

Tibiocalcaneal arthrodesis in fixed equinus deformity with ring fixator: functional assessment and quality of life

Artrodese tibiocalcaneana no pé equino rígido com fixador circular: avaliação funcional e qualidade de vida

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ABSTRACT

Objective: To evaluate the limb function and quality of life of patients with posttraumatic fixed equinus deformity treated at a tertiary hospital after arthrodesis with the Ilizarov external fixator.

Methods: A study was conducted from January 2015 to June 2018 in which 6 patients were evaluated at outpatient follow-up in the late postoperative period. First, an identification questionnaire was administered to assess limb function using the American Orthopedic Foot and Ankle Society (AOFAS) scale, and quality of life was assessed using the SF-36 questionnaire.

Results: A total of 66.6% of the sample had an AOFAS score below 70 (mean total= 57.5), which is considered poor. The mean SF-36 score was low (below 60) in all domains evaluated. The pain domain had the highest score (mean= 57.2).

Conclusions: Even after surgery to correct the deformity, patients had impaired function and quality of life.

Level of Evidence IV; Therapeutic Studies; Case Series.

Keywords: Arthrodesis; External fixators; Ilizarov technique; Equinus deformity.

RESUMO

Objetivo: Avaliar a funcionalidade do membro e a qualidade de vida de pacientes com equino rígido pós-traumático atendidos em um hospital terciário, após ser feita artrodese por fixador externo (Ilizarov).

Métodos: Estudo realizado no período de janeiro de 2015 a junho de 2018, em que se avaliou 6 pacientes no retorno ambulatorial em pós-operatório tardio. Primeiramente, aplicou-se um questionário de identificação para a avaliação da funcionalidade do membro, utilizou-se o questionário *American Orthopaedic Foot and Ankle Society* (AOFAS) e a avaliação da qualidade de vida foi realizada através do questionário SF-36.

Resultados: 66.6% da amostra apresentou pontuação AOFAS abaixo de 70 (média total=57,5), obtendo classificação ruim. A aplicação do questionário SF-36 mostrou pontuações médias baixas (inferiores a 60) para todos os domínios avaliados. O domínio "dor" foi o melhor pontuado (média=57,2).

Conclusões: Mesmo após a realização da cirurgia para correção da deformidade, houve comprometimento da função e da qualidade de vida dos pacientes.

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

Descritores: Artrodese; Fixadores externos; Técnica de Ilizarov; Pé equino.

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INTRODUCTION

In the equinus deformity of the foot, varying degrees of plantar flexion are observed. The deformity can be classified as mild, moderate or severe depending on the flexion angle⁽¹⁾. Rigidity is a more serious condition, causing pain and the shortening of soft tissues. The surgical approach is the most effective for this deformity and obtains a better outcome than conservative treatment⁽²⁾.

Fixed equinus deformity is caused by burns, severe trauma sequelae, nerve injury and compartment syndrome of the leg. This condition is disabling because it prevents walking with a plantigrade foot, hinders the use of conventional footwear and makes independent locomotion difficult. In addition, it can cause chronic pain and lead to plantar ulcerations, increasing the risk of infections⁽³⁾.

Dynamic or static techniques are the surgical options for treating this deformity. Dynamic techniques include muscle and tendon transfer, whereas static techniques include arthrodesis, osteotomy and tenodesis⁽⁴⁾. Arthrodesis is indicated for correcting deformities in severely painful feet, and the Ilizarov method is a treatment option for such conditions^(5,6).

Therefore, the aim of the present study was to evaluate patients with posttraumatic fixed equinus deformity who were treated in a tertiary hospital with arthrodesis correction using an Ilizarov external ring fixator and to determine whether there was limb function improvement as well as clinical and quality of life improvement.

METHODS

This study was approved by the Ethics Committee and registered in the Brazil Platform (Plataforma Brasil) under CAAE number 93866518.7.0000.0033.

Six patients were diagnosed with painful fixed equinus foot deformity and underwent tibiotalar arthrodesis with an Ilizarov external ring fixator. These patients remained under outpatient follow-up between January 2015 and June 2018.

