

QUALITY OF LIFE ANALYSIS ON PATIENTS AFTER ARTHROPLASTY OR LUMBAR ARTHRODESIS

ANÁLISE DA QUALIDADE DE VIDA EM PACIENTES PÓS ARTROPLASTIA OU ARTRODESE LOMBAR

ANÁLISIS DE LA CALIDAD DE VIDA EN PACIENTES TRAS UNA ARTROPLASTIA O ARTRODESIS LUMBAR

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ABSTRACT

Objective: To perform a retrospective analysis of patients with degenerative disc disease of the lumbar spine undergoing arthrodesis or lumbar arthroplasty in terms of functional capacity and quality of life. **Methods:** Retrospective observational study analyzing the medical records of patients undergoing arthrodesis or lumbar arthroplasty, followed-up at an outpatient clinic from 2018 to 2020. Patient characteristics were evaluated; the quality of life through the results of the Short Form 36 Health Survey Questionnaire (SF-36) and the functional capacity using the Oswestry Disability Index (ODI) in the pre-surgical and post-surgical periods (6 months, 1 and 2 years). The criterion to establish statistical significance was $p \leq 0.05$. **Results:** Sixty-one patients were evaluated. After the surgical interventions, the individuals migrated from the classification of invalid (61.4%-64.6%) to minimal/moderate disability (17.7%-25.6%). There was a decline in ODI scores over time of follow-up ($p \leq 0.001$) as well as in SF-36 values ($p \leq 0.001$) for all surgical techniques. In this regard, evaluating the difference in means revealed the better performance of lumbar arthroplasty ($p \leq 0.001$). **Conclusion:** The data suggest that lumbar arthroplasty offers greater benefits to patients regarding functional capacity and quality of life. **Level of Evidence III; Retrospective, descriptive, observational study.**

Keywords: Low Back Pain; Chronic Pain; Quality of Life; Spinal Fusion; Arthroplasty, Replacement; Intervertebral Disc Degeneration.

RESUMO

Objetivo: Realizar uma análise retrospectiva de pacientes com doença degenerativa discal da coluna lombar submetidos à artrodese ou artroplastia lombar em termos de capacidade funcional e qualidade de vida. **Métodos:** Estudo observacional retrospectivo de análise de prontuários dos pacientes submetidos à artrodese ou artroplastia lombar, acompanhados ambulatorialmente no período de 2018 a 2020. Foram avaliadas as características dos pacientes; a qualidade de vida através dos resultados do Questionário Short Form 36 Health Survey Questionnaire (SF-36) e a capacidade funcional utilizando o Oswestry Disability Index (ODI) nos períodos pré-cirúrgico e pós-cirúrgico (06 meses, 01 ano e 02 anos). O critério para estabelecer significância estatística foi valores de $p \leq 0,05$. **Resultados:** Foram avaliados 61 pacientes. Após as intervenções cirúrgicas, os indivíduos migraram da classificação inválido (61,4%-64,6%) para incapacidade mínima/moderada (17,7%-25,6%). Houve declínio nos escores do ODI ao longo do tempo de acompanhamento ($p \leq 0,001$) assim como nos valores do SF-36 ($p \leq 0,001$) para todas as técnicas cirúrgicas. Nesse quesito, a avaliação da diferença de médias revelou melhor desempenho da artroplastia lombar ($p \leq 0,001$). **Conclusão:** Os dados sugerem que a artroplastia lombar oferece maior benefício para os pacientes em termos de capacidade funcional e de qualidade de vida. **Nível de Evidência III; Estudo retrospectivo, descritivo, observacional.**

Descritores: Dor lombar; Dor crônica; Qualidade de vida; Fusão vertebral; Artroplastia de substituição; Degeneração do disco intervertebral.

