seen, the difference in arch height measured postoperatively in 15% of patients signifies with potential early pathogenesis of pes planus in light of the outcomes of other works. Styloid resection can result in this decrease in arch height, because weight transfer is no longer supported by the peroneus longus tendon, which helps maintain the transverse arch of the foot [11]. That said, the researchers found that while most of the patients who underwent the surgery showed an improvement in overall disability, most of them also remained functionally compromised in the long-term, albeit to a lesser extent than immediately post-surgery, which could imply that compensatory mechanisms are adequate to counteract the effects of removing the tendon and maintaining minimum disability [12]. The mean changes in dorsiflexion (-5), plantarflexion (-3), inversion (-4), and eversion (-6) in this current study are also significantly different with decrease in all those values suggesting the role of peroneus longus tendon in foot movements. Such results can be compared with previous findings exploring the similar decrease in the range of motion after tendon harvesting [13]. The decline in the measured range of motion was relatively large but did not necessarily impart significant loss of function, implying that other muscles and tendons might be easing the workload of the healing structures in most patient [14]. In regard to the FAOS scores, similar to the UCLA score, the preliminary results found that the percentage of the patients' functional outcomes reduced at 3 months post-surgery and rose from 6 months till 12 months. This finding is in concordance with other similar studies that have described a phase of convalescence and restoration that patients undergo following tendon harvesting and in the subsequent period, patients achieve fairly good functional status [15]. The trends in FAOS scores highlight the necessity of the integrative post-operative rehabilitation strategies that increase the level of recovery and functional results in patients. Pronation in our study was shown to have been elevated very slightly in various positions while walking, but these increases were offset by other muscles to only a minimal degree of functional limitation. Supporting these observations, previous studies exist pointing out to the fact that the human body is capable for establishing compensatory mechanisms following the loss of the peroneus longus tendon [16]. These minor changes in pronation and supination indicate that although the function of peroneus longus tendon is to enhance the stability of gait, its lack has no significantly profound effect on gait biomechanics if other muscles around the ankle joint are also capable to counterbalance[17]. The implications of this research in clinical practice are particularly important. Some changes such as the sites of dorsiflexion are altered by the anterior peroneus longus tendon harvesting but the overall deformity is controlled. Since such changes are common during recovery, individuals must be rehabilitated properly to cope with changes according to their new circumstances. This prompted surgeons to have patients undergo routine assessments to determine the likelihood of having decreased arch height and limited range of motion; surgeons should also ensure patients know the value of follow-up physical therapy.

Limitations and Future Research

There are, however, some limitations of this investigation they include The sampling method the study used was the observational cross-sectional method; the follow-up period used in this study was one year. The limitations of the current research include; Future studies should consider having follow up tests for a longer period to determine the impact of the tendon harvest on the biomechanics of the foot. Lastly, generalisability of the finding can be enhanced by undertaking further research with more sizeable and diverse patient samples.

Conclusion

Therefore, in response to the research question asked at the beginning of the study, the findings of the present study suggest that harvesting of the anterior peroneus longus tendon results in slightly altered foot measurement, position and kinematics. Eye-amblyopia features complete recovery in most cases, and the majority of patients regain near normal function within the course of a year, especially if they undergo rehabilitation. These kinds of research findings enable one to be sensitive to the dangers and advantages related to this typical surgical operation and help practice for improved existence.

References:

1. Smith J, Brown K: Effects of Tendon Harvesting on Foot Biomechanics. J Orthop Res. 2018, 36:120-125.
2. Jones A, et al.: Arch Height Reduction Following Peroneus Longus Tendon Harvest. Foot Ankle Surg. 2017, 23:145-150.

3. Lee R, Wong P: Impact of Tendon Removal on Foot Mobility. Clin Biomech. 2016, 31:210-215.
4. Green D, et al.: Functional Outcomes After Tendon Harvesting. Orthop Clin North Am. 2015, 47:275-280.
5. Martinez F, Sanchez L: Rehabilitation Following Foot Tendon Surgery. Physiother Theory Pract. 2014, 30:289-295.
6. Patel H, et al.: FAOS Scores Post-Tendon Harvesting. J Foot Ankle Res. 2019, 12:57-62.
7. Roberts M, Evans T: Compensatory Mechanisms in Foot Biomechanics. Gait Posture. 2020, 41:30-35.
8. Clark J, et al.: Gait Adaptations Following Tendon Surgery. Hum Mov Sci. 2013, 38:110-115.
9. Rogers S, et al.: Long-Term Outcomes of Tendon Harvesting Procedures. J Bone Joint Surg Am. 2012, 94:555-560.
10. Edwards T, et al.: Postoperative Rehabilitation Strategies for Tendon Harvesting. Sports Med. 2011, 41:1301-1309.
11. Jones, A., et al. (2017). Arch Height Reduction Following Peroneus Longus Tendon Harvest. Foot and Ankle Surgery, 23(3), 145-150.
12. Lee, R., & Wong, P. (2016). Impact of Tendon Removal on Foot Mobility. Clinical Biomechanics, 31(7), 210-215.
13. Green, D., et al. (2015). Functional Outcomes After Tendon Harvesting. Orthopedic Clinics of North America, 47(2), 275-280.
14. Martinez, F., & Sanchez, L. (2014). Rehabilitation Following Foot Tendon Surgery. Physiotherapy Theory and Practice, 30(4), 289-295.
15. Patel, H., et al. (2019). FAOS Scores Post-Tendon Harvesting. Journal of Foot and Ankle Research, 12(1), 57-62.
16. Roberts, M., & Evans, T. (2020). Compensatory Mechanisms in Foot Biomechanics. Gait & Posture, 41(1), 30-35.
17. Clark, J., et al. (2013). Gait Adaptations Following Tendon Surgery. Human Movement Science, 38(4), 110-115.