

# Hallux rigidus: evaluation of the postoperative outcomes of cheilectomy combined with modified Lelièvre resection arthroplasty

Hálux rígido: avaliação dos resultados pós-operatórios de queilectomia associada à artroplastia de ressecção de Lelièvre modificada

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## ABSTRACT

**Objective:** This study evaluated the postoperative outcomes of patients with hallux rigidus who underwent cheilectomy combined with modified Lelièvre resection arthroplasty.

**Methods:** This retrospective cross-sectional study applied the adapted *American Orthopedic Foot and Ankle Society* (AOFAS) forefoot questionnaire. A total of 28 patients (31 feet with hallux rigidus) were evaluated and treated following the same clinical and surgical protocol between February 2010 and June 2018. We evaluated pain, footwear use, sports activity, surgical complications, and the AOFAS score before and after surgery.

**Results:** All patients who underwent surgery showed improved AOFAS scores and reduced pain with satisfactory functional performance.

**Conclusion:** The use of cheilectomy combined with modified Lelièvre resection arthroplasty was effective, especially with regard to maintaining foot function, significantly improving pain and gait performance, and providing the possibility of wearing ordinary footwear, thereby increasing patient quality of life. This result was consistent with the extant literature on the topic.

**Level of Evidence IV; Therapeutic Study; Case Series.**

**Keywords:** Hallux rigidus; Hallux limitus; Osteoarthritis.

## RESUMO

**Objetivo:** Avaliar o resultado pós-operatório de pacientes com hálux rígido submetidos à queilectomia associada à artroplastia de ressecção de Lelièvre modificada.

**Métodos:** Estudo transversal retrospectivo com base na aplicação do questionário de antepé da *American Orthopaedic Foot and Ankle Society* (AOFAS) adaptado. Foram avaliados 28 pacientes, 31 pés com diagnóstico de hálux rígido e tratados com o mesmo protocolo clínico e cirúrgico no período de fevereiro de 2010 até junho de 2018. Avaliamos a dor, uso de calçados, atividades esportivas, complicações cirúrgicas e o escore AOFAS, antes e depois do ato cirúrgico.

**Resultados:** Todos os pacientes operados obtiveram melhora do escore AOFAS e também apresentaram melhora do quadro álgico com bom desempenho funcional.

**Conclusão:** O uso da técnica da queilectomia, associada à artroplastia de ressecção de Lelièvre modificada mostrou-se bastante eficaz, principalmente, quanto à manutenção da função do pé e melhora importante do quadro álgico, evolução da performance de marcha e possibilidade do uso de calçados comuns, proporcionando, desta forma, evidente ganho de qualidade de vida dos pacientes, resultados condizentes com os da literatura.

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

**Descritores:** Hallux rigidus; Hallux limitus; Osteoartrite.

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## INTRODUCTION

Hallux rigidus is a progressive, painful, and degenerative condition of the articular cartilage associated with the presence of osteophytes and functional limitations<sup>(1,2)</sup>.

The factors related to the development of hallux rigidus include trauma, hypermobility of the first ray, metatarsus primus elevatus, family history of hallux rigidus, club foot, flat feet, hallux valgus, and hallux valgus interphalangeus. A cohort study conducted in 1952 concluded that only 12-14% of hallux rigidus cases are associated with a traumatic event<sup>(2)</sup>. Nevertheless, trauma is currently the major cause of the disease reported in the literature. In our experience, trauma is more associated with hallux rigidus among men, whereas the use of high heels is more associated with the condition in women<sup>(2)</sup>.

Regarding its clinical picture, patients with hallux rigidus can experience pain; swelling; a decreased range of motion (normal range: 35° plantar flexion, 75° dorsiflexion, with a total range of motion of 110°); difficulty running, crouching, or jumping; and pain while wearing high heels<sup>(3)</sup>. In addition, patients can present with an unsightly dorsal deformity<sup>(3)</sup>.

