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Occupational Rhizarthrosis Treated Surgically: Effects on Work Performance

Rui Ribeiro[1,*], Salomé Moreira[1], Vanessa Teófilo[1], Sofia Pinelas[1], Mariana Miller[1], Paulo Pinho[1], Pedro Norton[1], Nelson Amorim[2], Francisco Serdoura[2], Vítor Vidinha[2]

[1]Occupational Health Service of Porto Hospital and University Center, Porto, Portugal
[2]Orthopedics and Traumatology Service of Porto Hospital and University Center, Porto, Portugal

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Abstract

Background: *Osteoarthritis of the trapeziometacarpal joint (rhizarthrosis) is one of the most frequent causes of hand dysfunction. Its significant impact on daily activities and work tasks is evident. This clinical condition is more commonly associated with older age, predominantly affects females, and is often linked to repetitive movements and heavy manual labor. Therefore, it is crucial to focus on the prevention and early intervention of this pathology to minimize its impact not only on worker's health but also on their professional performance. This article aims to critically examine the association between rhizarthrosis, namely the pain with these conditions and its influence on work capacity.* **Methods:** *An epidemiological survey was conducted on active workers diagnosed with symptomatic rhizarthrosis who underwent surgical treatment. Data collected included gender, age, dominant hand, labor intensity scale, radiological classification of rhizarthrosis, patient-reported pain classification, and work capacity before and after surgical intervention.* **Results:** *In this study, there was a higher prevalence among females and older individuals. More advanced radiological classifications of rhizarthrosis did not correlate with more advanced pain classifications; however, statistically significant differences were found in higher work disability. Jobs requiring higher labor intensity and greater hand use were significantly associated with higher pain levels, increased work disability, and elevated radiological classifications of rhizarthrosis according to the Eaton and Littler scale.* **Conclusions:** *Patients with rhizarthrosis surgically treated showed a statistically significant reduction in reported pain on the analog scale, as well as greater work capacity after surgical intervention, thus contributing to better professional performance.*

1. Introduction

Trapeziometacarpal joint osteoarthritis, commonly known as rhizarthrosis, is one of the most prevalent, painful, and disabling forms of hand osteoarthritis [1-6]. However, not all patients seek medical care for diagnosis and treatment, especially in the milder forms of the disease [2, 7]. Studies indicate that the symptoms experienced by patients and limitations in joint movement of the hand do not directly correlate with the radiographic severity observed. Therefore, clinical evaluation and objective examination are crucial for monitoring and treating this pathology [2, 8-10].

In the current occupational context, rhizarthrosis has emerged as a significant concern. It is frequently

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*Corresponding Author: Rui Ribeiro; E-mail: rui.mendes.ribeiro@chsj.min-saude.pt

associated with aging, repetitive movements, heavy manual labor, and inadequate postures during professional activities [3, 11, 12]. This condition can lead to a loss of hand functionality and substantial worker discomfort, thereby compromising their work capacity and increasing costs related to reduced productivity [3, 12-14].

Given the rising ergonomic, biomechanical, and psychosocial demands in today's workplaces, it is imperative to understand the potential consequences of rhizarthrosis in occupational settings [3, 15]. The existing literature emphasizes the importance of prevention and early intervention to mitigate the impact of this condition, aiming not only on the worker's health but also at the effectiveness and efficiency within the work environment [1, 11, 12, 14, 15].

