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Adhesive Capsulitis' Patients Report Improvement in Functionality Trough International Classification of Functioning, Disability and Health Checklist and Dash After Suprascapular Nerve Blocks*

Pacientes com capsulite adesiva relatam melhora da funcionalidade pela Classificação Internacional de Funcionalidade, Incapacidade e Saúde e DASH após bloqueios do nervo supraescapular

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Abstract

Objective To evaluate the functionality in patients with adhesive capsulitis undergoing suprascapular nerve block (SSNB).

Methods A before-and-after clinical prospective study in a single center was conducted with patients with secondary adhesive capsulitis treated with four nerve blocks based on anatomical limits. The sample was non-probabilistic, and it was obtained after a routine appointment at a specialized outpatient clinic. The instruments used for evaluation were the International Classification of Functioning, Disability and Health (ICF) and the Disabilities of the Arm, Shoulder and Hand (DASH) questionnaire, which were applied at baseline (T_0), one week after the fourth SSNB (T_4), and three months after the first SSNB (T_{12}). The paired *t*-test was used to compare the means of the ICF checklist items and DASH in the different: T_0xT_4; T_4xT_{12}; and T_0xT_{12}). The probability of rejecting the null hypothesis was 5%.

Keywords
- adhesive capsulitis
- nerve block
- International Classification of Functioning, disability and health
- shoulder
- patient reported outcome measures

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Results The sample was composed of 25 individuals with a mean age of 58.16 years; 16 of them were female. The duration of the pain symptoms ranged from 2 to 16 months, with a mean of 5.92 months. The ICF checklist showed that all domains had already improved in $T_{4,}$ except for the environmental factors, which only improved at 03 months ($p = 0.037$). The patients reported improvements in shoulder function in T_4, which increased more in T_{12}, at the end of data collection ($p = 0.019$).

Conclusion The SSNB technique is effective in patients with adhesive capsulitis after 4 weeks of application, with improvements in individual's functionality lasting for 12 weeks.

Resumo

Objetivo Avaliar a funcionalidade em pacientes com capsulite adesiva submetidos a bloqueio do nervo supraescapular (BNSE).

Métodos Um estudo clínico prospectivo do tipo antes e depois foi realizado em um único centro com pacientes com capsulite adesiva secundária tratados com quatro bloqueios baseados em limites anatômicos. A amostra foi não probabilística, tendo sido obtida após consulta de rotina em ambulatório especializado. Os instrumentos utilizados para avaliação foram a Classificação Internacional de Funcionalidade, Incapacidade e Saúde (CIF) e o questionário de Disfunções do Braço, Ombro e Mão (DASH), que foram aplicados antes da intervenção intervenção (T_0), uma semana após o quarto BNSE (T_4), e três meses após o primeiro BNSE (T_{12}). As médias dos itens da CIF e do DASH nos diferentes tempos (T_0 x T_4; T_4 x T_{12}; e T_0 x T_{12}) foram comparadas por meio do teste *t* pareado. A probabilidade de rejeitar a hipótese nula foi de 5%.

Resultados A amostra foi composta por 25 indivíduos com média de idade de 58,16 anos; 16 eram mulheres. Os sintomas dolorosos ocorreram por 2 a 16 meses, com média de 5,92 meses. A CIF mostrou que todos os domínios já haviam melhorado em $T_{4,}$ à exceção dos fatores ambientais, que só melhoraram aos 3 meses ($p = 0,037$). Os pacientes relataram melhora na função do ombro em T_4 e mais ainda em T_{12}, no final da coleta de dados ($p = 0,019$).

Conclusão A técnica de BNSE é eficaz em pacientes com capsulite adesiva após 4 semanas de aplicação, com melhora da funcionalidade e sua manutenção por até 12 semanas.