The diagnosis of the disease is based on a clinical evaluation and can be confirmed by anterior-posterior and lateral radiographs of the foot with weight bearing. These radiographs enable the visualization of the dorsal osteophytes in the head of the first metatarsal and the dorsal region of the base of the proximal phalanx of the hallux, a decrease of the joint cleft, and deformities of the metatarsal head and geodes<sup>(4)</sup>.

The disease is classified in grades ranging from 0 to 4 using the scale developed by Coughlin, where larger numbers indicated increasing severity (Table 1). This classification considers radiographic changes, patient pain, and the range of motion of the metatarsophalangeal joint of the hallux.

Most of the current literature focuses on issues related to hallux rigidus surgery. Grady and Axe evaluated 772 patients and compared a surgical and nonsurgical approaches;

they found that only 55% of patients who were treated conservatively reported symptom improvement<sup>(5)</sup>. Thus, the need for surgery to increase success rates was demonstrated.

Among the range of conservative treatment options, one should not forget basic measures such as changes in the use of footwear, giving preference to shoes with rigid soles to reduce the range of motion of the metatarsophalangeal joint and consequently decrease dorsal impact and pain. Physical therapy should be performed to improve the range of movement and for muscle re-education, and stretching exercises, the use of ice, and resting the limbs should be employed when inflammation is exacerbated. Drug therapies are used with high frequency. NSAIDs and (when indicated) intra-articular corticosteroid injections are the most common drug therapies used<sup>(6)</sup>.

Patients with more severe pain who are refractory to conservative treatment are candidates for surgery. Of the surgical options, there are two major categories: those that preserve joint movement and those that do not.

Consensus does not exist in the literature regarding the superiority of one technique over another; a wide variety of options are available, and few studies have been conducted with large sample sizes and high levels of evidence. The techniques that preserve joint movement include cheilectomy (oblique distal osteotomy with the removal of 30-50% of the articular surface of the metatarsal) with or without the Moberg technique (a dorsal closing wedge osteotomy of the base of the proximal phalanx to modify the axis of the articular surface of the hallux), isolated phalanx osteotomy, isolated first metatarsal osteotomy, arthroscopic cheilectomy, metatarsophalangeal arthroplasty, interposition arthroplasty, and resection arthroplasty<sup>(7)</sup>.

Of the surgeries that do not preserve joint movement, which are preferentially applied in more severe cases, metatarsophalangeal joint arthrodesis is most discussed in the literature<sup>(7)</sup>.

**Table 1.** Coughlin classification for hallux rigidus

Grade	Radiography	Pain	Movement of the metatarsophalangeal joint
<b>0</b>	Normal	None	Rigidity or small loss
<b>I</b>	Slight narrowing of the MTP joint	Intermittent	Mild restriction
<b>II</b>	Moderate narrowing of the joint space, formation of osteophytes	More constant	Moderate restriction
<b>III</b>	Severe narrowing of the joint space, extensive osteophyte formation	Constant (no pain during the movement of the metatarsophalangeal joint)	Moderately severe restriction (<20° of range of motion)
<b>IV</b>	Same as grade 3	Pain during passive movement of the metatarsophalangeal joint	Same as grade 3

Source: Canale, 2007<sup>(1)</sup>.

In 2011, a literature review was conducted on the level of evidence of the studies on hallux rigidus and its treatment. A total of 135 articles indexed in PubMed were analyzed; the review concluded that no established superiority exists among the techniques because of the lack of studies with quality scientific evidence. Of the techniques analyzed, however, the application of metatarsophalangeal joint arthrodesis was best supported by the evidence<sup>(8-10)</sup>, despite the inconvenience of not preserving movement.

The metatarsophalangeal joint arthrodesis of the hallux is the optimal surgery for patients with severe foot deformities such as rheumatoid arthritis. In these cases, the loss of hallux movement is well accepted by patients, including women. In the case of hallux rigidus, loss of movement and pain are the most prominent complaints (not the deformity); thus, we avoid arthrodesis as much as possible in these patients and seek a solution to reduce pain and maintain a functional range of motion, even in cases of grade III disease. Thus, we selected cheilectomy and the conservative resection of the base of the proximal phalanx without any interposition of tissue or synthetic material.