Treatment begins with conservative approaches, including temporary rest or immobilization of the affected thumb using orthoses, therapy with nonsteroidal anti-inflammatory drugs (NSAIDs) or intra-articular corticosteroid injections, strengthening and range-of-motion exercises, patient education on symptom control techniques, provision of a home exercise program, and physical or occupational rehabilitation [1, 4, 14, 16-19]. Conservative treatment is described in the literature as a practical first-line approach for thumb basal joint arthritis, demonstrating significant improvements in pain reduction, increased strength, and pinch capacity without notable differences compared to pharmacological therapy or joint immobilization with orthoses [14, 16, 18]. Physical rehabilitation, including physiotherapy, has also proven effective in treating this condition, either as a standalone therapy or as an adjunct to pharmacological or more invasive treatments [14, 18]. The application of unilateral passive accessory mobilization targeting the symptomatic thumb carpometacarpal joint induced an increase in pressure pain thresholds, though with limited clinical value [20]. Another option described in the literature is the neurodynamic mobilization of the median nerve in patients with secondary thumb carpometacarpal osteoarthritis, which has shown decreased pain and increased grip strength in the affected thumb [21].

In cases resistant to these methods, surgical intervention should be considered. Surgical options include techniques such as arthrodesis, trapeziometacarpal joint arthroplasty with or without implants, trapeziectomy with or without tendon interposition, or stabilization ligamentoplasty [1, 4, 14, 22].

The efficacy of surgical intervention for trapeziometacarpal joint osteoarthritis is well-documented in various literature reviews, providing significant evidence of its impact on pain reduction and long-term functional capacity improvement [1, 4, 5, 9, 23].

In summary, understanding rhizarthrosis within the occupational context is essential not only for the physical health and well-being of patients but also for optimizing professional performance and fostering healthier and more productive work environments [12, 15].

This article aims to advance knowledge in this area and promote more effective practices in managing this clinical condition. The study will consider demographic factors such as sex and age, along with preoperative determinants, including the disease's radiographic stage, the patient's dominant hand, the intensity of hand use in their occupation, reported pain levels, and work capacity. Additionally, the study evaluates postoperative determinants, specifically the degree of pain relief and improvement in work capacity, aiming to implement effective strategies for prevention and intervention in this clinical condition. Thus, we intend to determine whether the surgical intervention is beneficial for recovering the patient's functionality, particularly regarding work capacity.

2. Methods

2.1. Sample Description

This study is a prospective, cross-sectional observational study with intervention, conducted through the epidemiological survey of active workers diagnosed with rhizarthrosis who, after the failure of conservative treatment, underwent surgical treatment at a Portuguese tertiary hospital from January 1, 2017, to December 31, 2022. The following inclusion criteria were also considered: a primary diagnosis of rhizarthrosis; patients who underwent surgery after failure of conservative treatment; at least 15 years

of continuous work activity before surgery and 6 months of work activity to assess the degree of recovery.

Additionally, the following exclusion criteria were applied: patients who were retired at the time of surgical intervention; workers with fewer than 15 years of continuous employment prior to the surgical intervention; patients with secondary causes of rhizarthrosis, such as rheumatoid arthritis or trauma; and patients with other comorbidities affecting the joints, like systemic arthritis or hyperuricemia.

2.2. Variables

This analysis considers demographic factors such as sex and age. Additionally, it evaluates preoperative determinants, including the radiographic stage of the disease, the patient's dominant hand, the intensity of hand use in their profession, reported pain levels, and work capacity. The postoperative determinants analyzed include the degree of pain recovery and the improvement in work capacity.

2.3. Data Collection

Data were extracted from the clinical database records maintained by the Orthopedics Service of the institution under study and outlined in the flowchart (Figure 1), following ethics committee approval and informed patient consent. Participant anonymity was ensured.

The following data were collected: age and sex of the affected patients, date of intervention, professional category, workplace, and hand radiographs

