

Efficacy and Adaptability of Use of the Shoulder Pacemaker® Device During the Strengthening Phase of Shoulder Rehabilitation

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ABSTRACT

Shoulder pathology is one of the most common causes of care in Orthopedics, being caused by multiple entities such as instability, rotator cuff injuries, osteoarthritis, adhesive capsulitis, among others, which can present several signs or symptoms, and that will require comprehensive management. One of the fundamental pillars in the management of shoulder pathology is physiotherapy. Technological advancements have allowed the advent of devices that help us improve the physiotherapy process. In this study, we share our experience with the use of the Shoulder Pacemaker®, a device designed to improve muscle balance in patients with shoulder pathology.

Key words: Shoulder; instability; rotator cuff; osteoarthritis; rehabilitation; Shoulder-pacemaker.

Level of Evidence: III

Eficacia y adaptabilidad de uso del dispositivo Shoulder Pacemaker® durante la fase de fortalecimiento en la rehabilitación de hombro. Estudio preliminar

RESUMEN

La patología de hombro es una de las causas más comunes de atención en salas de Ortopedia, y puede deberse a múltiples entidades, como inestabilidad, lesiones del manguito rotador, artrosis, capsulitis adhesiva, que pueden provocar un sinnúmero de signos o síntomas, y requerirán un manejo integral. Uno de los pilares fundamentales en el manejo de la patología de hombro es la fisioterapia. El avance tecnológico ha permitido la incorporación de dispositivos que nos ayudan a mejorar el proceso de fisioterapia. En este estudio, compartimos nuestra experiencia con el uso del Shoulder Pacemaker®, un dispositivo diseñado para mejorar el balance muscular en pacientes con patología de hombro.

Palabras clave: Hombro; inestabilidad; manguito rotador; artrosis; rehabilitación, Shoulder-Pacemaker®.

Nivel de evidencia: III

INTRODUCTION

The treatment of shoulder pathology and its complex approach force us to understand its intricate anatomy and biomechanics, considering that the shoulder is a joint complex that is made up of four joints (glenohumeral, acromioclavicular, scapulothoracic, sternoclavicular), making it the joint with the greatest range of motion of the body. It allows the upper limb to be placed in multiple positions; however, this same characteristic is what predisposes it to the appearance of diseases.¹

We understand the shoulder as a functional unit that, in order to work properly, needs its structures to work in coordination. Its anatomical structure allows functions that include six degrees of freedom, three of rotation and three of translation.² Translation movement is the difference between the humeral head and the glenoid, while

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rotation has three degrees: internal and external rotation in relation to the trunk, medial and lateral rotation in relation to an anteroposterior axis perpendicular to the plane of the scapula, and an anterior and posterior tilt along an established axis at the spine of the scapula, characteristics that allow the shoulder a wide range of motion and must be well understood to adequately comply with physical therapy programs.^{3,4}

The stability of the glenohumeral joint is given by the passive components that correspond to bone geometry, intra-articular pressure, the glenoid labrum and capsuloligamentary structures. Regarding the active components, the contractile muscle activity around the joint is modulated by the neuromuscular system.⁵

This dynamic stabilization factor can be improved by exercises. There are two fundamental aspects that must be taken into account during the strengthening phase: the specific strength level of each muscle group and the balance of forces on the muscles that act in the same joint.⁶

This has a great impact on the treatment of certain types of glenohumeral instability.

The Stanmore classification of glenohumeral instability is based on the analysis of the combination of structural abnormalities (traumatic or atraumatic) and alterations of the neurological system.⁷ Three entities are thus defined (Table) that can be related to each other. Both the therapist and the surgeon play a fundamental role in their treatment, be it conservative or surgical, understanding that type I shall be managed surgically, type II shall initially be treated conservatively, and then surgically if there is no response, and type III, which generally requires a conservative approach, shall be treated with exercises focused on activating the center of rotation of the organism where the functional kinetic chain (core) begins, and postural education with the final objective of achieving adequate activation of the rotator cuff.⁸

Table. Stanmore classification

Polar I	Traumatic structural instability
Polar II	Atraumatic structural instability
Polar III	Abnormal muscle activation instability

Taken from Jaggi A, Lambert S. Rehabilitation for shoulder instability. *Br J Sports Med* 2010;44(5):333-40.