RESUMEN

Objetivo: Realizar un análisis retrospectivo de pacientes con enfermedad degenerativa del disco de la columna lumbar sometidos a artrodese o artroplastia lumbar en términos de capacidad funcional y calidad de vida. **Métodos:** Estudio observacional retrospectivo analizando las historias clínicas de pacientes sometidos a artrodese o artroplastia lumbar, seguidos en consulta externa desde 2018 hasta 2020. Se evaluaron las características de los pacientes; la calidad de vida a través de los resultados del Cuestionario de Encuesta de Salud Short Form 36 (SF-36) y la capacidad funcional utilizando el Oswestry Disability Index (ODI) en los periodos prequirúrgico y posquirúrgico (06 meses, 01 año y 02 años). El criterio para establecer la significación estadística fue $p \leq 0,05$. **Resultados:** Se evaluaron 61 pacientes. Después de las intervenciones quirúrgicas, los individuos migraron de la clasificación de inválidos (61,4%-64,6%) a invalidez mínima/moderada (17,7%-25,6%). Hubo una disminución en las puntuaciones del ODI a lo largo del tiempo de seguimiento ($p \leq 0,001$) así como en los valores del SF-36 ($p \leq 0,001$) para todas las técnicas quirúrgicas. En ese sentido, la evaluación de la diferencia de medias reveló un mejor desempeño de la artroplastia lumbar ($p \leq 0,001$). **Conclusión:** Los datos sugieren que la artroplastia lumbar ofrece mayor beneficio a los pacientes en términos de capacidad funcional y calidad de vida. **Nivel de Evidencia III; Estudio retrospectivo, descriptivo, observacional.**

Descriptores: Lombalgia; Dolor Crónico; Calidad de Vida; Fusión Vertebral; Artroplastia de Reemplazo; Degeneración del disco Intervertebral.

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INTRODUCTION

Low back pain (LBP) is a symptom of discomfort or pain located between the costal margin and the lower gluteal fold area and may or may not be associated with irradiation to the lower limb, which occurs in up to 60% of cases.^{1,2}

Studies show that low back pain is the most common occupational problem in the world, with an incidence of 139 per 100,000 people per year among the general population of the United States. Low back pain has an important socioeconomic impact. It is considered a major contributor to the premature retirement of workers, with a higher rate than Heart Disease, Diabetes Mellitus, Systemic Hypertension, Neoplasia, Respiratory Diseases, and Asthma.³⁻⁵ In Australia, the total cost of managing low back pain was estimated to be \$9 billion in 2001. In the Brazilian context, in SUS alone, the costs for treating low back pain exceed 4 million Reais annually, especially in the Southeast region.⁶⁻⁸ In the country, the prevalence of low back pain exceeds 50% of the adult population, and chronic cases represent 4.2% and 14.7% of the population. In addition, low back pain is the leading reason for leave from work.⁹

One of the main causes of low back pain in recent years is Lumbar Degenerative Disc Disease (DDD) which presents as a complaint of muscle tension or lumbar stiffness and has an overall prevalence of 84% in the population throughout life, affecting young and old individuals, being more common among people over 65 years of age and resulting in worsening quality of life.¹⁰⁻¹²

Initially, the treatment is conservative with bed rest for 2 to 3 days, physical exercise with the restoration of strength, and flexibility, postural education, physical therapy with strengthening and stretching of the paravertebral muscles, use of ultrasound, electrical stimulation, and massage. In pharmacological treatment, non-steroidal anti-inflammatory drugs (NSAIDs) are the first-line agents. Selective transforaminal steroid injections can produce symptomatic relief in many patients and are offered to those who have failed non-invasive measures but are not interested in or are not good candidates for surgical treatment; all are useful in short-term symptomatic relief of low back pain.¹³ The absolute indication for surgical treatment is progressive neurological deficit and intractable pain. However, patients who present radiological findings of compressive pathology concordant with clinical signs and symptoms and refractory to conservative treatment are considered ideal candidates for surgical approaches. Among the surgical options are segment fusion, associated with bone grafting, to promote the affected segment's arthrodesis. Lumbar arthrodesis is accepted as the gold standard in the surgical treatment of DDD.^{14,15} Arthrodesis is expected to block motion and instability at symptomatic levels, reducing or eliminating pain in the addressed segment.¹⁶