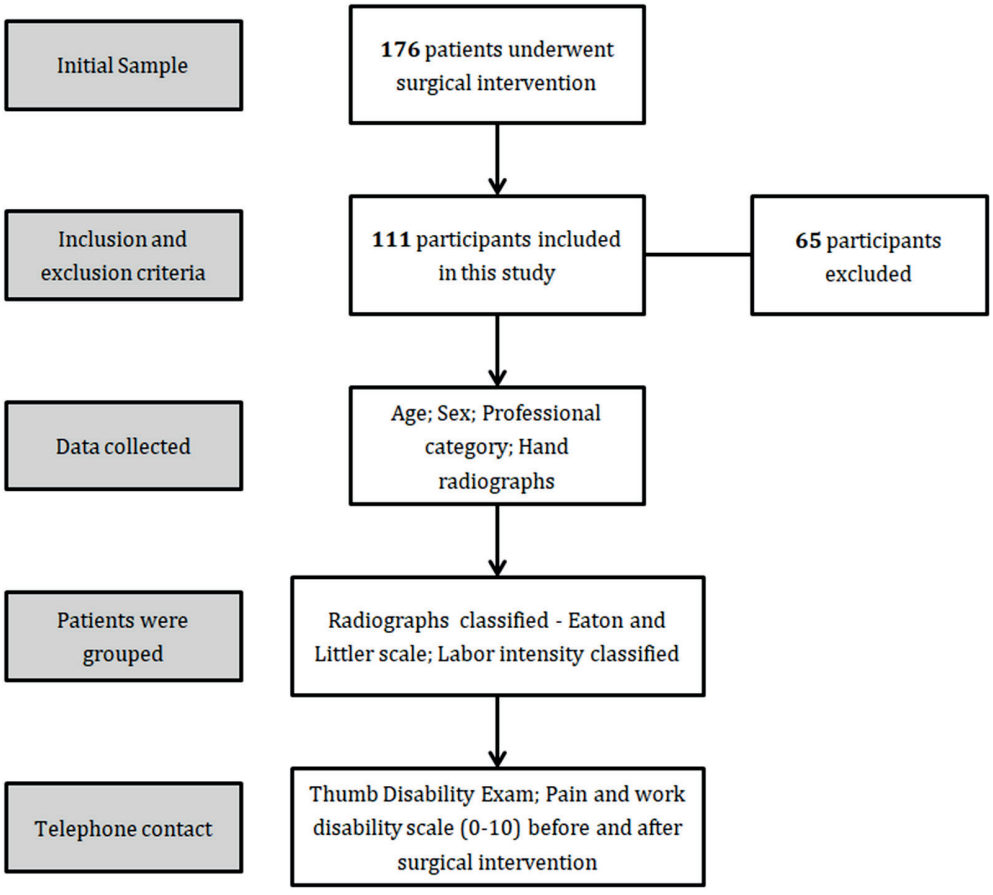

Figure 1. The flowchart represents the data collection scheme, patient selection, and subsequent analysis steps.

with a rhizarthrosis diagnosis classified according to the Eaton and Littler scale [24]. This classification describes four stages of osteoarthritis based on an X-ray of the trapeziometacarpal joint of the thumb, considering joint space narrowing, joint destruction, and the presence and size of osteophytes. Patients were subsequently grouped according to their profession on an analog scale (1-3) of labor intensity regarding hand use into the following three categories: light manual work (repetitive thumb movements <10 actions/minute), moderate manual work (repetitive thumb movements 10-20 actions/minute), and heavy manual work (repetitive thumb movements>20 actions/minute), adapted from the scale for risk assessment of repetitive tasks of the upper limbs (the ART tool) [2, 25].

Through telephone contact, the Thumb Disability Exam (TDX) scale [26, 28], which has been approved and translated into Portuguese [26], was utilized to classify the pain, work capacity impairment, and quality of life reported by the patient prior to surgical intervention. This scale evaluates the activities performed by the patient through 20 questions, scored from 1 to 5, organized into three sections that respectively assess function, pain level, and satisfaction with thumb mobility before surgery [26].

To objectively measure pain levels and work disability before and after surgical intervention, a numerical scale from 0 to 10 was utilized, where 0 indicates no pain or work disability, and 10 represents the maximum possible pain or total work disability [28, 29]. The degree of pain improvement and recovery of work capacity was subsequently assessed by comparing the averages obtained from the aforementioned scales before and after surgical intervention.

