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Arthroscopic Repair of Rotator Cuff Injury: An Analysis of Function, Muscular Strength and Pain Between Single Row and Double Row Techniques*

Reparo artroscópico da lesão de manguito rotador: Uma análise da função, força muscular e dor entre técnicas de fileira simples e fileira dupla

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Abstract

Objective To evaluate the patients submitted to arthroscopic repair of the rotator cuff (RC), comparing the functional results, muscle strength, and pain obtained after single row (SR) and double row (DR) techniques.

Methods Data were collected at the postoperative follow-up (minimum of 12 months) of 128 patients submitted to arthroscopic RC repair from 2011 to 2018. The clinical-functional variables were collected through the clinical examination, and the demographic, surgical and injury variables of the RC were collected from the electronic medical records. The results were compared between the SR and DR groups.

Results The DR group showed higher anterior elevation strength when compared with the SR group (SF: 4.72 ± 2.73 kg versus DR: 5.90 ± 2.73 kg; $p = 0.017$). The other variables of muscle strength, Constant-Murley Score, University of California at Los Angeles Shoulder Rating Scale (UCLA), and pain, were similar. Performing the stratification by size, in the analysis of small and medium injuries, no differences were found between the groups. However, in the analysis of large and extensive injuries, patients submitted to DR presented superiority of both muscle lifting strength (SF: 3.98 ± 2.24 kg versus DR: 6.39 ± 2.73 kg) and Constant score (SF: 81 ± 10 versus DR: 88 ± 7).

Keywords
- rotator cuff
- arthroscopy
- muscle strength
- functional evaluation
- shoulder

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Conclusion The use of the DR technique in arthroscopic RC repair allowed higher levels of muscle strength for anterior shoulder elevation when compared with the SF technique. Data stratification in large and extensive injuries showed superiority of anterior shoulder elevation muscle strength and of the Constant score in patients submitted to DR.

Resumo

Objetivo Avaliar os pacientes submetidos ao reparo artroscópico do manguito rotador (MR), comparando-se os resultados funcionais, força muscular e dor obtidos após as técnicas de fileira simples (FS) e de fileira dupla (FD).

Métodos Foram coletados os dados do seguimento pós-operatório (mínimo de 12 meses) de 128 pacientes submetidos ao reparo artroscópico do MR durante o período de 2011 a 2018. As variáveis clínico-funcionais foram coletadas por meio do exame clínico, e as variáveis demográficas, cirúrgicas e das lesões do MR a partir dos prontuários eletrônicos. Os resultados foram comparados entre os grupos FS e FD.

Resultados O grupo FD demonstrou força de elevação anterior maior quando comparado ao grupo FS (FS: $4{,}72 \pm 2{,}73$ kg *versus* FD:$5{,}90 \pm 2{,}73$ kg; $p = 0{,}017$). As demais variáveis de força muscular, Constant-Murley Score, University of California at Los Angeles Shoulder Rating Scale (UCLA, na sigla em inglês) e dor foram similares. Realizando-se a estratificação por tamanho, na análise das lesões pequenas e médias, não foram encontradas diferenças entre os grupos. Porém, na análise das lesões grandes e extensas, os pacientes submetidos à FD apresentaram superioridade tanto na força muscular de elevação (FS: $3{,}98 \pm 2{,}24$ kg *versus* FD: $6{,}39 \pm 2{,}73$ kg) quanto no escore Constant (FS: 81 ± 10 *versus* FD: 88 ± 7).

Conclusão A utilização da técnica de FD no reparo artroscópico do MR possibilitou maiores níveis de força muscular para elevação anterior do ombro quando comparada à técnica de FS. A estratificação dos dados em lesões grandes e extensas evidenciou superioridade da força muscular de elevação anterior do ombro e do escore Constant nos pacientes submetidos à FD.