On the other hand, in the case of rotator cuff pathologies, rehabilitation based on the consensus of the American Society of Elbow and Shoulder (ASES) with the American Society of Shoulder and Elbow Therapists (ASSET) sets clear objectives, such as restoring ranges of both active and passive motion, an adequate couple of forces between the glenohumeral joint and the scapulothoracic joint, and restoring pain-free shoulder function.⁸

Finally, the objective of rehabilitation in patients who have undergone shoulder arthroplasty must be based on three fundamental pillars: protecting the joint, protecting the deltoid, and establishing clear expectations regarding the ranges of motion and functionality that the operated shoulder may have,⁹ that is, the management of the periarticular musculature is very important.

Regular physical therapy and commonly available muscle training therapy do not always lead to the desired result and this led to the development of an adjunctive technology called Shoulder Pacemaker®.⁹ Its functioning is based on stimulating hypoactive muscles during shoulder movement to restore muscle balance (Figure 1).

The first formal indications for the use of the Shoulder Pacemaker® device were posterior instability and scapular dyskinesis, but the vast majority of shoulder pathologies present a significant percentage of added scapular dyskinesis. The postoperative immobilization itself generates muscle weakness, alteration of force couples and could cause temporary dyskinesis.

The objective of this study was to retrospectively evaluate the results with the use of this device in a series of patients with shoulder pathology.



Figure 1. Example of use of the device during a rehabilitation session.

MATERIALS AND METHODS

A retrospective study was conducted between December 2020 and December 2021, including a search of our outpatient database and the electronic registry of our Shoulder Pacemaker® device. All patients who completed the physical therapy process and used the device during it were identified. After the identification of cases, an electronic survey was carried out that the patient had previously accepted by means of a telephone call.

The inclusion criteria were: patients who clinically presented scapular dyskinesia that was not easily reversed with the usual treatment, either with only conservative or post-surgical management, or with posterior instability. Patients who were undergoing treatment, those who expressed their wish not to participate, and those who could not be located were not included.

The elements that were assessed were the functionality after the use of the device through the Simple Shoulder Test (SST)¹⁰ and a satisfaction and adaptability survey on the use of electronic devices as a complement to the conventional physiotherapeutic process.

RESULTS

The review of medical records revealed a total of 16 patients who had used the Shoulder Pacemaker® device as an adjuvant in the physical therapy process. One of them expressed his desire not to participate in the research process, two could not be located and one was undergoing treatment, for which he did not meet the inclusion criteria; therefore, the final sample consisted of 12 patients.

Seven patients were men and 5 women; the average age was 49.8 years (range 18-67). The affected side was the left in seven cases and the right in five, there was no bilateral pathology. Six clinical entities were identified, in which rotator cuff pathology predominated. It should be noted that surgical or non-surgical management was not discriminated in patients with this diagnosis, who represented half of the sample. In [Figure 2](#), the identified entities are detailed.