2.4. Statistical Analysis

Sample characterization and statistical analysis were conducted using SPSS version 27.0 – PASW (SPSS Inc., Chicago, IL, USA), along with descriptive statistics from this program. The Kolmogorov-Smirnov test assessed whether the variables followed a normal distribution. Numerical variables exhibiting a normal distribution are described using mean ± standard deviation (SD), while those without a normal distribution are represented by the median (range of values). For the analysis of normally distributed variables, the t-test for independent samples was applied. Conversely, the Mann-Whitney U test was utilized for analyzing non-normally distributed variables. Contingency tables and Chi-square tests were performed to examine relationships between relevant variables, and Spearman's correlation test was applied to assess the relationships among variables. A p-value of <0.05 was regarded as statistically significant for all tests conducted in this study.

3. Results

3.1. Demographic and Clinical Characteristics

The studied population comprised 176 patients who underwent surgical interventions for trapeziometacarpal joint osteoarthritis. After applying the inclusion and exclusion criteria, a total of 111 participants were included in this study. Detailed demographic and clinical characteristics are presented in Table 1. Among these patients, 99 were female (89.2%) and 12 were male (10.8%), with a mean age of 59.64 ± 6.58 years. It was noted that the dominant hand was affected in 92 patients (82.9%).

The average years of work experience in the study population was 24.55 ± 3.76 years. The profession most commonly impacted by the pathology was textile workers (18.0%), followed by administrative personnel (15.3%) and construction workers (12.6%).

The distribution of the radiographic stage, according to the Eaton and Littler classification, is also illustrated in Table 1, indicating that most participants were in grade IV with 52 cases (46.8%), followed by grade III with 31 cases (27.9%). Regarding the intensity of hand usage categorized by the patients' professional activities, as shown in Table 1, out of the total study population, 71 patients (64.0%) were engaged in occupations requiring heavy manual labor. Additionally, 15 patients (13.5%) participated in moderate manual labor, and 25 patients (22.5%) in light manual labor.

Table 1. Demographic and Clinical Characteristics of Patients Undergoing Surgical Treatment for Rhizarthrosis.

	Study Sample (n=111)	
Variable	**No. or mean ± SD**	**%**
Age (years)	59.64 ± 6.58	
Sex: *Female*	99	89.2%
Male	12	10.8%
Hand: *Dominant*	92	82.9%
Non-Dominant	19	17.1%
Years of actívity activity (years)	24.55 ± 3.76	
Work activity: *Textile workers*	20	18.0%
Administrative personnel	17	15.3%
Construction workers	14	12.6%
Automotive industry workers	10	9.0%
Footwear production workers	9	8.1%
Senior technicians	9	8.1%
Metalworker	7	6.3%
Canning industry workers	5	4.5%
Farmers	4	3.6%
Kitchen staff	4	3.6%
Cleaning staff	3	2.7%
Other activities	9	8.1%
Radiographic Classification – Eaton & Littler scale:		
Grade 1	6	5.5%
Grade 2	22	19.8%
Grade 3	31	27.9%
Grade 4	52	46.8%
Manual Work Intensity (1-3): *Light (<10 actions/min)*	25	22.5%
Moderate (10-20 actions/min)	15	13.5%
Heavy (>20 actions/min)	71	64.0%
TDX Classification (1 to 5)	4.10 ± 0.62	
Analog Pain Scale (0 to 10)	8.27 ± 1.29	
Work Disability (0 to 10)	8.23 ± 1.38	

3.2. Pre-Operative Determinants

Regarding the Eaton and Littler scale, radiographs classified as grade 3 or higher were associated with an older average age and a higher proportion of males, both statistically significant ($p<0.001$ and $p=0.002$, respectively). The dominance of the affected hand did not significantly influence on the more or less advanced stage of rhizarthrosis, according to the radiographic scale ($p=0.813$).