Palavras-chave
- capsulite adesiva
- bloqueio nervoso
- Classificação Internacional de Funcionalidade, incapacidade e saúde
- ombro
- medidas de resultados relatados pelo paciente

Introduction

Adhesive capsulitis (AC) is a disabling shoulder disease with a prevalence of 2% to 5% among the general population that most commonly affects females between 40 and 70 years of age.[1,2] Its clinical features are pain and stiffness;[1,3,4] it often presents bilaterally, and does not affect the same shoulder twice. Adhesive capsulitis can present in the primary (idiopathic) form or be secondary to previous surgery, trauma, immobilization, and systemic alterations such as diabetes mellitus and hypothyroidism.[1,3–6] The non-surgical approach is mandatory, and suprascapular nerve block (SSNB) is one therapeutic option with satisfactory results.[7,8]

This condition is limiting and negatively impacts the function and structure of the affected person's body.[8] The International Classification of Functioning, Disability and Health (ICF) was developed by the World Health Organization (WHO) in 2001 so that the individual can describe their current state of health-disease-functionality-care.[9–11] Due to its multifaceted nature, the ICF contributes to the assessment of different health conditions; however, its use has been restricted to rehabilitation professionals.[12,13]

The use of the ICF checklist in the clinical practice can provide important information to be raised in patient care, with a unified and standardized language based on different constructs and domains.[14–16] Another widely used instrument in studies on uppers limb diseases is the Disabilities of the Arm, Shoulder and Hand (DASH) questionnaire, but it is only applied to evaluate the function and symptoms of this part of the body during the performance of certain activities.[17]

There is an increasing support for the use of patient-reported outcomes to determine the quality of the treatment and of the therapeutic conduct. These outcomes are obtained through validated questionnaires that are filled out by the patients according to their perceptions of their health status, disability and level of impairment. These questionnaires also enable the comparison of outcomes before and after

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procedures to evaluate the efficacy of a clinical intervention from the patients' perspective. A combination of two types of patient-reported outcome measures is often used.[18]

To date, studies on AC with the simultaneous use of the ICF checklist and the DASH have not been found. This investigation would enable the mapping of the functionality construct regarding the aspects affected by AC as well as the individual as a the aim of the present study was to evaluate, through the ICF and DASH simultaneously, the functionality of patients with AC submitted to SSNB. We hypothesize that those affected will experience an improvement in both patient-reported outcome measures after the treatment.

Materials and Methods

Location of the Study and Study Design

The present is a prospective study, of the before-and-after type, performed in a single center at a tertiary private hospital from March 2019 to July 2020. It was approved by the institutional Ethics in Research Committee on February 29, 2019, under protocol 08599119.1.0000.8058. All subjects signed the Informed Consent Form.

Participants

The finite proportion sample calculation was used considering a significance level of 5%, a test power of 80% and a margin of error of 5%. The sample size obtained was 25 participants. The sample, which was non-probabilistic and consecutive, was obtained after routine appointments at a specialized outpatient clinic.

The eligible cases of AC were those which had constant pain for more than four weeks and limited active and passive range of motion in every direction, such as: anterior elevation, external rotation in 0°/90° of abduction, and internal rotation in adduction. The imaging diagnosis showed local disuse osteopenia on radiographs and volume restriction of axillary recess, as well as thickening of coracohumeral ligament, on magnetic resonance imaging.

Patients who had secondary AC were included in the study due to the following factors established by Zuckerman and Rokito:[4] previous surgery, trauma, prolonged immobilization, rotator cuff tear, calcareous tendinitis, as well as diabetes mellitus, neuropathies and hypo- or hyperthyroidism.

Patients with glenohumeral arthrosis, blocked shoulder dislocation, humeral head necrosis, malunion of the proximal humerus, and primary AC were excluded.

Data Collection

Data was collected through the following steps: 1) presentation of the research proposal and signing of the Free and Informed Consent Term; 2) application of the sociodemographic and clinical questionnaire; and 3) application of the patient-reported outcome measures (ICF checklist and DASH). All of these steps were performed by the same researcher (SRN), who was not in charge of performing the SSNB.

The four SSNBs, based on anatomical limits, were performed by the same shoulder specialist (MRF) in a prepared room in weekly intervals (►**Figs. 1**, **2**, **3**).[19] The AC patient