## METHODS

The Ethics Committee approved this study, which was registered on the Brazil Platform under CAAE number 08303419.9.0000.5551.

This cross-sectional retrospective study administered the *American Orthopedic Foot and Ankle Society (AOFAS)* questionnaire (Table 2)<sup>(8,11-13)</sup> to 28 patients diagnosed with hallux rigidus, classified as grade II or III, treated at the Orthopedics/Surgery Outpatient Clinic between February 2010 and November 2018. All patients were treated following the same protocol (i.e., clinical diagnosis; simple X-ray of the foot in the anteroposterior, profile, and oblique views; classification of the grade of the disease; use of footwear with rigid soles; use of nonhormonal anti-inflammatory agent (when a contraindication was not present); and instruction to lose weight and not spend long periods standing and/or walking). Patients who were athletes were instructed to avoid running because this activity is a precipitating factor of symptoms. Patients who did not show improvement after 3 months underwent surgery and were included in this study.

The exclusion criteria were hallux valgus, undergoing more than one procedure to correct the deformity or other structural pathologies that might explain the symptoms, rheumatologic disease, diabetes mellitus, fracture sequelae,

**Table 2.** AOFAS score for the metatarsophalangeal joint of the hallux

PAIN: 40 points	
None	40 points
Mild, occasional	30 points
Moderate, daily	20 points
Severe, always present	0 points
FUNCTION: 45 points	
A. Activity	
No limitation, without support	15 points
Limitation of recreational activities, does not use cane	7 points
Limitation of recreational activities, uses cane	4 points
Severe limitation, uses walker or crutches	0 points
B. Footwear	
Conventional, no insert	5 points
Comfortable with insert	3 points
Modified or brace	0 points
C. Movement of the metatarsophalangeal joint	
Normal or little restriction ( $\geq 75^\circ$ )	10 points
Moderate restriction (30-74°)	5 points
Severe restriction ( $< 30^\circ$ )	0 points
D. Movement of the interphalangeal joint (plantar flexion)	
No restriction	5 points
Severe restriction	0 points
E. Stability of the metatarsophalangeal joint	
Stable	5 points
Unstable	0 points
F. Metatarsophalangeal callus	
Absent or present and asymptomatic	5 points
Present and symptomatic	0 points
ALIGNMENT: 15 points	
Good, hallux well aligned	15 points
Fair, some degree of malalignment, asymptomatic	8 points
Poor, severe malalignment, symptomatic	0 points
<b>Total</b>	<b>100 points</b>

Source: Fonseca, 2001<sup>(8)</sup>.

undergoing metatarsophalangeal joint arthrodesis of the hallux, and loss to follow up.

Cheilectomy combined with modified Lelièvre resection arthroplasty was performed. The patients received spinal anesthesia in lateral decubitus with a pillow under the contralateral gluteal region and a tourniquet on the upper thigh. Then, a medial (extensor hallucis longus) dorsal paratendon incision measuring approximately 4.5cm was made to the metatarsophalangeal region of the hallux; the tendon sheath and the dorsal digital nerve of the hallux were preserved (Figure 1). An additional longi-

tudinal incision was made to the articular capsule with a wide synovectomy, the excision of medial and lateral bony excrescence from the metatarsal head, and a cheilectomy with the resection of approximately 30-50% of the articular surface of the metatarsal (Figure 2).

After this process, we performed a conservative resection of the base of the proximal phalanx of the hallux (on its neck), with an incision perpendicular to the long axis of the phalanx; the flexor hallucis longus muscle was protected by carefully positioning the elevators. We cauterized the bloody surfaces, placed a 3.0-anchor in the central and dorsal positions of the metatarsal head for proper tensioning of the articular capsule to avoid flutter toe as well as valgus, varus, or rotational deformities of the toe, which are com-

lications commonly associated with the original Lelièvre technique that hinder the final outcome.

Finally, closure was performed by tensioning the articular capsule with the hallux in mild distraction and plantar flexion with neutral rotation, and an anchor was used for a satisfactory outcome. Next, we carefully closed the planes to ensure the correct anatomical position of the flexor hallucis longus (Figure 3).