Moreover, higher manual work intensities ($p<0.001$) and greater work disability ($p=0.023$) were associated with Eaton and Littler scores of 3 or higher. Conversely, TDX classification ($p=0.082$) and analog pain scale scores ($p=0.104$) did not show statistically significant differences, as detailed in Table 2.

When evaluating the intensity of manual work performed by the patients, it was found that heavy manual work was predominantly associated with male patients ($p=0.007$), higher Eaton and Littler scores ($p<0.001$), higher TDX classifications ($p=0.034$), higher analog pain scale scores ($p=0.033$), and lower work capacity ($p<0.001$). All these differences were statistically significant, as detailed in Table 3. In contrast, age and dominant hand status were not statistically significant concerning the type of manual work intensity ($p=0.356$ and $p=0.538$, respectively).

Table 2. Clinical Characteristics and Radiographic Classification: Comparison between Eaton and Littler grades below and above 3.

Variable	Total Sample (n= 111)	Eaton and Littler Scale <3 (n=28)	Eaton and Littler Scale ≥3 (n=83)	p-value
Age (years)	59.64 ± 6.58	55.46 ± 5.48	61.05 ± 6.34	<0.001
Female (n)	99	28	71	0.002
Dominant hand (n)	92	24	68	0.813
Manual Work Intensity	2.41 ± 0.83	1.11 ± 0.32	2.86 ± 0.35	<0.001
TDX Classification	4.10 ± 0.62	3.92 ± 0.44	4.16 ± 0.66	0.082
Analog Pain Scale	8.27 ± 1.29	7.93 ± 0.86	8.39 ± 1.39	0.104
Work Disability	8.23 ± 1.38	7.71 ± 1.63	8.40 ± 1.25	0.023

Table 3. Clinical Characteristics and comparison between light or moderate and heavy manual work intensity

Variable	Total Sample (n= 111)	Light or Moderate Work Intensity (n=40)	Heavy Work Intensity (n=71)	p-value
Age (years)	59.64 ± 6.58	57.48 ± 6.36	57.86 ± 6.43	0.356
Female (n)	99	40	59	0.007
Dominant hand (n)	92	31	61	0.538
Eaton and Littler Scale	3.16 ± 0.93	2.17 ± 0.71	3.72 ± 0,45	<0.001
TDX Classification	4.10 ± 0.62	3.93 ± 0.44	4.19 ± 0.69	0.034
Analog Pain Scale	8.27 ± 1.29	7.93 ± 0.86	8.46 ± 1.44	0.033
Work Disability	8.23 ± 1.38	7.45 ± 1.65	8.66 ± 0.97	<0.001

3.3. Post-Operative Determinants

All patients in the sample initially received conservative treatment, which included pharmacological therapy. In 72 cases, rehabilitation therapy (physiotherapy) was also attempted. After the failure of conservative treatment, surgical intervention was recommended for these patients. The main surgical techniques performed on the observed patients included arthrodesis, arthroplasty, and trapeziectomy with tendon interposition, revealing no significant differences in surgical outcomes or results. Analysis of the analog pain scale before and after surgery showed a statistically significant decrease ($p<0.001$), as did work disability ($p<0.001$), with reported values being significantly lower compared to the preoperative work disability levels. This information is detailed in Table 4.

Table 4. Work Intensity and Pain Classification: Comparison before and after surgical intervention

Variable	Pre-Surgery Classification	Post-Surgery Classification	p-value
Analog Pain Scale	8,27 ± 1,29	2,87 ± 1,75	<0.001
Work Disability	8,23 ± 1,38	2,34 ± 1,39	<0.001

It should also be noted that data were collected six months after the total return to work to assess pain recovery and work capacity, as described in the methods. Additionally, it is essential to highlight that two patients reported post-surgical complications; however, they also showed significant improvements in pain recovery scores and work capacity during data collection.