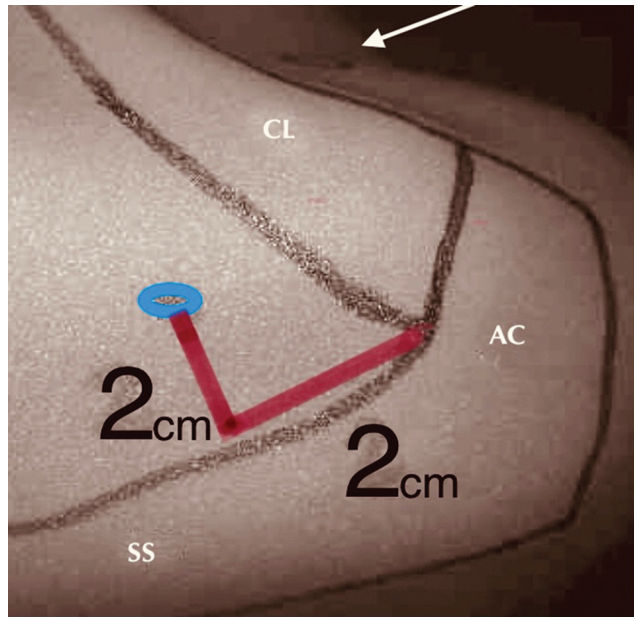

Fig. 1 Lateral and indirect technique of suprascapular nerve block based on anatomical limits. Posterior and superior shoulder view; blue circle: the needle is inserted perpendicularly to the skin in the craniocaudal direction, 2 cm from the medial acromial border and 2 cm from the upper margin of the scapular spine. White arrow: coracoid process. Abbreviations: CL, clavicle; AC, acromion; SS, scapular spine.



Fig. 2 Posterior shoulder view during suprascapular nerve block. Abbreviations: AC, acromion; SS: scapular spine.

was placed in a sitting position with the affected upper limb at 0° of abduction, and the region of the shoulder was sterilized with 70% alcohol before the injection. A syringe with an 18-gauge venipuncture catheter (Abocath; Bio-Med Healthcare Products, Haryana, India) was used with 10 mL of bupivacaine at 0.5% associated with 1:200.000 epinephrine (Neocaine, Cristália, Itapira, Brazil).

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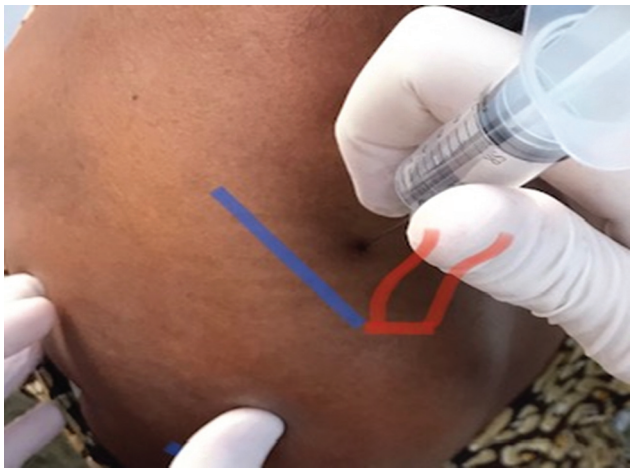

Fig. 3 Superior shoulder view during suprascapular nerve block. Blue line: superior border of scapular spine; red lines: distal clavicle.

All patients were evaluated through the ICF checklist and DASH at baseline (T_0), one week after the fourth SSNB (T_4), and three months after the first SSNB (T_{12}) (►**Fig. 4**).

Instruments

All 54 categories of the ICF checklist were used, and 11 of them concern body functions, 2 concern body structures, 17 are on activity and participation – performance, 17 are on activity and participation – capacity, and 7 involve environmental factors.[20] We used the RAW Scale formula, which has a score form 0 to 100, with qualifiers graded from 0 to 4 to determine the magnitude of the disability: 0% to 4% – none (0); 5% to 24% – slight (1); 25% to 29% – moderate (2); 50% to 95% – serious (3); and 96% to 100% – complete (4). The lower the value, the better the individual's functionality.[15,20]

The DASH evaluates upper limb disabilities over time through 30 questions about symptoms and the performance of specific activities, and it can be applied before and after procedures. Its score goes up to 100 (the higher the score, the greater the disability).[17,21]

Outcomes/Independent Variables

The outcomes were the functionality of individuals and of the upper limb according to the ICF checklist and the DASH. The independent variables were: age (in years); gender (male/female); ethnicity (white/black/brown); level of schooling ($<$ or $\geq$ eight formal years); monthly income (in multiples of the minimum wage); religion (yes/no); duration of pain (months); affected side (right/left); dominance (right-handed/left-handed).