The patients were assessed according to sex, age and laterality. To assess limb function, the patients answered items from the American Orthopedic Foot and Ankle Society (AOFAS) scale 6 months after removal of the fixator. This questionnaire is specific for the ankle and hindfoot, is easy to apply and understand, does not require imaging exams,

and consists of nine items divided across three categories: pain (40 points), functional aspects (50 points) and alignment (10 points), totaling 100 points.

The result can be classified as excellent (between 90 and 100 points), good (between 80 and 89 points), fair (between 70 and 79 points) and poor (below 70 points)^(7,8) (Figure 1).

AOFAS ANKLE-HINDFOOT SCALE (100 POINTS TOTAL)	
Pain (40 points)	
No pain	30
Mild, occasional	20
Moderate, daily	0
Severe, almost always present	0
Functional (50 points)	
Restrains in activities, support required	
No restraints, no support	10
No restraints in daily activities, restrained recreational activities, no support	7
Restrains in daily and recreational activities, cane required	4
Strong restraints in daily and recreational activities; walker; crutches, wheelchair, orthosis (ankle restraint, ankle immobilizer)	0
Maximum walking distance, in blocks	
More than 6	5
4-6	4
1-3	2
Less than 1	0
Walking surfaces	
No difficulties in any surface	5
Some difficulty on irregular floors, stairs, steep hills	3
Strong difficulties on irregular floors, stairs, steep hills	0
Gait abnormality	
No abnormality, mild	8
Evident	4
Strong	0
Sagittal mobility (flexion + extension)	
Normal or slightly limited (30° or more)	8
Moderate limitation (15° - 29°)	4
Strong limitation (less than 15°)	0
Hindfoot mobility (inversion + eversion)	
Normal or slightly limited (75-100% of the normal mobility)	6
Moderate limitation (25-74% of the normal)	3
Strong limitation (less than 25% of the normal)	0
Ankle-Hindfoot stability (anteroposterior, varus-valgus)	
Stable	8
Unstable	0
Alignment (10 points)	
Good, plantigrade foot, well-aligned forefoot and hindfoot	10
Fair, plantigrade foot, some degree of misalignment of the ankle and hindfoot, asymptomatic	5
Poor, non-plantigrade foot, strong and symptomatic	0
TOTAL DE SCORE:	

Figure 1. AOFAS scale for the ankle and hindfoot.
Source: Rodrigues et al., 2008⁽⁷⁾.

The quality of life of the patients was evaluated using the Brazilian version of the Medical Outcomes Study 36-Item Short-Form Health Survey (the SF-36 quality of life questionnaire), an instrument for assessing generic quality of life that consists of a questionnaire with 36 items divided into 8 scales or domains: physical functioning, physical role functioning, bodily pain, general health perceptions, vitality, social role functioning, emotional role functioning and mental health. The final score ranges from 0 to 100, where 0 is the worst and 100 is the best state of health^(9,10).

The collected data were kept confidential and will be archived for five years and then incinerated, according to CNS Resolution n. 196/96. All human rights requirements were met in the present study.

The proposed surgical technique was performed with the patient positioned in dorsal decubitus under spinal anesthesia, and sterile surgical drapes were placed. The joint was approached with an anterolateral incision of approximately 10 cm. Osteotomy of the fibula was performed proximal to the ankle; it was combined with arthrotomy for the removal of the cartilage and body of the talus, which was used as a bone graft. The foot was then placed at 90°, engaging the tibia and calcaneus, and kept in this position with the use of an external ring fixator.

The system assembly has two parts: first, a support for the leg is applied to the lower third of the leg, and second, a support for the foot is applied to the hind/midfoot and forefoot. These two parts are connected by fixed rods and hinges to maintain the position of the talocalcaneal arthrodesis.

In the distal tibia, the components of the fixator are two parallel rings of equal diameter connected by four threaded rods. One of the rings is placed in the middle third of the leg, the other is placed over the malleolus, and each ring is stabilized using 2 or 3 crossed Kirschner wires.

In the foot, the fixator consists of two horseshoe-shaped rings, one placed posterior to the calcaneus and the other placed at a 90° angle to the metatarsals. This assembly is stabilized with the use of 2 threaded rods in the calcaneus and one in the first metatarsal. The external fixator was removed months after surgery according to the clinical progression of the patient and radiological evidence of bone consolidation⁽⁵⁾ (Figures 2 to 4).