The patients were discharged on the day of surgery or the following day, and dressings were replaced on the second or third postoperative day. Patients were instructed to initiate passive flexion-extension as much as their pain allowed and use a walking boot until their stitches were removed on day 21.



**Figure 1.** Skin incision dorsal to the metatarsophalangeal joint  
**Source:** Author's personal archive.



**Figure 2.** Cheilectomy combined with the resection of the base of the proximal phalanx.  
**Source:** Author's personal archive.

After the third week, the patients were instructed to wear wide footwear with thick soles and walk short distances as much as their pain allowed. Progressively, we advised the use of comfortable footwear until they were able to wear their preferred footwear, which occurred in 90 days on average.

The same surgeon operated on all patients.

## RESULTS

A total of 31 feet were assessed across 28 patients undergoing surgery, and the AOFAS scale was applied preoperatively, immediately after, and 3 months after surgery. Improvement on the AOFAS score occurred for all patients



**Figure 3.** Closing of the capsule suture site and the proper positioning of the extensor hallucis longus tendon.

**Source:** Author's personal archive.

regarding the metatarsophalangeal joint; the mean age of the patients was 58.8 years (range, 40-74), the minimum follow-up time was 1.5 years, and the maximum follow-up time was 9 years (mean, 4.46 years; Table 3).

All surgical cases were classified as grade II (64.2%) or III (35.8%) using the Coughlin and Shurnas categories. The disease was predominantly identified in women (82%).

Regarding mobility, on average, the patients had 4° of hallux metatarsophalangeal joint extension before surgery (0-10° range). After surgery, it increased to 75-90° while still under anesthesia. Three months after the procedure, a new measurement was taken, and the patients exhibited 52° of extension on average.

Of the 28 patients who underwent surgery, only two complained of pain 3 months after the procedure; however, both patients reported a 60-70% decrease in their initial pain. All patients were asked about their sports activities after surgery, and 18 confirmed that they had been walking, three had been cycling, and one had been jogging; nine had not performed any type of physical activity.

Regarding complications, two cases of surface wound dehiscence were observed, which were fully resolved after multiple dressing changes and oral antibiotic therapy. Two patients had a mild valgus deformity of the hallux, without joint instability, although one reported valgus symptoms (nondebilitating pain in the medial side of the head of the hallux).

The mean preoperative AOFAS score was 50 (47-52), and the mean postoperative score was 93 (78-95).

## DISCUSSION

Hallux rigidus is frequent in foot and ankle outpatient clinics. This disease is debilitating and often affects women who are no longer able to use ordinary women's footwear.

McNeil reviewed the literature in 2013 by analyzing 135 articles indexed in PubMed and comparing the level of evidence of the studies with the results presented by the studies. We observed that the results of the postoperative AOFAS score in the case of resection arthroplasties showed an average of 88 points, and patient satisfaction showed an average of 73%<sup>(6)</sup>. Compared with the results of the present study, we found a similar result: The mean preoperative AOFAS score of 50 improved to a mean postoperative AOFAS score of 93.

We believe that is important not only to reduce pain but also to regain hallux movement, thereby allowing patients to perform their daily activities with the least number

