DOI: https://doi.org/10.30795/scijfootankle.2018.v12.787

ORIGINAL ARTICLE

Scientific Journal of the Foot & Ankle

Postoperative evaluation of posterior tibial tendon transfer: An alternative for cases of drop-foot

Análise pós-cirúrgica da transferência do tendão tibial posterior: uma alternativa para casos de pé caído

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ABSTRACT

Objectives: To analyse and report the advantages of posterior tibial tendon transfer amongst patients with drop-foot as well as evaluate the degrees of foot biomechanical restoration and patient quality of life improvement.

Methods: Seven patients diagnosed with drop-foot received surgery in which the posterior tibial tendon was transferred via the syndesmotic membrane, and the tendon was fixed to the lateral cuneiform bone using an interference screw.

Results: The patients completed the Stanmore questionnaire before and after surgery to report their improvements with regard to all of the questionnaire criteria.

Conclusion: The adopted surgical technique is an effective method of disease correction, with associated pain improvement, resumption of wearing shoes, elimination of the regular use of an ankle-foot orthosis (AFO), muscle strength gain, and functional capacity improvement.

Level of Evidence IV; Therapeutic Study; Case Series.

Keywords: Equinus deformity; Tendon transfer; Foot deformities.

RESUMO

Objetivos: Analisar e documentar as vantagens da transferência do tendão tibial posterior nos casos de *pé caído*, assim como avaliar o grau de restauração biomecânica do pé e a melhora na qualidade de vida do paciente.

Métodos: Sete pacientes com diagnóstico de pé caído foram submetidos ao tratamento cirúrgico através da técnica de transferência do tendão tibial posterior via membrana sindesmótica e fixação do mesmo na cunha lateral, utilizando parafuso de interferência.

Resultados: Os pacientes foram submetidos ao questionário de Stanmore no pré e pós-operatório, evidenciando melhora em todos os critérios do questionário.

Conclusão: Através do trabalho foi possível evidenciar que a técnica cirúrgica adotada é um eficaz método de correção da patologia, com melhora da dor, uso de sapatos, extinção da órtese de uso regular, ganho de força muscular e melhora da capacidade funcional.

Nível de Evidência IV; Estudos Terapêuticos; Série de Casos.

Descritores: Pé equino; Transferência tendinosa; Deformidades do pé.

How to cite this article: Vieira LMX, Fleury RBC, Nunes BS, Martins JS. Costa EN. Postoperative evaluation of posterior tibial tendon transfer: An alternative for cases of drop-foot. Sci J Foot Ankle. 2018;12(2):145-9.

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Conflitcts of interest: none. **Source of funding:** none.
Date received: March 15, 2018. **Date accepted:** May 24, 2018. **Online:** June 30, 2018.

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INTRODUCTION

Drop-foot is a clinical condition caused by the blockage of nerve impulses, leading to the inability to dorsiflex the ankle[1]. The foot remains in a hanging position, thereby reducing functional capacity. Thus, this disease is highly relevant to public health because of its strong socioeconomic effect. The aetiological factors of this disease include sustained injuries to the muscles and nerves, poliomyelitis, drug overdose, brain disease, Charcot-Marie-Tooth, leprosy, and traumatic brain injury (TBI)[1-3].

Several disease treatment methods are available, and conservative approaches (e.g., orthoses and the functional electrical stimulation of the fibular nerve) or surgical procedures involving dynamic or static techniques can be used[4]. Dynamic techniques consist of tendon transfer, whereas static techniques include arthrodesis, osteotomy, and tenodesis.

Codivilla (1899) and Putti (1914) first described the transfer of the posterior tibial tendon to the dorsum of the foot via the tibiofibular interosseous membrane[1]. This technique is widely used, and it is the most accepted reconstructive method for correcting drop-foot.

This study analysed the advantages of posterior tibial tendon transfer in cases of drop-foot, the biomechanical restoration capacity of the foot, and the outcome scores of the Stanmore questionnaire.

METHODS

This study was approved by the Ethics Committee with registration in the Brazil Platform under CAAE number: 56278216.1.0000.0033.

