

THE USE OF SHOCK WAVE TREATMENT IN THE REGENERATE OF TIBIAL PSEUDARTHROSIS

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Abstract: Pseudarthrosis is defined by a failure of bone healing without radiographic evidence of progression. Treatment first consists of identifying its type, according to the three classifications of the pathology, well vascularized, poorly vascularized and synovial. The surgical process in these cases is the most used, however, a less invasive technique has been applied, Shock Wave Treatment (TOC). TOC is performed with a device that emits acoustic waves, with a greater energy capacity than Ultrasound, applied to the injured region. Sessions last an average of ten to twenty minutes, and each patient reacts differently to the process, however, studies show that from the third session onwards it is already possible to notice the first results. Treatment using shock waves aims to release free radicals, nitric oxide, growth factors and cell differentiation, therefore generating an increase in collagen production and an increase in neovascularization and angiogenesis, thus stimulating regeneration tissue. To act this way, the technique helps in the complete healing of the fracture by more than 70%, being considered effective in pseudarthrosis. This case study has data from the treatment of a patient with a fracture of the left tibia, who underwent a surgical procedure that progressed to chronic osteomyelitis (COM) and pseudarthrosis, with a total of five TOC sessions being carried out, in which a significant improvement was obtained in the clinical picture of the patient.

Keywords: Pseudoarthrosis; Tibia; Regenerative medicine; Ilizarov technique

INTRODUCTION

The word pseudarthrosis is used in a situation in which a bone injury or fracture does not show radiographic evidence of progression of the consolidation process, indicated by sclerosis at the ends of the fracture, presence of a hiatus, absent or hypertrophic

callus and persistence or widening of the feature. of fracture. (1)

It is evident that the implementation of the term pseudarthrosis is still controversial among authors, causing conflicts regarding the appropriate time to characterize a fracture as a pseudarthrosis, which is why the consolidation delay was created. Relating the normal time for fracture consolidation (dependent on numerous variables such as energy involved, soft tissue injury, form of treatment and infection) and pseudarthrosis (which does not have a defined time to be diagnosed).

The pathology is classified and divided into three types according to its profile, being used to better understand its treatment. Classified as well vascularized, when it occurs due to lack of adequate mechanical stability leading to local detachment of the periosteum, causing additional bone formation, as poorly vascularized, due to devascularization of bone fragments adjacent to the fracture site, or due to the high energy of the trauma or surgery, and synovial tissue, composed of fibrocartilaginous tissue that produces synovial fluid, can result from prolonged persistence of movement at the fracture site. (3)

Therefore, the treatment of pseudarthrosis is determined by the classification and profile of the patient, making it possible to use several methods in the treatment, such as osteoperiosteal scaling, cancellous autograft, the addition of bone morphogenetic protein (BMP), cell concentrate, bone marrow stem and platelet growth factors, bone callus distraction with external fixators, vascularized bone graft in bone loss, internal stabilization materials, external stabilizers (external fixators or orthoses), in addition to ultrasound, waves of shock and electromagnetic fields.(4)

In 1998, in Brazil, the use of shock waves applied to the musculoskeletal system began with the arrival of the first urological

lithotripsy machines, which were adapted for use in orthopedic injuries. The introduction of this tool made it possible to measure the depth and strength with which shock waves penetrate the human body. (5)

The physiology of Shock Wave Treatment is determined by the penetration of waves into tissues without damaging the skin, vessels and nerves. When it reaches the injured area, the shock waves promote a mechanical stimulus that induces a series of biological effects, such as: increased production of prostaglandins related to the tissue repair process; increased local blood congestion and microcirculation and increased concentration of nitric oxide in the area, generating pain relief. (6)

MATERIALS AND METHODS

This is a case report based on data acquired from the patient's medical records, photographic records of the diagnostic and therapeutic methods to which the patient was subjected. For the theoretical basis of this study, information was acquired from reference bibliographic materials in orthopedics, oncology and pediatrics, in addition to an extensive search for articles in databases such as PubMed and SciELO.

A meticulous reading was carried out on the selected articles, with the aim of comparing the advances in OCD over the years, until it was included in musculoskeletal treatment.

REPORT OF CASE

In October 2013, N.G.B., male, sought medical care reporting that he had suffered an accident, with a fracture of his left lower limb, undergoing surgery at a public hospital in Cuiabá, M.T. (Photography 1). After the procedure, the patient developed COM and pseudarthrosis, the patient presented mobility of the focus and secretion. In January 2022, at the age of 62, surgical treatment of COM and left tibia pseudarthrosis was performed

using the corticotomy technique and bone lengthening with an Ilizarov-type triplanar external fixator (Photography 2).

During weekly follow-up, with x-rays, it was identified at 18 weeks that the regenerated bone was in poor condition radiographically and the patient had edema in the operated limb (Photography 3). During this period, stretching was paused in an attempt to improve the vascular and radiographic conditions of the regenerate. In the 23rd post-operative week, weekly TOC was started, with a total of five sessions being carried out with the device, with radiographic control 9 weeks after TOC, visualizing reorganized bone formation in both the medullary and cortical bone as well as the regenerated bone (Photography 4, 5 and 6).

DISCUSSION

Although there are new technological advances in the field of trauma surgery, it is still challenging to treat a group of fractures that present changes in the consolidation process and culminate in pseudarthrosis. It is estimated that around 10% of long bone fractures progress to a delay in bone healing or even pseudarthrosis. (7)

There are several possibilities for surgical treatments, however, the advancement of technology in regenerative medicine allows for a new front of less invasive therapy and promising results in the therapeutic opportunity. Therefore, OCD is modern and effective, being indicated when conventional methods do not achieve healing or when the recovery process is slow.