Data Analysis

The categorical variables were presented as frequencies and percentages, while the continuous variables, as mean, standard deviation, maximum and minimum values.

The Kolmogorov-Smirnov test was used to verify the distribution of sample data. The Cronbach alpha coefficient was calculated to verify the internal consistency and reliability of the ICF and DASH at T_0, T_4, and T_{12}. The Chi-squared test was used to verify the homogeneity of the sample. The paired *t*-test was used to compare the means of the ICF checklist items and DASH in the different periods: T_0xT_4, T_4xT_{12}, and T_0xT_{12}. Statistical analyses were performed using the Statistical Package for the Social Sciences (IBM SPSS for Windows, IBM Corp., Armonk, NY, United States) software, version 20.0. The probability of rejecting the null hypothesis was 5%.

Results

The number of patients with AC who were recruited was 52; however, 9 had primary CA, 13 with secondary CA did not want to undergo the SSNB, 3 with secondary CA did not have time to participate, and 2 did not return with the test results requested. So, the final sample was composed of 25 participants with AC.

The sociodemographic and clinical data of the sample are summarized in ►**Table 1**. The mean age was of 58.16 years, and the duration of the pain symptoms ranged from 2 to 16 months, with a mean of 5.92 months.

►**Table 2** shows the reliability and internal consistency analysis of the ICF and DASH at T_0, T_4, and T_{12}, with a Cronbach alpha > 0.80.

►**Table 3** shows the results of the mean, standard deviation, maximum and minimum values of the ICF checklist domains, as well as the DASH scores at T_0, T_4, and T_{12}.

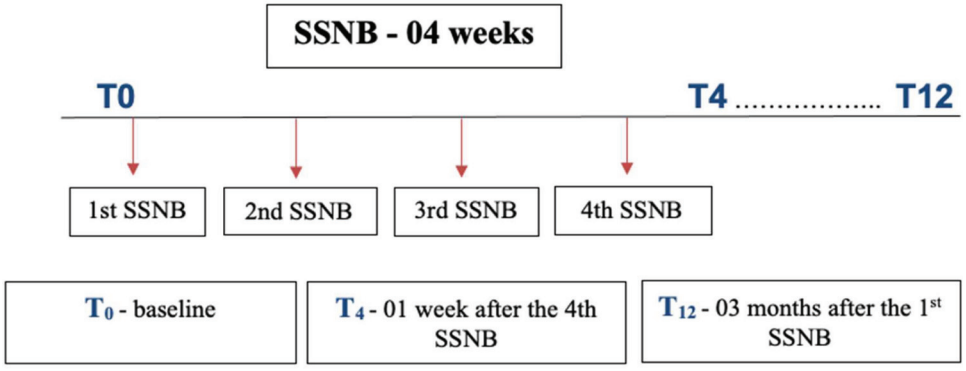

Fig. 4 Flowchart of assessment of the adhesive capsulitis patients through the ICF checklist and the DASH during the three months of the study. Abbreviations: SSNB, suprascapular nerve block; T, injection time; ICF, International Classification of Functioning, Disability and Health; DASH, Disabilities of the Arm, Shoulder and Hand questionnaire.

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Table 1 Sociodemographic and clinical data of adhesive capsulitis patients ($n = 25$)

Variables	n	%	p^*
Gender			
Female	16	64.0	
Male	9	36.0	0.162
Age			
$\leq$ 60 years old	15	60.0	
$>$ 60 years old	10	40.0	0.317
Monthly income			
1 to 2 minimum wages	7	28.0	
3 to 4 minimum wages	8	32.0	0.756
$\geq$ 5 minimum wages	10	40.0	
Ethnicity			
White	17	68.0	
Black	2	8.0	**0.001**
Brown	6	24.0	
Religion			
Yes	24	96.0	
No	1	4.0	**0.000**
Level of schooling			
$<$ 8 years	4	16.0	
$\geq$ 8 years	21	84.0	**0.001**
Affected side			
Right	17	68.0	
Left	8	32.0	0.072
Dominance			
Left-handed	2	8.0	
Right-handed	23	92.0	**0.000**
Duration of pain			
2 to 6 months	12	48.0	
$>$ 6 months	13	52.0	0.841

Note: *Chi-squared test.