Palavras-chave
- manguito rotador
- artroscopia
- força muscular
- avaliação funcional
- ombro

Introduction

Rotator cuff (RC) injuries are common in orthopedic practice, corresponding to between ~ 30 to 70% of cases of shoulder pain.[1,2] The therapeutic arsenal is extensive, encompassing conservative and surgical treatments.[3] The surgical method can be performed by means of open technique with minimal incision *("mini open")* or of arthroscopic technique, and in some cases of irreparable injuries associated with RC arthropathy, there is the possibility of reverse shoulder arthroplasty.[3,4] In Brazil, according to data from the Department of Informatics of the Brazilian Unified Health System (DataSUS, in the Portuguese acronym) and considering both open and arthroscopic repair, 50,207 RC repair surgeries were performed in the period from 2003 to 2015.[5] In 2015, the rate of RC repairs was 2.81 procedures per 100,000 inhabitants.[5] These data, however, include only the procedures performed by the SUS, which leads us to infer that the numbers referring to RC repair throughout Brazil are even higher, since the data regarding supplementary health are not publicly aggregated and disclosed.

Once the arthroscopic treatment is established, another point to be decided is the technique of suturing the tendon in the humerus. It can be performed in a single row (SR), double row (DR) or transbone equivalent. In Brazil, the most widespread technique is SR, used by 50.4% of orthopedists, while 26.1% use the DR configuration.[6] When comparing the two techniques, the literature presents divergences, and the studies are not conclusive.[7–10] DeHaann et al.[7] and Chen et al.[8] did not show functional differences between the techniques. Ying et al.[9] demonstrated better muscle strength in the group submitted to DR. Sobhy et al. [10] determined that, in the short and medium term, the DR group presented significantly better University of California at Los Angeles Shoulder Rating Scale (UCLA) score and that, in the long term, there is a direct correlation between the integrity of the RC and the functional results, with superiority of the DR. On the national scene, the only work, published by Senna et al.,[11] there was no statistically significant functional difference between the two methods.

In view of such evidence, it is observed that fixation techniques in SR and DR in arthroscopic repair of RC still present controversial results, especially in Brazil, since there is only one national study on the topic.[11] Since the use of more anchors makes the procedure more costly,[12] it is necessary to demonstrate whether there is real clinical benefit when using this technique. Therefore, one should expand the study base to prove the superiority of one technique over the other or the equivalence of both.

Thus, the aim of the present study was to evaluate patients submitted to arthroscopic repair of RC, comparing the results of muscle strength, functional strength, and pain obtained after the SR and DR techniques. Given the above and based on the logic that led to the development of the DR technique (greater RC area of insertion – footprint –, generating a lower chance of rerupture),[10,13] hypothesizing that patients submitted to the DF technique will present superiority in the outcomes analyzed.

Methodology

Study Design and Participants

This is a retrospective cohort study. During the period from 2011 to 2018, 465 patients underwent arthroscopic RC repair. Patients >18 years old submitted to arthroscopic repair of the RC and with a minimum postoperative follow-up of 12 months were included. Those who underwent other procedures, such as glenoid lip repair, acromioplasty, tenotomy, and biceps tenodesis, as well as those who refused to participate in the study and whose contact was not possible, which characterized loss of follow-up, were excluded. After applying the criteria (inclusion and exclusion), 128 patients agreed to participate in the research and attend the hospital to be reevaluated, totaling 135 shoulders.

Outcome Analysis

The primary outcome was the postoperative functional scores, UCLA and Constant-Murley Score (Constant), and as secondary outcomes the variables of strength, range of motion (ROM), and postoperative pain.

Methods and Instruments

Data collection during the postoperative follow-up was performed in two stages: first – consultation of medical records for collection of demographics, surgical descriptions, and RC injuries; and second – clinical evaluation with collection of functional variables, muscle strength, and pain.

Demographic and characterization data of RC injury were obtained through analysis of electronic medical records. The variables collected were: age, gender, dominance and laterality, follow-up time, smoking, diabetes mellitus, type of rupture (total or partial), classification of the injury (small, medium, large or extensive for complete injuries, and bursal, articular or intratendinous for partial injuries), mechanism of injury (traumatic or degenerative), tendons addressed, type of fixation (SR or DR), and number of anchors used in the surgical treatment. The complete injuries were classified, according to the measurement of their largest diameter, as small (<1 cm), medium (1 to 3 cm), large (3 to 5 cm), and extensive (≥ 5 cm).[14,15] Extensive injuries, however, can be defined both by the criterion mentioned, ≥ 5 cm, and by the complete rupture of $\geq$ 2tendons.[15] The size and classification of the injuries were obtained from preoperative magnetic resonance imaging (MRI) and/or surgical descriptions. When there was divergence between the MRI report and the surgical description, the intraoperative description was considered.