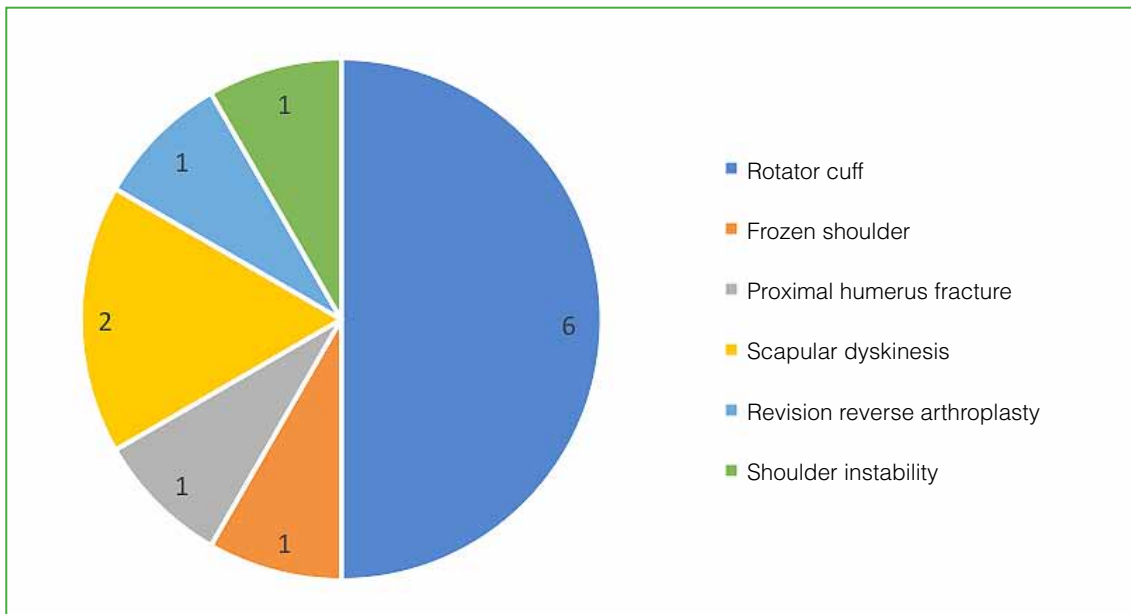


Figure 2. Pathologies addressed in our study.

The functionality of the affected shoulder was assessed with the SST, which yielded an average value of 79.86%. In 10 of the 12 patients, the average SST value was 90%, two cases had a poor evolution with an average of 29.16%. **Figure 3** shows the results after the final evaluation.

The average satisfaction and adaptability rate was high, the best outcomes were obtained in rotator cuff pathology and instability, there were two cases with a low functional assessment.

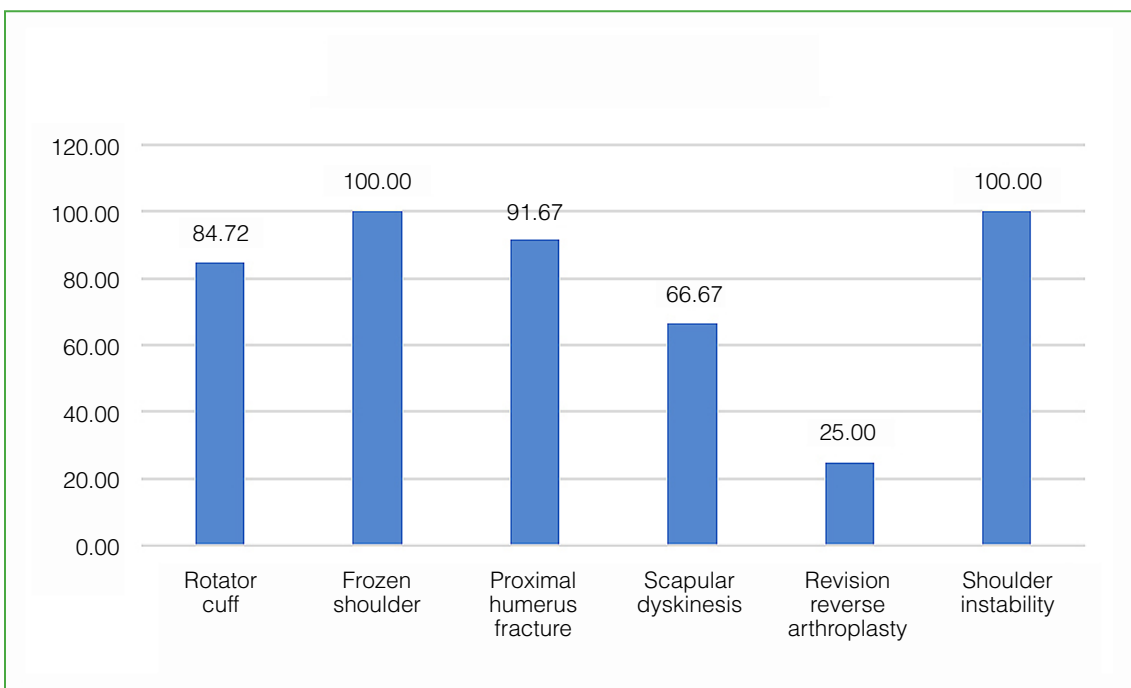


Figure 3. Average evaluation of the Simple Shoulder Test.