Table 2 Cronbach reliability coefficient regarding the ICF checklist and DASH at T_0, T_4, and T_{12} ($n = 25$)

	Cronbach alpha	Number of items
ICF at T_0	0.91	54
ICF at T_4	0.87	54
ICF at T_{12}	0.85	54
DASH at T_0	0.87	30
DAHS at T_4	0.96	30
DASH at T_{12}	0.94	30

Abbreviations: DASH, Disabilities of the Arm, Shoulder and Hand questionnaire; ICF, International Classification of Functioning, Disability and Health; T_0, baseline; T_4, one week after the fourth suprascapular nerve block (SSNB); T_{12}, three months after the first SSNB.

The analysis of the general classification of the ICF Checklist enabled us to verify that, at the beginning of the study (T_0), the individuals had functional disability, which restricted and limited their activities. At T_{12}, they presented lower values in terms of the extent of the disability, represented by the ICF qualifiers, mainly in the categories of performance and capacity, when compared with the beginning of treatment. Likewise, the DASH scores decreased, which expresses an improvement in upper limb function.

►**Table 4** shows the t-paired test analysis comparing the mean scores on the ICF checklist and DASH at T_0, T_4, and T_{12}. The score on the ICF checklist showed improvement in all domains as early as T_4, except for the environmental factors, which only improved at 03 months ($p = 0.037$). In the evaluation of the DASH, the patients had already reported an improvement in shoulder function at T_4 ($p = 0.019$), which improved even more at the end of data collection (T_{12}).

Discussion

The functionality of AC patients improved after four weeks (T_4) of SSNB injections (one per week) according to the two patient-reported outcome measures used: the ICF checklist and the DASH. This improvement continued until three months after the beginning of the treatment (T_{12}). The single ICF domain that improve only in T_{12} was environmental factors.

We need to know more about the health status of people with AC. The data collected in the present study contributed to the assessment of the treatment, and they can point to a new perspective regarding the assessment of functionality in the field of orthopedics.[22] The results of the present study showed that the ICF checklist and the DASH enable the identification of the level of impairment of the individual and of the upper limb before the procedure, as well as the clinical evolution after it.

Studies[23,24] on other health conditions that used the ICF checklist highlighted the value of this tool.[23,24] Magalhães et al.[23] evaluated work-related repetitive stress disorders/musculoskeletal disorders, and found that, the ICF enabled the identification of the clinical and social aspects experienced by patients during rehabilitation and their return to work. Silveira et al.[25] evaluated individuals with Parkinson disease, and the results demonstrated that the ICF seems to have good ability and sensitivity to address aspects of functionality regarding this disease.

Access to information about functionality has been a priority in the treatment of certain diseases, and the ICF is a tool with great applicability to guide these functionality processes.[26] Therefore, there is a need to check the importance of including the ICF in the clinical measures, as it considers the biopsychosocial context in which the individual is inserted. In the present study, all ICF domains had already improved in the outcome studied at T_4, except for the "environmental factors."

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Table 3 Mean, standard deviation, maximum and minimum values of the ICF checklist and DASH scores at T_0, T_4, and T_{12} ($n = 25$)

	n	Mean	SD	Min.	Max.
ICF checklist					
T_0					
Body functions	25	46.82	7.65	31.82	59.09
Body structures	25	62.50	8.84	50	75
Activity and participation –performance	25	38.53	14.96	1.47	64.71
Activity and participation – capacity	25	42.59	12.41	16.18	64.71
Environmental factors	25	57.71	9.26	39.29	75
T_4					
Body functions	19	32.06	9.90	11.36	52.27
Body structures	19	50.00	12.50	37.5	75
Activity and participation – performance	19	9.91	9.67	1.47	35.29
Activity and participation – capacity	19	25.77	9.55	5.88	39.71
Environmental factors	19	55.45	7.28	35.71	64.29
T_{12}					
Body functions	19	19.02	9.62	6.82	36.36
Body structures	19	50.66	11.39	25	62.50
Activity and participation – performance	19	8.90	8.64	1.47	32.35
Activity and participation – capacity	19	22.68	8.21	4.41	33.82
Environmental factors	19	54.89	7.92	35.71	67.86
DASH					
DASH at T_0	25	50.68	11.18	28	67
DASH at T_4	19	42.37	16.88	5	70
DASH at T_{12}	19	29.58	13.33	7	51

Abbreviations: DASH, Disabilities of the Arm, Shoulder and Hand questionnaire; ICF, International Classification of Functioning, Disability and Health; Max., maximum; Min., minimum; SD, standard deviation; T_0, baseline; T_4, one week after the fourth suprascapular nerve block (SSNB); T_{12}, three months after the first SSNB.