In this regard, there are a few surgical approaches for performing lumbar arthrodesis, among which are the Posterior Lumbar Intervertebral Fusion (TLIF) technique and the Anterior Lumbar Intervertebral Fusion (ALIF). In TLIF, the exposure of the lumbar spine extends laterally to the transverse processes. For this, it is necessary to retract all adjacent soft tissues,¹⁷ and implant a bone-filled Cage with pedicle screw instrumentation.¹⁸ With ALIF, access to the lumbar spine is via the abdominal route, avoiding trauma to the posterior musculature, which can reduce pain and postoperative limitations.¹⁹

Inherently, arthrodesis produces abnormal conditions in the spine biomechanics that can cause overloading at asymptomatic levels, leading to an increased rate of degeneration of adjacent discs.²⁰ Furthermore, complications with screw placement, failure of synthesis material, and pseudoarthrosis are conditions observed in post-surgical follow-up and have received scrutiny by surgeons over time, driving the development of alternative methods to arthrodesis.^{21,22}

As an option, lumbar arthroplasty, which is technically defined as an artificial total intervertebral disc replacement (TDR-Total Disc Replacement), is used judiciously in the surgical treatment of lumbar DDD in eligible patients, helping to restore and preserve motion in the affected segment and protect the adjacent levels from

unphysiological overload. Thus, recent studies show a reduced incidence of degenerative disc disease at the adjacent level.^{23,24}

Recent clinical studies using lumbar arthroplasty have shown sustained clinical and radiographic results over five years, with superior clinical outcomes compared to lumbar arthrodesis.^{25,26} Thus, arthroplasty has been increasingly used as an alternative surgical treatment for degenerative disc disease in eligible patients. The purpose of this study was to perform a retrospective analysis of patients with DDD of the lumbar spine who underwent single-level lumbar arthrodesis or arthroplasty in terms of functional capacity and quality of life.

METHODS

Study type and location

A retrospective observational study of analysis of information collected from medical records from 2018 to 2020, of patients followed up as outpatients in tertiary care services in São Paulo state.

Eligibility Criteria

Patients over 18 years of age with DDD, refractory to conservative treatment, and undergoing lumbar arthrodesis or single-level lumbar arthroplasty. For adequacy and standardization of the groups, the eligible patients had a Pfirrmann classification - IV, associated with degenerative discopathy, with the presence of bulging, protrusion, or presence of extruded herniation with pain and irradiation to lower limbs, with outpatient follow-up of at least 06 months, showing the full capacity to understand the research instruments. In contrast, the exclusion criteria were data from patients' medical records with loss of follow-up or less than 06 months of outpatient follow-up.

Data Collection and Research Instrument

A database examiner performed data collection from information contained in the medical records using a form with the patient's characteristics, the Short Form 36 Health Survey Questionnaire (SF-36), and the Oswestry Disability Index (ODI) in the preoperative and postoperative periods (6 months, 1, and 2 years).

The SF-36 is used to assess general health and quality of life that contains 36 items measured by eight domains: Functional Capacity (FC), Limitation by Physical Aspects (LAF), Pain (DOR), General Health Status (GHS), Vitality (VIT), Social Aspects (AS), Limitation by Emotional Aspects (LAE) and Mental Health (SM). The number of response options for each domain ranges from three to six, the calculations of which produce scores of up to 100 points and are considered reliable instruments. The evaluation of the scores advocates that higher scores are related to better health status.²⁷

The ODI is an instrument for functional assessment of the lumbar spine, consisting of 10 items representing different aspects of health, such as pain intensity, physical functioning, impacts on sleep, and social activities. The ODI total score is presented as a percentage, in which lower values are attributed to better functioning.²⁸ The interpretation of the findings is presented as follows: minimal disability (0 - 20%), moderate disability (21 - 40%), severe disability (41 - 60%), disability (61 - 80%), bedridden or overestimating their symptoms (81 - 100%).²⁹

Study Variables and Statistical Analysis

The clinical and demographic characteristics of the patients (gender, age, education, lifestyle habits, and comorbidities) were analyzed. ODI findings and quality of life by SF-36 established functional capacity.