The second moment of evaluation was performed in person, when the strength (kg) and amplitude (°) of the lifting, lateral rotation, and medial rotation of the shoulder were measured. Strength was measured by a digital dynamometer and measured in Kg, while amplitude was measured by goniometry and measured in degrees. In addition, during this evaluation, the functional UCLA[16] and Constant[17] capacity scores were applied, together with the collection of pain data, using the visual analog scale.[18] The scales mentioned above (UCLA and Constant) were translated to Portuguese and culturally adapted to the Brazilian population,[19,20] and are frequently used to evaluate the function of the upper limbs in patients with RC injuries.[10,11,21–23]

After tabulation of the data, the individuals were divided into two groups, based on the surgical fixation technique used: SR and DR.

Surgical Procedure

The surgeries were performed by specialist surgeons and with extensive experience in the subject. The SR fixation technique was performed through the technique in which the tendon is tied, by means of simple stitches, to the anchors arranged in a single row.[24] The DR fixation technique was described by Lo et al.,[13] consisting of a medial row of anchors tied with "U" points and another lateral row of anchors tied with simple points. The procedures were performed in the "beach chair" position.

It is known that, in our country, the cost of surgical material is a limiting factor. The intention of the surgeon when requesting approval to perform the procedure was always to perform DR fixation; however, the number of anchors authorized is not always enough for the DR procedure. When that was the case, we opted for the SP technique. Therefore, since all selected injuries were susceptible to treatment by DR, the factor that directed to one technique or another was the availability of materials.

All patients with partial injuries were submitted to conservative treatment for at least 3 months. When there was no good response to this therapy, surgical treatment was indicated.

Those who presented irreparability criteria were submitted to other surgical techniques other than arthroscopic and, therefore, were not included in the study.

Postoperative Rehabilitation

Postoperative rehabilitation was performed through maintenance in a simple Velpeau sling for 6 weeks, and active movement of the elbow, the wrist and the hand was stimulated from the immediate postoperative period. After the 6th week, gain of active movement began. Finally, after the 12th week, muscle strengthening was started.

Ethical Approvals

All patients signed the Informed Consent Form. The present study was submitted to the evaluation and approval of the Ethics and Research Committee with Human Beings, with opinion number 2,444,726, CAAE: 80401317.3.0000.0023.

Statistics

Descriptive analysis was carried out, expressed by the measures of central tendency and dispersion appropriate for the numerical data and by the frequency and percentage for the

categorical data. For the numerical variables, the Shapiro-Wilk normality test was initially performed. For the variables that did not present normal distribution, the statistical analysis was performed by means of the Mann-Whitney nonparametric test, and for those that presented normal distribution, the Student t-test was used. For categorical variables, the Fisher chi-squared or exact tests were used, depending on the number of categories of the random variable.

Subsequently, the sample was stratified into the following subgroups: one – small and medium injuries; and two – large and extensive injuries. From this, new comparations were made of functional results and muscle strength of SR and DR techniques within these stratifications.

Multiple linear regression analysis was also performed to evaluate whether the characteristics of the patients or of the injuries had an influence on clinical-functional results. The correlated variables were follow-up time, age, dominance, injury size, injury etiology, diabetes, and smoking.

The significance determination criterion adopted was at the level of 5%. Statistical analysis was processed IBM SPSS Statistics for Windows, version 20.0 (IBM Corp., Armonk. NY, USA).

Results

Demographic and Surgical Characteristics Among Groups

From 2011 to 2018, 465 patients underwent arthroscopic RC repair. From these, 147 were excluded because they underwent other procedures during surgery, 8 died, and 182 refused to participate or it was not possible to contact them.

The sample consisted of 135 shoulders (128 patients). From these, 94 (69.6%) correspond to the cases operated by the SR technique and 41 (30.4%) by DR. The mean follow-up time was 46.5 months, and there was no statistically significant difference between the SR and DR groups. When the demographic characteristics and the surgical profile were compared between the groups, a statistically significant difference was observed for age (SR: 59 ± 9 versus DR: 55 ± 8), higher in the SR group ($p = 0.010$), and for the number of anchors used (SR:3 ± 1 versus DR: 4 ± 1), higher in the DR group ($p = 0.012$). The other variables were statistically similar and are shown in ►**Table 1.**