These "environmental factors" are composed of the physical, social and environmental actions through which people live and lead their activities.[9,12,15] In the present study, the results showed that the environmental factors did not represent barriers (negative) or facilitators (positive) before T_{12}, and that the lived experience did not interfere with the disease nor impacted the individual's functionality. It is important to know that this domain still lacks clarity about the scope of the personal factors, and if it really represents an influence on the individual's specific functionality.[10,12,26]

Jung et al.[27] compared the efficacy of SSNB and intra-articular corticosteroid injection in two intervention groups

Table 4 Comparative analysis of the ICF checklist and DASH scores mean values at T_0, T_4, and T_{12} ($n = 25$)

	T_0 X T_4	T_4 X T_{12}	T_0 XT_{12}
	p^*	p^*	p^*
ICF Checklist			
Body functions	**0.000**	**0.000**	**0.000**
Body structures	**0.000**	0.841	**0.000**
Activity and participation – performance	**0.000**	**0.005**	**0.000**
Activity and participation – capacity	**0.000**	**0.000**	**0.000**
Environmental factors	0.134	0.547	**0.037**
DASH	**0.019**	**0.003**	**0.000**

Abbreviations: ICF, International Classification of Functioning, Disability and Health; DASH, Disabilities of the Arm, Shoulder and Hand questionnaire; T_0, baseline; T_4, one week after the fourth suprascapular nerve block (SSNB); T_{12}, three months after the first SSNB.
Note: *Paired *t*-test.

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during a two-month evaluation, and they concluded that the association of interventions significantly improved the pain and functional outcomes of the patients. In the present study, the parameters that indicate significant improvement were observed in the first month of treatment with the SSNBs (T_4), which was confirmed by the DASH and the ICF checklist.

The strategy used in the present study was composed of four injections of SSNB in seven-day intervals over the course of four weeks; however, Mortada et al.[28] compared single and multiple blocks (nine injections) in three weeks, and they highlighted that this number of injections yielded better results than a single one. In the present study, improvement in shoulder function was observed with fewer applications until 12 weeks, which corroborates the findings by Haque et al.,[29] who recommended the SSNB as the initial procedure of choice in patients with AC. The guidance by ultrasound[28] or anatomical limits[8] is effective regarding the SSNB, with comparable results.[30]

The use of the DASH to assess upper limb disabilities before and after the treatment is satisfactory, as it is easy to apply, and enables the monitoring of the patient in the clinical setting.[21] A wide variety of available outcome tools, including the DASH, demonstrate acceptable levels of measurement properties, and are appropriate for virtually every patient with a shoulder disorder.[22]

The limitations of the present study include the lack of a control group submitted to another intervention for comparison. Some risk factors were not analyzed, neither were the comorbidities and other methods of treatment. The non-probabilistic sampling, of the consecutive type, may have imposed a selection bias, not enabling all patients to participate in the study. Moreover, we do not know if more severe AC patients had worse results.

However, the strengths of the study are the validated instruments (with good internal consistency that have been translated into Brazilian Portuguese, which enables the comparison across different cultures); the longitudinal clinical design with follow up; the well-defined eligibility criteria, and the absence of similar studies in the literature. All patients were submitted to x-rays and magnetic resonance, as well as to a complete clinical evaluation performed by the same shoulder specialist who performed the SSNB, who was not the same researcher who collected the data.

The simultaneous application of the DASH and ICF tools (patient reported outcome measures) in AC patients is the novelty of the present study. The correlation of these two instruments applied in AC patients is under analysis to be published in the near future, which will enable us to understand if they complement each other or not.

Conclusion

According to the ICF and DASH, the SSNBs improve the functionality of AC patients. This improvement lasted up to three months after the beginning of procedure. The single ICF domain that only improved at T_{12} was "environmental factors".

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

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