After collecting the data on a specific form, they were tabulated in a Microsoft Office Excel 2013 spreadsheet. The Statistical Package for the Social Sciences 25.0 statistical package was used to conduct the relevant statistical analyses. In this aspect, we evaluated the means and standard deviation for the ODI and SF-36 scores and the normality test of the data distribution by the Shapiro-Wilk method. Measures of statistical significance in terms of values and $p \leq 0.05$

at all observation times, including for the evaluation of paired samples, were obtained using Student's t-test for normally distributed variables. Given the non-normality of the distribution, the Wilcoxon test was used. The magnitude of the difference in means between the groups was checked by Cohen's test (d), and values ≥ 0.8 were considered large-magnitude effects.

Ethical Aspects

The research project was submitted to the Ethics and Research Committee of the University Center of the ABC Medical School and approved under the CAAE registration: 54889222.4.0000.0082.

RESULTS

The study population consisted of 61 patients, of whom 14 underwent lumbar arthroplasty, 22 Anterior Lumbar Intervertebral Fusion (ALIF) with Cage Stand - Alone, and 25 Posterior Lumbar Interbody Fusion (TLIF) (Table 1). Regarding comorbidities, the ALIF group reported the highest occurrence of diabetes mellitus and associated systemic arterial hypertension (27.3%). Smoking was also most commonly reported by this group (18.2%). On the other hand, the group with the fewest comorbidities was the TLIF group, in which 64.0% of the patients denied having any disease.

It was noticed that the patients migrated from the invalid classification (61.4%-64.6%) to minimal/moderate disability (17.7%-25.6%) (Figure 1). Furthermore, the analysis of the results for the techniques evaluated showed a consistent decrease in the ODI values over the follow-up time, of which lumbar arthroplasty had the greatest impact of decrease, with statistical significance ($p < 0.001$).

The evaluation of the comparison of the ODI values by the paired-samples technique is shown in Table 2. Again, you can see the differences in the averages and the maintenance of results over time, with better performance for the lumbar arthroplasty technique.

Regarding the SF-36 findings, an increasing mean was observed for the ALIF technique for the investigated domains, except EGS

Table 1. Sociodemographic characterization of the study population according to the surgical techniques instituted.

Age	Lumbar arthroplasty		ALIF		TLIF	
	n	%	n	%	n	%
40 - 65 Mean = 56.7 Standard deviation = 8.7			28 - 79 Mean = 49.8 Standard deviation = 13.5		27 - 78 Mean = 47.9 Standard deviation = 12.1	
Sex						
Male	05	35.7	16	72.7	13	52.0
Female	09	64.3	6	27.3	12	48.0
Education						
Elementary School	00	-	07	31.8	04	16.0
High School	09	64.3	13	59.1	08	32.0
Higher Education	05	35.7	02	9.1	13	52.0

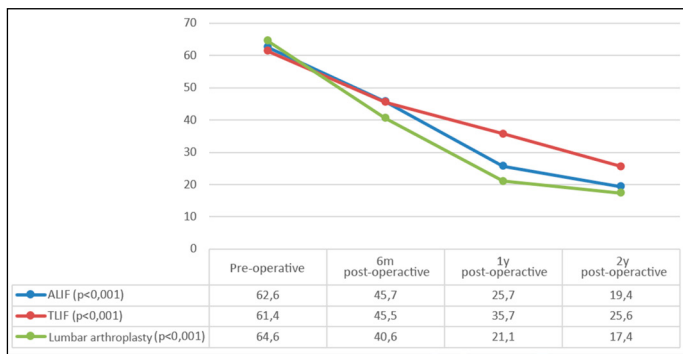


Figure 1. ODI values for the follow-up times according to surgical techniques.