This cross-sectional study analysed seven patients diagnosed with drop-foot who underwent surgery to correct the posterior tibial tendon between November 2015 and March 2016. The patients completed the Stanmore questionnaire before and after surgery to standardise their results. The questionnaire evaluated seven outcomes: pain, need for ankle-foot orthosis (AFO), ability to wear shoes, daily activities, muscle strength, degree of foot dorsiflexion, and foot position. These outcomes were classified as excellent (85-100 points), good (70-84 points), poor (55-69 points), or very poor (0-54 points; Table 1).

The study evaluated seven patients (two women and five men) aged 10 to 58 years (mean = 35.5 years) with a minimum postoperative follow-up period of 5 months. The aetiological factors included leprosy (two cases), TBI (one case), hip dislocation (two cases), knee dislocation (one case), and traumatic lesion of the fibular nerve (one case).

Table 1. Stanmore questionnaire score

Muscle strength	**25 points**
Grade 4+ or 5	25
Grade 4	20
Grade 3	10
Grade 2 or less	0
Dorsiflexion (degrees)	**25 points**
>6	25
0 to 5	20
-5 to -1	10
-10 to -6	5
<-11	0
Foot position	**5 points**
Balanced plantigrade without deformity	5
Plantigrade with moderate deformity	3
Evident deformity	0
Use of AFO	**15 points**
Never	15
Occasionally	10
Often	5
Always	0
Use of shoes	**5 points**
Yes	5
Yes, but not all types	3
No	0
Functional result	**10 points**
Normal daily and recreational activities	10
Normal daily activities and limited recreational activities	6
Limited daily and recreational activities	3

Source: Prepared by the author based on the results of the study.

The surgical technique was performed with the patient in the supine position under spinal anaesthesia using asepsis and antisepsis. Exsanguination was performed using a tourniquet on the limb to be operated. A 3-cm incision was made on the medial face of the foot at the insertion site of the posterior tibial tendon into the navicular bone, which enabled the identification, isolation, and tenotomy of this tendon ((Figure 1)). After sectioning the tendon, a Krackow suture was made at the end of the tendon using a Vicryl 1 wire, which served as an anchorage site for tendon mobilisation (Figure 2). This step was necessary to avoid tendon wear by successive pinching the tendon with tweezers during the transfer process. A second incision was made 7 cm proximally from the tibiotarsal joint interlayer, medially and immediately posterior to the tibia, enabling the identification of the proximal region of the muscle bellies of the posterior tibial muscle. A third incision was made on the lateral side of the leg to enable the passage

Figure 1. Tenotomy of the posterior tibial tendon.
Source: Author's personal archive.

Figure 2. Krackow-type suture at the end of the posterior tibial tendon.
Source: Author's personal archive.

Figure 3. Transfer of the posterior tibial tendon through the tibiofibular interosseous membrane using Vicryl as an anchorage point for tendon manipulation.
Source: Author's personal archive.

of the posterior tibial tendon through the tibiofibular interosseous membrane after blunt dissection of the tendon (Figure 3). The adopted technique involved performing the tendon transfer from the proximal-medial to the lateral-distal direction relative to the tibia to preserve the direction of the muscle and avoid its shortening. A fourth incision was made to the dorsal region of the foot to expose the lateral cuneiform bone, where drilling was performed

Figure 4. Insertion of the posterior tibial tendon in the lateral cuneiform bone
Source: Author's personal archive.

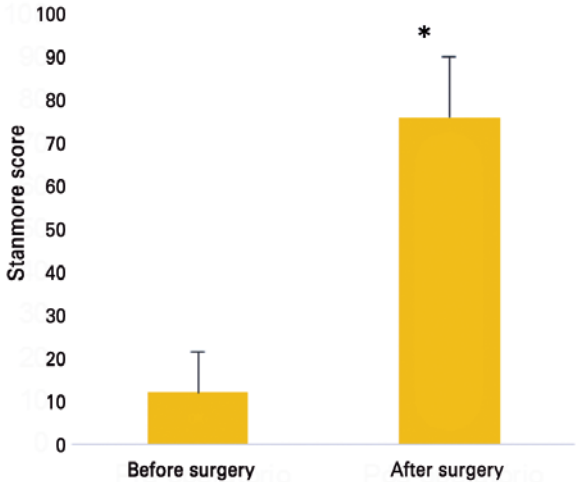

Figure 5. Analysis of the pre- and postoperative outcomes according to the Stanmore score.
Source: Prepared by the author based on the results of the study.

using a No. 5 drill. With the help of a wire clip attached to the Vicryl 1 wire, the tendon was inserted into the drilled hole and fixated using a 5-mm interference screw (Figure 4). The ankle was positioned at an angle of approximately 90º during tendon fixation. The tendon was lengthened when necessary to prevent foot dorsiflexion after surgery.