4. Discussion

Given that trapeziometacarpal osteoarthritis is one of the leading causes of functional disability in the thumb, it significantly impacts the ability to perform daily activities as well as work tasks [5, 6, 16]. In this study, a higher prevalence of female patients was observed, consistent with the literature, along with older participants, which correlated with more advanced stages of rhizarthrosis [31]. The occurrence of rhizarthrosis in the dominant hand did not demonstrate statistical significance; this could be explained by the bilateral nature of the disease in many cases, with no clear preference for one side. Moreover, many tasks are performed with both hands, contributing to the bilateral manifestation of the disease.

Higher Eaton and Littler scale classifications did not correlate with higher pain scales and TDX classification levels, which is expected and has been previously described in the literature [4]. Thus, there is no clear association between increased patient-reported pain and a more advanced stage of rhizarthrosis on the radiographic scale. This underscores the importance of quantifying pain when deciding to proceed with surgery rather than relying solely on the radiographic classification presented by the patient after conservative treatment has failed.

When evaluating the parameter of labor intensity, specifically jobs with more significant hand use—such as textile workers, construction workers, automotive industry workers, footwear production workers, and metalworkers—significant statistical differences were found. These included higher work disability and elevated Eaton and Littler classifications. Therefore, it can be concluded that the intensity and work disability experienced by the patient should also be considered when proposing surgical treatment for these workers to provide greater comfort and productivity after conservative treatment has failed.

This study also showed that older male employees typically engaged in jobs with more intense hand usage, which is expected considering that heavy manual labor, particularly among construction workers or in metallurgy, is predominantly performed by males. Moreover, it was statistically significant that changes in the dominant hand were unaffected by the worker's higher labor intensity. However, jobs with greater manual intensity were associated with higher Eaton and Littler radiological classifications, higher pain scales, TDX classifications, and increased work disability.

From these data, it can be inferred that evaluating a worker's work is significant when examining rhizarthrosis. More intense work was generally associated with a more significant impact on patient-reported pain and a stronger connection with reduced work capacity at the time of rhizarthrosis diagnosis.

Finally, it is essential to emphasize the significance of conservative treatment as the first approach for thumb basal joint arthritis, with high efficacy in improving pain, strength, and pinch capacity, as extensively described in the literature [14, 17, 18, 31]. Surgical intervention should be considered a practical approach in cases refractory to this first line of treatment. This was confirmed in the present study, highlighting the substantial improvement workers experienced in pain scores and work capacity after surgical intervention and full reintegration into the workplace. This demonstrates the therapeutic efficacy not only in reducing patient-reported pain, as described in other studies [23], but also in increasing the worker's capacity post-surgical treatment of rhizarthrosis, thereby enabling better professional performance. This is the main difference in this study article.

5. Conclusions

This study demonstrates that jobs requiring higher manual intensity are associated with greater pain and work disability in patients diagnosed with rhizarthrosis. Radiological classification did not correlate with pain but correlated with labor intensity. A key strength of the study is its emphasis on the importance of assessing work intensity as a determinant for surgical indication. This approach has proven beneficial in providing better pain control and increasing work capacity, suggesting that surgical intervention positively impacts the professional performance of workers following the failure of conservative treatment.

The main weakness and limitation of the study, considering future research, is that the evaluated cases were only those who received surgical indications during a hospital consultation after

conservative treatment failed, which likely introduces a bias towards cases with greater clinical severity and more advanced radiographic stages. Therefore, it is important for future research within primary healthcare to assess the recovery of work capacity using conservative treatments and to determine which of these treatments is most effective in improving work performance, either as a standalone treatment or as an adjunct to surgery.

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Institutional Review Board Statement: The study was conducted according to the guidelines of the Declaration of Helsinki, and approved by the Institutional Ethics Committee of Porto Hospital and University Center (protocol code CE-413/2023, approved on April 2024).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

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