and VIT. More expressive findings were identified for LAF. Statistical significance was observed with values of $p < 0.001$. (Figure 2)

For the TLIF technique, it was observed that the mean was increasing for all SF-36 domains, especially for the AS (Figure 3). However, after analyzing the comparison of means, it was noticed that the increment for most domains was lower than that of the other surgical techniques investigated (Table 3). Student's t-test ($p < 0.001$) observed the statistical significance of the correlations.

Regarding the SF-36 results for the lumbar arthroplasty technique, increasing mean values were identified for most of the investigated domains since there was a slight reduction in the LAE and VIT values in the 2-year postoperative period. The most expressive findings were for LAF, the domain with the greatest increase observed among all techniques when comparing the pre-and postoperative periods (0.0 - 85.7) (Figure 4). These findings proved to be statistically significant ($p < 0.001$).

The stratified analysis of the SF-36 by surgical technique showed that lumbar arthroplasty presented better results after 02 years of follow-up for LAF, DOR, EGS, and AS ($p < 0.001$). Considering the magnitude of the results for the 08 domains of the SF-36, this surgical technique was the one that presented the greatest benefit for the patients. (Table 2)

Table 2. Comparison of mean difference for ODI values for the follow-up times according to surgical techniques.

Postoperative	Preoperative ODI values					
	ALIF = 62.6		TLIF = 61.4		Lumbar arthroplasty = 64.6	
	Average	d	Average	d	Average	d
ODI 06 months	16.9	1.84	15.5	1.47	24.0	3.38
ODI 01 year	37.0	2.25	25.7	1.99	43.4	3.51
ODI 02 years	43.3	3.18	35.3	2.88	47.1	4.08

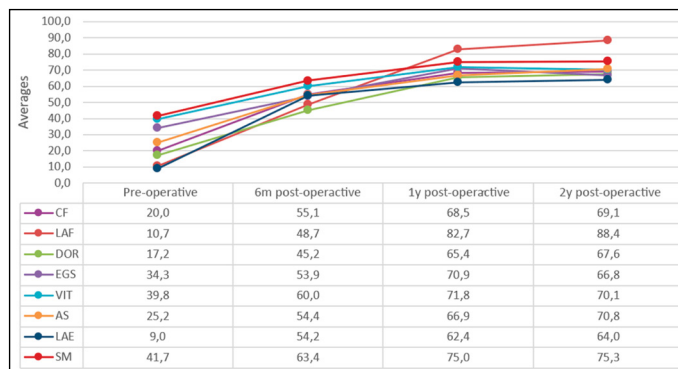


Figure 2. SF-36 values for the follow-up times according to the ALIF surgical technique.

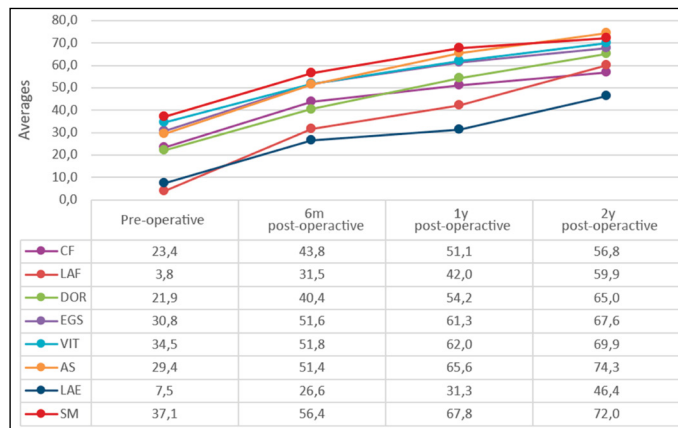


Figure 3. SF-36 values for the follow-up times according to the TLIF surgical technique.