RESULTS

The mean age of the patients was 36.5 years (range 20-53 years), with 50% (n=3) females and 50% (n=3) males. There was no predominance of laterality of the operated limb.



Figure 2. Preoperative clinical aspect of fixed equinus deformity. **Source:** Author's personal archive.

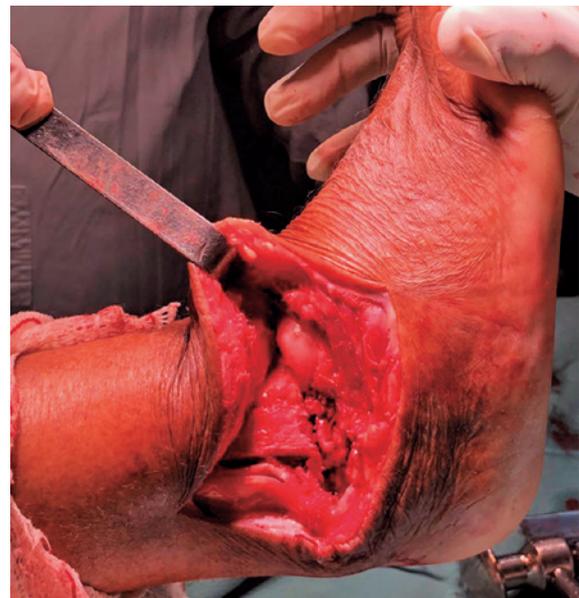


Figure 3. Intraoperative view of tibiocalcaneal arthrodesis after resection of the talus. **Source:** Author's personal archive.

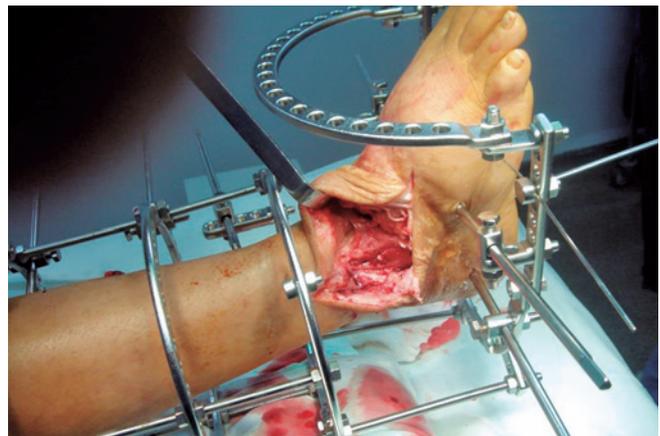


Figure 4. Final appearance of the external ring fixator assembly during the arthrodesis. **Source:** Author's personal archive.

The results of the AOFAS questionnaire are shown in table 1. The pain domain showed the best mean score among the evaluated patients, reaching 26.7 points.

The results of the quality of life evaluation are shown in table 2. The item on this questionnaire with the best mean score was also pain, with 57.2 points.

In the postoperative period, it was observed that the foot of some of the participants had a right angle with plantigrade support (Figure 5).

DISCUSSION

Treatment with the Ilizarov method is indicated for fixed and severe deformities, unfavorable skin conditions, joint stiffness, excessive shortening and loss of protective foot sensitivity^(6,11). Some studies have shown good results in limbs treated with this method^(6,12), making it an alternative treatment for foot deformities⁽¹³⁾. Nevertheless, some studies show that this surgical technique is associated with problems, such as axial deviation and pin infections⁽¹⁴⁾.

Table 1. AOFAS Questionnaire*

Patient	Score obtained				
	Pain score	Functional aspects	Alignment	Total	Classification
A	20.0	17.0	5.0	42.0	Poor
B	20.0	26.0	10.0	56.0	Poor
C	20.0	12.0	0.0	32.0	Poor
D	40.0	30.0	10.0	80.0	Good
E	30.0	30.0	10.0	70.0	Fair
F	30.0	25.0	10.0	65.0	Poor
Mean	26.7	23.3	7.5	57.5	Poor

Source: Prepared by the author based on research data.