Table 1 Sample characterization

Variable	Total	Simple row	Double row	*p-value*
	135 (100%)	**94 (69.6%)**	**41 (30.4%)**	
Age (years old)	58 ± 9	59 ± 9	55 ± 8	**0.010***
Female gender	77 (57%)	53 (56.4%)	24 (58.5%)	0.816
Male gender	58 (43%)	41 (43.6%)	17 (41.5%)	
Follow-up time (months)	46.5 ± 23.55	44.19 ± 23.95	50.32 ± 22.29	0.111
Dominant member	91 (67.4%)	62 (66%)	29 (70.7%)	0.586
Diabetics	24 (17.8%)	20 (21.3%)	4 (9.8%)	0.107
Smokers	9 (6.7%)	7 (7.4%)	2 (4.9%)	0.582
Degenerative injury	89 (65.9%	59 (67.8%)	30 (73.2%)	0.241
Traumatic injury	46 (34.1%)	35 (37.2%)	11 (26.8%)	
Number of tendons addressed:1	46 (34.1%)	32 (34%)	14 (34.1%)	0.141
Number of tendons addressed: 2	71 (52.1%)	46 (48.9%)	25 (61%)	
Number of tendons addressed: 3	18 (13.3%)	16 (17%)	2 (4.9%)	
Number of anchors	3.56 ± 1.17	3 ± 1	4 ± 1	**0.012***

Table 2 Characterization and comparison of rotator cuff injuries (partial and total) between the Single Row (SR) and Double Row (DR) groups

Simple row			Double row			*p-value*
Partial 16 (17%)	Bursal	13 (81.2%)	Partial 7 (17.1%)	Bursal	7 (100%)	0.136
	Articulate	3 (18.8%)		Articulate	0	
Total 78 (83%)	Small	13 (16.7%)	Total 34 (82.9%)	Small	9 (26.5%)	
	Average	22 (28.2%)		Average	11 (32.4%)	
	Large	16 (20.5%)		Large	10 (29.4%)	
	Extensive	27 (34.6%)		Extensive	4 (11.8%)	

Characteristics of Rotator Cuff Injuries Between Groups

Regarding the type of injury, both groups showed predominance of cases of total ruptures (SR: 83% versus DR: 82.9%). Among the partial ruptures, the bursals were the majority and there was no intrasubstantial case. Regarding the size of the total injuries, the SR group presented a higher percentage of extensive injuries (34.6%), while in the DR group mean injuries presented a higher percentage (32.4%). However, these differences between the groups regarding the percentage of each injury did not present statistical significance ($p = 0.136$). The full description of the data is set out in ►**Table 2.**

Comparison of Muscle Strength, Function and Pain Variables between Groups

A statistically significant difference was observed in the anterior shoulder elevation force between the groups ($p = 0.017$). The DR group showed higher strength levels when compared with the SR group regarding anterior elevation (SF: 4.72 ± 2.73 kg versus DR: 5.90 ± 2.73 kg). The other variables of muscle strength and function (ROM and reported functional capacity questionnaires) were similar ($p > 0.05$) (►**Table 3**).

Regarding pain at follow-up, there was no statistically significant difference between the groups (►**Table 3**). However, it was possible to observe that, in both groups, > 50% of the patients did not present pain during the clinical evaluation at the postoperative follow-up.

Multiple linear regression analysis showed no relationship between clinical-functional results and the variables follow-up time, dominance, injury size, injury etiology, diabetes, and smoking. However, the age of the patients was correlated with the results of lifting force, lateral rotation, and medial rotation.

Table 3 Comparison of functional variables, muscle strength, and pain between the Single Row (SR) and Double Row (DR) groups

Variable		Simple row	Double row	*p-value*
Elevation	ROM (°)	157 ± 29	161 ± 27	0.302
	Strength (kg)	4.72 ± 2.73	5.90 ± 2.73	**0.017***
Lateral rotation	ROM (°)	58 ± 22	60 ± 23	0.595
	Strength (kg)	5th ± 2.66	5.05 ± 2.09	0.535
Medial rotation	ROM (°)	60 ± 23	64 ± 18	0.506
	Strength (kg)	6.28 ± 3.12	6.97 ± 2.96	0.165
UCLA		33 ± 3	33 ± 3	0.365
Constant		82 ± 11	86 ± 9	0.084
Pain at follow-up	No pain	48 (51.1%)	23 (56.1%)	0.759
	Light (1–3)	27 (28.7%)	9 (22%)	
	Moderate (4–6)	15 (16%)	6 (14.6%)	
	Intense (7–10)	4 (4.3%)	3 (7.3%)	

Abbreviations: Constant, Constant-Murley Score; ROM, range of motion; UCLA, University of California at Los Angeles Shoulder Rating Scale.