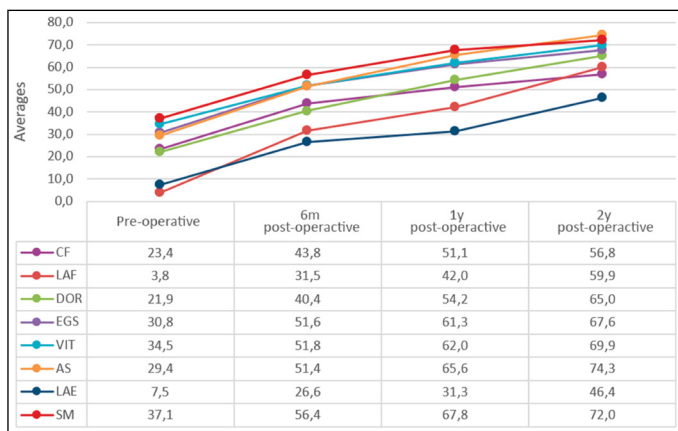


Figure 4. SF-36 values for the follow-up times according to surgical technique Lumbar Arthroplasty.

Table 3. Stratified analysis of the SF-36 for the follow-up periods according to surgical techniques.

SF-36		Lumbar arthroplasty		ALIF		TLIF	
		Average	p	Average	p	Average	p
CF pre	CF 6m	-32.1	<0.001	-35.1	<0.001	-20.4	<0.001
	CF 1y	-37.9	<0.001	-48.5	<0.001	-27.7	<0.001
	CF 2y	-41.4	<0.001	-49.1	<0.001	-33.4	<0.001
LAF pre	LAF 6m	-63.5	<0.001	-38.0	<0.001	-27.8	<0.001
	LAF 1y	-78.2	<0.001	-72.0	<0.001	-38.2	<0.001
	LAF 2y	-85.7	<0.001	-77.7	<0.001	-55.7	<0.001
DOR pre	DOR 6m	-29.8	<0.001	-28.0	<0.001	-18.6	<0.001
	PAIN 1y	-50.9	<0.001	-48.2	<0.001	-32.3	<0.001
	PAIN 2y	-57.1	<0.001	-50.4	<0.001	-43.1	<0.001
EGS pre	EGS 6m	-37.1	<0.001	-19.6	0.001	-20.7	<0.001
	EGS 1y	-40.1	<0.001	-36.6	<0.001	-30.4	<0.001
	EGS 2y	-42.8	<0.001	-32.5	<0.001	-36.7	<0.001
VIT pre	VIT 6m	-26.9	<0.001	-20.3	<0.001	-17.2	<0.001
	VIT 1y	-31.4	<0.001	-32.0	<0.001	-27.4	<0.001
	VIT 2y	-27.3	<0.001	-30.4	<0.001	-35.4	<0.001
AS pre	AS 6m	-31.4	<0.001	-29.2	<0.001	-22.0	<0.001
	AS 1y	-49.4	<0.001	-41.6	<0.001	-36.3	<0.001
	AS 2y	-54.0	<0.001	-45.5	<0.001	-44.9	<0.001
LAE pre	LAE 6m	-47.6	<0.001	-45.2	<0.001	-19.1	<0.001
	LAE 1y	-59.1	<0.001	-53.4	<0.001	-23.8	0.001
	LAE 2y	-57.8	<0.001	-79.4	<0.001	-38.8	<0.001
SM pre	SM 6m	-22.1	<0.001	-21.7	<0.001	-19.3	<0.001
	SM 1y	-27.7	<0.001	-33.3	<0.001	-30.7	<0.001
	SM 2y	-31.0	<0.001	-33.5	<0.001	-35.1	<0.001

Pre: preoperative period. 6m: 06-month postoperative period. 1y: 01-year post-op period. 2y: 02-year postoperative period.