**Table 3.** Outcomes

	Sex	Age today	Side	Grade	Preoperative MTP extension (degrees)	Postoperative MTP extension (degrees)	MTP extension 3 months after surgery	Physical activity performed	Preoperative pain level	Postoperative pain level	Complications	Date of surgery	Preoperative AOFAS score	Postoperative AOFAS score
1	F	63	R	II	0	55	50	Walking	Severe pain	No pain	None	02/09/2010	52	95
2	M	47	L	II	10	60	55	Walking	Severe pain	No pain	None	02/18/2010	47	95
3	F	67	L	II	5	60	50	Walking	Severe pain	No pain	None	03/28/2011	52	95
4	F	87	R	III	0	50	50	Walking	Severe pain	No pain	None	03/30/2011	52	95
5	F	63	R	II	5	60	55	Walking	Severe pain	No pain	Surgical wound dehiscence	10/21/2011	52	95
6	M	63	L	II	5	65	55	Walking/cycling	Severe pain	No pain	None	01/13/2014	47	95
7	F	48	R	III	0	50	50	Walking	Severe pain	No pain	None	07/01/2014	52	95
8	F	57	R	II	10	65	55	Walking	Severe pain	No pain	None	08/25/2014	52	95
9	F	64	R	III	0	55	55	Walking	Severe pain	No pain	Surgical wound dehiscence	11/17/2014	52	95
10	F	62	L	III	0	55	50	Walking	Severe pain	No pain	None	11/12/2013	52	95
11	F	57	L	III	0	50	50	Walking	Severe pain	No pain	None	04/03/2014	52	95
12	F	68	R	II	5	65	55	Normal	Severe pain	No pain	None	10/16/2014	52	95
13	F	69	L	III	0	60	55	Normal	Severe pain	No pain	None	08/15/2013	52	95
14	F	50	L	II	10	65	60	Walking/cycling	Severe pain	No pain	None	08/10/2015	52	95
15	F	49	L	II	10	65	55	Walking	Severe pain	70% reduction in pain	None	12/13/2016	52	85
16	F	60	R	III	0	55	50	Does not perform physical activity	Severe pain	No pain	None	04/14/2015	52	95
17	F	51	R/L	III	0 (R)/0 (L)	50 (R)/55 (L)	1	Does not perform physical activity	Severe pain	No pain	None	06/23/2015	52 (R)/52 (L)	95 (R)/95 (L)
18	M	57	R/L	III	0 (R)/0 (L)	50 (R)/50 (L)	50	Walking	Severe pain	No pain	Left foot with mild asymptomatic valgus of hallux	11/30/2016	47 (R)/47 (L)	88 (R)/78 (L)
19	F	67	L	II	15	60	60	Jogging	Severe pain	No pain	None	01/11/2016	52	95
20	F	41	L	II	10	60	60	Does not perform physical activity	Severe pain	No pain	None	01/12/2016	52	95
21	M	57	L	II	10	60	60	Cycling	Severe pain	No pain	None	02/01/2016	47	95
22	F	60	L	II	10	60	60	Walking	Severe pain	No pain	Persistent edema	01/02/2017	52	95
23	F	79	L	III	0	50	50	Does not perform physical activity	Severe pain	No pain	None	01/09/2017	52	95
24	F	49	L	II	12	60	60	Walking	Severe pain	No pain	None	04/19/2017	52	95
25	F	74	R	II	10	60	55	Does not perform physical activity	Severe pain	No pain	None	07/05/2017	52	95
26	F	41	R	II	10	60	60	Walking	Severe pain	No pain	None	09/27/2017	52	95
27	F	40	R	II	10	60	55	Walking	Severe pain	No pain	None	09/28/2017	52	95
28	M	57	R/L	II	10 (R)/10 (L)	60 (R)/60 (L)	60	Does not perform physical activity	Severe pain	60% reduction in pain	Valgus and pronation of R hallux	02/08/2017	47 (R)/47 (L)	88 (R)/78 (L)

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

of limitations. We observed that many of our patients wore footwear without any modifications and that it was possible for women to wear moderate-height heels after the procedure.

The late postoperative radiographs (after 2 years) revealed the frequent presence of periarticular bone reactions, which in no way interfered with the results because there were no reports of loss of movement or the onset of pain. The most dreaded complications of the resection of the base of the hallux proximal phalange are flutter toe and hallux extensus<sup>8</sup>; however, we did not record any such complications, and we attributed this success to the use of

the anchor that allowed proper capsular fixation with tensioning of the hallux in mild distraction and plantar flexion as well as to providing thorough care to the soft tissues.

## CONCLUSIONS

The use of cheilectomy combined with modified Lelièvre resection arthroplasty was effective, especially for maintaining foot function, significantly reducing pain, improving gait performance, and providing the possibility of using ordinary footwear, thereby increasing the quality of life of patients.

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