Since its implementation in the orthopedic and traumatology area, TOC has been increasingly used and studied. There are several ways of generating shock waves that can be used in the technique, data found in the literature indicates that hydraulic, magnetic, piezoelectric and pneumatic generators can be used. In Brazil, all methods are used, but

mainly pneumatic and hydraulic. (8,9)

As for the mechanism of action on tissues, the basis of a mechanical action induces a biological action that alters cellular permeability and promotes an increase in the concentration of tissue regeneration factors and vascular regeneration factors in the stimulated site. (9)

Finally, the present study confirms that shock wave treatment is a safe approach for the treatment of pseudarthrosis of long bones, since no local or systemic complications were observed, in addition to an improvement in the clinical and radiology of the patient during the TOC sessions.

CONCLUSION

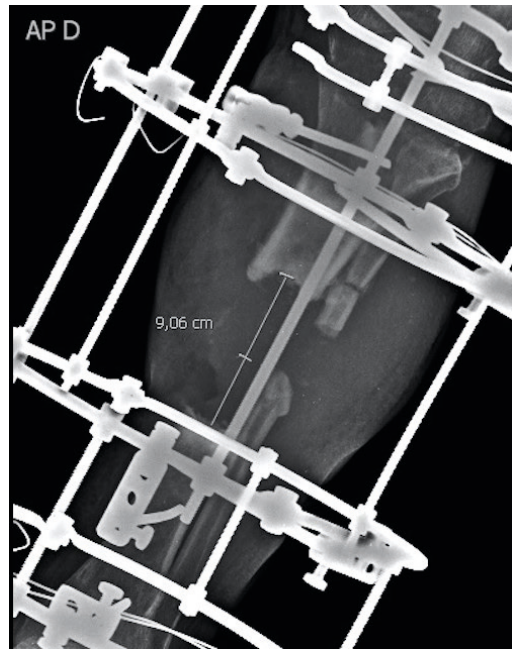
Shock wave treatment can be used in a wide range of ways in orthopedics, however, the scientific field still has a lot to add to the topic. This study concluded that TOC is a safe and non-invasive method for chronic cases in which conventional treatments have not been satisfactory in tibial nonunion.

FIGURES



Photography 1: Pre-surgical radiography with pseudarthrosis

Source: Photograph recorded by the authors in 2022.



Photography 2: Beginning of bone lengthening

Source: Photograph recorded by the authors in 2022.



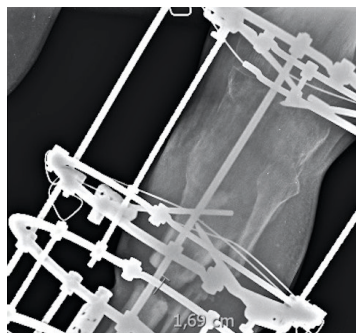
Photography 3: 23rd week of stretching

Source: Photograph recorded by the authors in 2022.



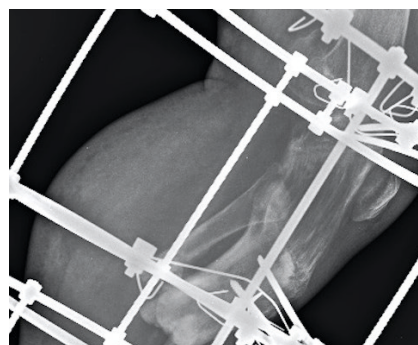
Photography 4: Carrying out the TOC

Source: Photograph recorded by the authors in 2022.



Photography 5: RX AP após 9 semanas de TOC

Source: Photograph recorded by the authors in 2022.



Photography 6: RX perfil após 9 semanas de TOC

Source: Photograph recorded by the authors in 2022.

REFERENCES

1. Bastos Filho R, Lermontov S, Borojevic R, Schott PC, Gameiro VS, Granjeiro JM. Terapia celular da pseudoartrose. Acta Ortop Bras. [online]. 2012;20(5): 270-3. Disponível em URL: <http://www.scielo.br/aob>.
2. Reis FB., Faloppa F., Zumiotti A.W., et al: Tratamento das pseudoartroses da diáfise dos ossos do antebraço com osteossíntese com placas de compressão e enxertia óssea autóloga. Rev Bras Ortop 38: 676-691, 2003.
3. Rosen H.: "Fracture healing and pseudoarthrosis". In: Radiology: diagnosis-imaging-intervention. Philadelphia, Lippincott, 1986.
4. Rosen H.: "Treatment of nonunion". In: Operative orthopedics. Philadelphia, Lippincott-Raven, p. 489-509, 1988.
5. Kertzmana P., Lenzab M., André Pedrinelli A., Benno Ejnismann B. Tratamento por ondas de choque nas doenças musculoesqueléticas e consolidação óssea - Análise qualitativa da literatura. Rev Bras Ortop. 2015, 50(1): 1-8. 2014.
6. Kertzman PF, Duarte Júnior A. Terapia por ondas de choque –Uma nova opção para o tratamento de tendinopatias crônicas. Rev Bras Med. 2011;68(1):24-8. 7. Reis FB, Hubngria Neto JS, Pires RES. Pseudoartrose. Rev Bras Ortop. 2005;40(3):79-88.
7. Ogden JA, Tóth-Kischkat A, Schultheiss R. Principles of shock wave therapy. Clin Orthop Relat Res. 2001;(387):8-17.
8. Wang CJ, Huang HY, Pai CH. Shock wave enhances neovascularization at the tendon-bone junction. J Foot Ankle Surg. 2002;41(1):16-22