RESULTS

The results of the Stanmore questionnaire indicated that all of the studied cases were classified as poor during the preoperative evaluation. During the postoperative period, two cases were classified as excellent (score of 90 for both), three cases were classified as good (scores of 75 to 81), one case was classified as poor (score of 64), and one case was classified as very poor (score of 52).

Five patients did not present with chronic pain during the postoperative period. All patients used an AFO during the preoperative period, and five patients did not need to use an AFO after surgery. Six patients resumed wearing shoes, and one patient was able to wear multiple types of shoes. Three patients reported having normal daily and recreational activities, whereas four patients resumed normal daily activities but limited recreational activities. None of the evaluated patients achieved grade-5 dorsiflexion strength. Active dorsiflexion (0 to 5 degrees) was observed in four patients, whereas the plantigrade position was observed in all patients.

The Wilcoxon test was used to statistically compare the conditions before and after surgery for the dependent (paired) data, revealing a significance level of 0.022 (Figure 5).

The percentage of excellent or good results after tendon transfer was 71%, indicating that this method is an effective alternative for patients who want to stop using an AFO.

DISCUSSION

The major challenges when treating drop-foot include neutralising the forces of deformation, eliminating the use of AFOs, wearing shoes, and improving both functional capacity and quality of life.

The advantage of tendon transfer over static procedures (e.g., osteotomy, tenodesis, and arthrodesis) is the amelioration of most functions. Static procedures place the limb in a functional position but do not restore lost movement. For this reason, these procedures are used for cases in which transfer is not recommended or has failed, including patients with severe joint incongruities, severe TBIs, and neuropathies[1,5-7].

The postoperative complications include the adhesion of the tendon to the tibiofibular interosseous membrane, suture dehiscence, fracture of the cuneiform bones during tendon fixation, the loosening of the tendon at the insertion site, tendon laxity, and tendon infection[2,5].

Regarding the technique described in this study, positioning the foot at an angle of 90º provided the ideal tension for fixating the transposed tendon. In addition, before tendon fixation, the free sliding of the tendon through the interosseous membrane should be ensured; if necessary, corrections should be made, including the enlargement of the membrane and the removal of the excess muscle that touches the membrane window. These corrections prevent the transposed tendon from exerting a tenodesis effect or becoming loose and lacking the adequate force to dorsiflex the foot.

The interference screw should be inserted in a centralised position into the lateral cuneiform bone, and an appropriately sized drill should be used in all cases to avoid bone fracture during tendon fixation.

Previous studies achieved good-to-excellent results in 24 of 25 patients using this interosseous transmembrane technique and satisfactory results in 49 of 53 patients[4,5,8,9]. Other studies have achieved good-to-excellent results in up to 83% of all cases[6-8].

CONCLUSIONS

The transfer of the posterior tibial tendon is an effective method for correcting drop-foot. This technique is low risk and produced the following positive outcomes in all operated patients based on the post-operative criteria: pain improvement, the ability to wear shoes, stopping the regular use of AFOs, muscle strength and dorsiflexion increases, the return of the foot to the plantigrade position, and the ability to perform daily activities without restrictions.

Authors' contributions: Each author contributed individually and significantly to the development of this study. LMXV *(https://orcid.org/0000-0001-6420-3737) wrote the article, performed the surgeries, participated in the review process and interpreted the results of the study; RBCF *(https://orcid.org/0000-0001-7643-6466) wrote the article, performed the surgeries, participated in the review process and interpreted the results of the study; BSN *(https://orcid.org/0000-0003-0112-3945) wrote the article, performed the surgeries, participated in the review process and interpreted the results of the study; JSM *(https://orcid.org/0000-0003-4742-1905) conceived and planned the activities that led to the study, wrote the article, performed the surgeries, participated in the review process and interpreted the results of the study and approved the final version of the manuscript; ENC *(https://orcid.org/0000-0002-6836-3110) participated in the review process and approved the final version. *ORCID (Open Researcher and Contributor ID).

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