DISCUSSION

In this study, 61 patients with disability classification for functional capacity were evaluated and divided into three groups: those who underwent arthrodesis using the ALIF technique with Stand-Alone Cage, those who underwent arthrodesis using the TLIF technique, and those who underwent lumbar arthroplasty with total intervertebral disc replacement. The retrospective evaluation of three postoperative periods (6 months, one year, and two years) showed significant clinical improvement regardless of the surgical technique

used; however, the functional capacity and quality of life results were superior in the lumbar arthroplasty group.

Regarding functional capacity, the ODI values for this surgical technique showed a constant reduction in scores over the follow-up period, culminating in an improvement of 47.1 points at two years postoperatively, that is, minimal disability in terms of clinical classification at the end of the follow-up period. Our findings were superior to those of the study by Scott-Young and colleagues,³⁰ in which the ODI score showed an improvement of 31.7 points. The literature reveals that scores above 18.8 are considered a substantial benefit for patients with high levels of disability preoperatively.³¹

The specialized literature has suggested the superiority of arthroplasty over intervertebral fusion surgical techniques,³² data corroborated by our findings. A recent meta-analysis study concluded that after three years of follow-up, the mean percentages for ODI scores were lower among patients who underwent arthroplasty (22.8 points) than patients in the arthrodesis group (27.6 points).³³

The lumbar fusion technique is very well established for treating degenerative disc disease. However, despite the satisfactory clinical results, the change in the original biomechanics of the spine proposed by the technique with consequent immobility caused by the fused segments generates an overload on the adjacent segments and may lead to disc degeneration.³⁴ In clinical terms, this particularity may culminate in negative repercussions for patients, including joint stress, impact on neural structures, and tension on the paravertebral muscles, which may translate into pain, limitation of movement, and loss of quality of life over time. In this respect, arthroplasty emerges as an alternative to arthrodesis by replacing the intervertebral disc with the maintenance of spinal motion and harmonic distribution of the axial load.³⁵

Among our patients, the SF-36 results showed gains mainly in limitation by physical aspect. This finding becomes particularly important considering that our population was classified as economically active. Reduced physical activity substantially influences the maintenance of independence and resumption of work activities, with positive effects on the economy. Low back pain is known as the main cause of absence from work, reverberating in the social security dynamics by absenteeism and the demand for specialized health services.⁹

The positive findings for SF-36 in our study agree with the results of previous investigations conducted by Joelson, Sigmundsson, and Karlsson³⁶ for arthrodesis and Scott-Young³⁷ for arthroplasty, with the maintenance of post-surgical outcomes. We emphasize that our study compared patients who underwent different surgical techniques. Still, all had their surgery performed by the same professional, who used standardized techniques and did not participate in data collection and analysis, thus having no influence on the results presented here.

Regarding the study's limitations, we highlight its retrospective nature, whose inferences were made based on data collected by third parties. In addition, the sample size was relatively small, and patients were not randomly assigned to each surgical technique group. In this respect, we emphasize that the election of patients for a particular technique was made carefully based on well-established clinical criteria. Furthermore, the use of different outcome instruments, both with positive results, and the conduct of robust statistical analyses appropriate for our sample allowed us to affirm our findings.

CONCLUSION

The surgical techniques evaluated had a positive and sustained impact over two years of postoperative follow-up, improving patients' functional capacity and quality of life, of which lumbar arthroplasty had superior performance.

All authors declare no potential conflict of interest related to this article.

CONTRIBUTIONS OF THE AUTHORS: Each author contributed individually and significantly to the development of this article. SGM: design of the paper; data analysis and interpretation, writing of the manuscript; RLMR: a review of the intellectual concept of the paper and final approval of the manuscript version to be published; LFA: data analysis and revision of the paper; CAEM: substantial contribution in the design of the paper and critical review of its intellectual content.

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