Table 4 Comparison of functional and muscle strength variables between the Single Row (SR) and Double Row (DR) groups, stratified in small and medium rotator cuff injuries

Small and medium rotator cuff injuries				
Variable		**Simple row**	**Double row**	***p-value***
Elevation	ROM (°)	160 ± 28	159 ± 27	0.993
	Strength (kg)	5.41 ± 2.89	5.80 ± 2.94	0.642
Lateral rotation	ADM (°)	58 ± 20	57 ± 23	0.833
	Strength (kg)	5.39 ± 2.83	4.95 ± 2.42	0.772
Medial rotation	ROM (°)	62 ± 21	64 ± 20	0.712
	Strength (kg)	6.70 ± 3.06	7.45 ± 3.19	0.393
UCLA		34 ± 2	33 ± 3	0.899
Constant		86 ± 8	86 ± 11	0.927

Abbreviations: Constant, Constant-Murley Score; ROM, range of motion; UCLA, University of California at Los Angeles Shoulder Rating Scale.

Table 5 Comparison of functional and muscular strength variables between Single Row (SR) and Double Row (DR) groups, stratified in large and extensive rotator cuff injuries

Large and extensive rotator cuff injuries				
Variable		**Simple row**	**Double row**	***p-value***
Elevation	ROM (°)	160 ± 27	164 ± 26	0.473
	Strength (kg)	3.98 ± 2.24	6.39 ± 2.73	**0.003***
Lateral rotation	ROM (°)	62 ± 22	63 ± 25	0.845
	Strength (kg)	4.82 ± 2.33	5.54 ± 1.66	0.290
Medial rotation	ROM (°)	60 ± 25	67 ± 16	0.497
	Strength (kg)	6.23 ± 2.96	6.50 ± 2.86	0.546
UCLA		33 ± 3	34 ± 2	0.148
Constant		81 ± 10	88 ± 7	**0.019***

Abbreviations: Constant, Constant-Murley Score; ROM, range of motion; UCLA, University of California at Los Angeles Shoulder Rating Scale.

Comparison of Functional Variables and Muscle Strength Stratified by Total Injury Size

Performing the analysis in a stratified manner, the functional and muscle strength results were compared between the groups (SR and DR), stratified in small/medium injuries and large/extensive injuries.

In the analysis for small and medium injuries, no differences were found between the groups (►**Table 4**). However, in the analysis of large and extensive injuries, patients submitted to DR presented an advantage both in muscle lifting strength (SF: 3.98 ± 2.24 kg versus DR: 6.39 ± 2.73 kg) and in the Constant score (SF: 81 ± 10 versus DR: 88 ± 7) (►**Table 5**).

Discussion

Analyzing the characteristics of the sample, the only variable that presented statistically significant difference between the groups was age, which was higher in the SR group. In both groups, the mean value was compatible with the literature.[6,22] This age difference is important because the profile of RC ruptures varies widely according to age group,[25] and injuries in the elderly are generally degenerative.[25] This type of injury, in general, presents a higher degree of fatty infiltration, a variable that correlates with worse outcomes, since it indicates poor tendon quality and increases the risk of reruptures.[26]

Regarding gender, both groups had mostly females. This data is in line with what is presented in the literature, which indicates that, in general, patients undergoing arthroscopic repair of the RC are mostly women.[2,11,23] In both groups, the dominant shoulder was the most operated, a majority also found in other national studies.[2,23]

Biomechanical studies emphasize the potential increase in the contact area in footprint and maximization of repair forces in DR, which can decrease the rate of anatomical failure.[27,28] However, in an analysis of clinical outcomes, controversies still persist.[7–10] In this sense, we compared the results of muscle strength, function and pain of patients after arthroscopic RC repair with SR and DR. Our results confirm, in part, the initial hypothesis. We showed greater muscle strength of anterior elevation in patients submitted to DR repair. However, the other variables of muscle strength, function, and pain were similar between the techniques.