DISCUSSION

The device is relatively new to the market, and there is little literature to support its use in various pathologies. In 2017, Moroder et al.¹¹ carried out a pilot study whose objective was to demonstrate the functionality of this device in the activation process of hypoactive external rotator and periscapular muscles. Three patients with a diagnosis of instability and previous failed conservative treatment participated. These patients described that they were able to move their arms freely and without pain, and even without subjective or objective signs of instability, they all rated it as excellent in their rehabilitation process.

In 2020, Moroder et al.¹² carried out a case series study that included 24 shoulders in 16 patients with a diagnosis of posterior functional instability and previous failed conservative treatment and a follow-up of up to 2 years. The authors reported favorable outcomes, with a reduction in the rate of instability assessed with the WOSI (Western Ontario Shoulder Instability Index) scale, and excellent outcomes at the one and two-year follow-up. 81% were very satisfied with the device and 19% were satisfied. All would recommend its use to other patients.

In our study, there were two cases with low values. The first of them corresponds to a patient who underwent a shoulder arthroplasty due to fracture, with subsequent periprosthetic infection, plus extraction of the implant, surgical cleaning and placement of a cement spacer, and who, in a third surgical stage, underwent a reverse shoulder arthroplasty procedure in the context of pseudoparalysis and deltoid deficit, with a poor final functional assessment and a 25% SST. However, he was satisfied with the functionality remaining at the end of the process and reported that the device was easy to use. The second case that had a torpid evolution was a patient diagnosed with scapular dyskinesia and confirmed suprascapular nerve entrapment who underwent arthroscopic release, his functional ranges and scapular biomechanics were clinically excellent, but he suffered persistent neuropathic pain, which we believe influenced his score of 33.33% on the SST. He reported that the device was easy to use, but that he was not satisfied with its use. Currently, this patient is receiving pain therapy with excellent results; however, when the SST was performed, he was not in the same condition as he is today.

These two cases are considered exceptional and do not correspond to the average number of patients, but they deserve to be reported to establish a basis on the scope that the use of the device can have.

There are no published reports on the use of this device in pathologies other than those of instability, although our study includes a small number of patients, it has been shown that the indication of the device can be extended.

It is important to mention that the manufacturer has recently expanded the indications of use for other pathologies, such as pre- and postoperative management of inverted arthroplasty, rotator cuff rehabilitation, scapular dyskinesia, posterior instability, and announced that it will soon be expanded for weight-bearing athletes, pre- and post-operative deltoid rehabilitation, overhead athlete rehabilitation, and throwing athlete rehabilitation.

Knowing the limitations of retrospective studies and the probable bias that can be generated, we consider this study to be a pioneer in communicating the benefits of the Shoulder Pacemaker® device in the physical rehabilitation process.

Eleven of our patients recommended the use of the Shoulder Pacemaker® device as an adjunct in the physical therapy process to achieve excellent outcomes in the activation phase and one patient was not entirely satisfied with the device.

CONCLUSIONS

The use of electronic devices in medicine has grown exponentially in recent years, the ease of access to medical technologies has favored the development of increasingly effective diagnostic and therapeutic methods and with better results for the patient. In this study, we highlight the Shoulder Pacemaker® device in the physical rehabilitation process, where excellent outcomes have been observed in multiple pathologies, which expands the treatment possibilities for our patients, making it a practical, reliable, and safe method that is available to our patients.

Conflict of interests: The authors declare no conflicts of interest.

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