*American Orthopedic Foot and Ankle Society

Table 2. Assessment of Quality of Life (SF-36)

Patient	Aspects evaluated							
	Physical Functioning	Physical role	Pain	General health	Vitality	Social role	Emotional role	Mental health
A	40.0	25.0	51.0	57.0	75.0	62.5	0.0	44.0
B	50.0	0.0	51.0	47.0	20.0	37.5	0.0	24.0
C	15.0	0.0	31.0	25.0	20.0	12.5	0.0	16.0
D	70.0	60.0	70.0	70.0	75.0	70.0	80.0	80.0
E	75.0	65.0	70.0	70.0	60.0	60.0	70.0	70.0
F	60.0	65.0	70.0	8.0	60.0	75.0	70.0	80.0
Mean	51.7	35.8	57.2	46.2	51.7	52.9	36.7	52.3

Source: Prepared by the author based on research data.



Figure 5. Postoperative clinical aspect.

Source: Author's personal archive.

Leite et al.⁽¹⁵⁾ evaluated 12 patients undergoing tibiocalcaneal arthrodesis using the AOFAS scale and obtained a mean score of 72.5 points, with bone consolidation in 100% of cases, in addition to pain relief and patient satisfaction.

Another study, conducted by Pistorello et al.⁽³⁾ with seven patients diagnosed with severe equinovarus deformities and undergoing surgery with gradual and progressive joint distension using an external ring fixator, showed good results in 86% of the sample (n=6) and fair results in 14% (n=1) based on radiological criteria.

These data suggest that the surgical technique provided adequate alignment and allowed independent walking, a plantigrade stance, stable support, and adequate functional capacity⁽³⁾.

In turn, the study by Ferreira et al.⁽¹³⁾ examined 16 patients with severe fixed foot deformities undergoing correction using the distraction osteogenesis technique based on the principles of Ilizarov and found satisfactory appearance of the feet, which were painless, plantigrade and fixed in 12 patients; however, the degrees of adduction and residual varus were variable.

When evaluating patients with fixed equinus deformities treated with open Lambrinudi arthrodesis, Muniz Filho et al.⁽¹⁶⁾ applied the AOFAS questionnaire in the postoperative period and obtained an average score of 61.71 (ranging from 41 to 74 points). These results were considered satisfactory because there was improvement in walking and pain and because of the degree of correction of the equinus deformity.

Although these studies show that treatment of equinus foot deformity with arthrodesis is a viable alternative and improves limb function, in the present study, the clinical evaluation obtained by applying the AOFAS questionnaire showed that 66.6% of the sample (n=4) had a poor rating (score below 70) after undergoing surgical treatment using the Ilizarov method.

Regarding the SF-36 questionnaire, low mean scores (less than 60) were observed in all aspects evaluated, with the physical role functioning domain presenting the lowest mean score. The mean score for the bodily pain domain (mean=57.2) was higher, followed by social role function-

ing (mean=52.9), mental health (mean=52.3), vitality (mean=51.7), physical functioning (mean=51.7), general health perceptions (mean=46.2), emotional role functioning (mean=36.7) and physical role functioning (mean=35.8).

The study by Reitenbach et al.⁽¹⁴⁾ included 43 patients with 20 lower limbs treated with an Ilizarov fixator and found that the patients reported better quality of life compared to patients who underwent a different treatment (with the Taylor Spatial Frame[®] hexapod); in particular, significant differences were observed in physical and social domains. These data contrast with the results of the present study, which showed that the patients' quality of life was impaired even after surgery.

Data from the literature are scarce regarding the assessment of the postoperative quality of life of patients with a fixed equinus deformity diagnosis, which made comparison with more studies difficult.

There are limitations regarding the sample size. The could have been evaluated preoperatively using the same questionnaires to compare the results and evaluate the degree of improvement after surgery. Nevertheless, it was possible to observe that the pain parameter obtained better results than the other parameters.

CONCLUSION

Arthrodesis using the Ilizarov method may be considered an option for the treatment of fixed and severe foot deformities, although patients diagnosed with fixed equinus foot deformity experience impaired function and quality of life even after undergoing corrective surgery. The pain domain obtained the best score, with a mean of 57.2 points on the AOFAS.

It is believed that the present study, despite its limitations, contributes to the current scientific data. The need for further research on the assessment of the quality of life and limb function of patients with fixed equinus deformity undergoing treatment using the Ilizarov method is noteworthy.

In addition, the importance of the preoperative evaluation is emphasized as it allows the physician to assess the improvement of the affected limb after surgical correction.

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