Sobhy et al.[10] concluded that, in the short (minimum of 12 months of follow-up) and medium (minimum of 24 months) terms, patients treated with the DR technique had significantly higher UCLA scores. In addition, the authors identified that, in the long term, there is a direct correlation between the integrity of the RC and the functional results, with superiority of the DR technique. Thus, when analyzing the functional results, the integrity of the tendon submitted to the procedure is indirectly verified, reducing, in part, the impact of not performing imaging tests in the present study. Similarly, Ying et al.[9] identified higher values of muscle strength in patients submitted to the DR technique. In the present study, we identified greater muscle strength in the shoulder elevation movement in patients who underwent the DR technique. However, the results of function and pain were similar between the groups. The greater area of insertion of the tendon in the humerus provided by the DR technique leads to a greater chance of the repaired tendon being intact at follow-up. This integrity is directly related to the strength gain of the respective muscle.[10,22,29,30]

Furthermore, with the objective of identifying greater benefits for specific groups of patients, stratification by large and extensive injuries allowed the visualization of the greater effectiveness of the DR technique in the variables of muscle strength (anterior elevation of the shoulder) and in the Constant score. However, we did not observe a statistical difference in the outcomes analyzed when comparing the techniques in small and medium injuries. Regarding the differences between the two scores used, although the UCLA includes lifting force,[16] the Constant score presents more variables in its composition, mainly a greater variety of movements and daily activities,[17] which may have led to the different results between these scales.

Similarly, two randomized clinical trials showed better results with the DR technique in patients with injuries > 3 cm.[21,31] Carbonel et al.[21] found better results in the UCLA

and American Shoulder and Elbow Surgeons (ASES) scores, while Ma et al.[31] observed significantly higher strength in groups submitted to DR. As previously stated, the DR fixation technique leads to a greater integrity of the tendon in the postoperative period.[10,29,30] When analyzing the factors that lead to new ruptures, it is well reported that the initial size of the injury is a significant factor of influence on tendon healing, and that the relative risk of rerupture increases 2.29-fold for every additional centimeter in the size of the injury.[32,33] This finding may explain the fact that larger injuries benefit more from the DR technique. Since, of course, larger injuries tend to present higher chances of new injuries,[32] a technique that offers greater postoperative integrity can bring better results[10,29,30] However, in smaller injuries, this benefit is not so evident, since simple fixation would be sufficient to ensure good postoperative results.

In view of the above, it is concluded that the DR technique presents superiority only in the shoulder lifting force. However, when performing an analysis stratified by the size of the injuries, the DR fixation technique presented better results for patients with injuries >3 cm (large and extensive). Therefore, it seems essential to analyze the size of the injury when opting for one fixation technique over the other.

Regarding the negative points of DR, in addition to the increase in the cost and in the duration of surgery, this technique has specific complications, such as the place where the repair failure occurs.[34] While in the SR technique the failure occurs at the repair site, in DR they occur in the muscle-tendon junction, being, therefore, a more serious complication, whose treatment is challenging.[33]

Among the strengths of the present study, we highlight the postoperative analysis performed with several variables of shoulder functionality, as well as the stratification of cases according to the size of the injury, which made it possible to identify a subgroup of patients who presented greater benefit with the use of the DR technique.

Among the limitations of the present study, there is heterogeneity regarding the age variable, which can influence the analysis of the results, since patients submitted to SR had a higher mean age. In addition, it is worth noting the absence of analysis regarding the cost of the techniques, since the fixation in DR needs greater use of anchors. This is a parameter that needs to be correlated with functional improvement to establish the real cost-benefit of this procedure in future studies.

Moreover, there are limitations regarding the design of the study, which is retrospective and observational, which, therefore, does not allow to reach a conclusion regarding the superiority of one technique or of the other, but rather to raise hypotheses that should be confirmed through clinical trials. Another limitation refers to the nonevaluation of prognostic factors in the preoperative period, such as muscle trophism and the degree of fatty infiltration, as well as the absence of evaluation of postoperative imaging tests.

Conclusion

The use of the DR technique in arthroscopic RC repair allowed better functional results, especially in cases of large and extensive injuries, with superiority in the anterior elevation force and in the Constant score, when compared with patients submitted to the SR technique.

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Conflict of Interests
The authors have no conflict of interests to declare.

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