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Alejandro Alvarez López *

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Research Article

Arthrodiastasis in Knee Osteoarthritis

Alejandro Alvarez López

Department of Orthopaedic Surgery. Full professor. University Children's Hospital of Camagüey. Camagüey city. Cuba.

***Corresponding Author:** Alejandro Alvarez López, Department of Orthopaedic Surgery. University Children's Hospital of Camagüey. Camagüey city. Dolores Betancourt No 2. Camagüey city. Camagüey. Cuba.

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Abstract

Background: Knee osteoarthritis is a common disease and affects a large group of patients, especially those over 40 years of age. Treatment can be conservative or surgical; the latter one includes those that preserve the joint, such as arthrodiastasis.
Aim: to provide updated and detailed information on arthrodiastasis for patients suffering from knee osteoarthritis.
Methods: PubMed, Hinari, SciELO and Medline databases were searched for citations from October 1st 2022 to November 30th 2022 using the EndNote search manager and reference manager. Out of 162 articles, 30 selected citations were used in this review, being 23 of the last five years.
Results: the effects of arthrodiastasis in patients with osteoarthritis of the knee are mentioned. The procedures that can be combined with this surgical modality, both arthroscopically and with biological rescue therapies are described. Reference is made to the indications for arthrodiastasis and the main differences with osteotomy and arthroplasty. The results of arthrodiastasis by various authors in patients with osteoarthritis of the knee are shown.
Conclusions: arthrodiastasis is a surgical method that preserves the knee joint, its indications are very specific and it is not a frequently used modality. To achieve distraction of the joint, an external fixation device is needed, which is applied for an average time of six weeks. Complications are minimal and are mostly related to the use of the distraction device.

Keywords: knee osteoarthritis; knee joint distraction; arthrodiastasis; external fixation; surgical treatment

Introduction

Osteoarthritis is the most frequent chronic degenerative disease, affecting 10% of the population after the age of 60, according to Goh et al. [1].

Treatment aims to relieve pain and improve joint function, for this purpose conservative and surgical techniques are used, the latter justified by the failure of the first one [2,3].

Surgical techniques are subdivided into those that preserve the joint such as: arthroscopy, osteotomy, proximal fibula ostectomy, which can be carried out both in isolation and in combination with other surgical procedures [4,5].

On the other hand, surgeries that do not preserve the joint include arthroplasty and arthrodesis; the arthroplasty can be partial or total [6].

Arthrodiastasis (joint distraction) of the knee is an alternative surgical method that preserves the patient's joint, which was initially introduced to correct joint malalignment and treat contractures; it is used in diseases of the knee, hip such as Perthes disease, in addition to ankle and knee osteoarthritis [7,8].

The main purpose of arthrodiastasis in patients with primary knee osteoarthritis lies in slowing down the degenerative process of the joint and avoiding more complex procedures like arthroplasty. For its realization, external fixators are used, which are used for a period of approximately six to eight weeks. [9,10]

Because of the increasing number of patients suffering from knee osteoarthritis in the population, the search for less expensive and effective treatment alternatives, the authors of this paper aims to provide updated and detailed information on arthrodiastasis for patients suffering from knee osteoarthritis.

Methods

An extensive literature search in various data bases such as: PubMed [https://pubmed.ncbi.nlm.nih.gov/], Hinari [https://www.who.int/hinari/es/], SciELo [https://scielo.org/es/] and Medline [https://medlineplus.gov] was carried out with search term including ' knee distraction AND knee osteoarthritis', 'arthrodiastasis AND knee osteoarthritis', 'knee joint distraction' from October 1st 2022 to November 30th 2022. Out of 162 articles, 30 selected citations were used in this review, being 23 of the last five years.

A review of biomechanical studies, originals, and case presentations in patients who underwent arthrodiastasis because of knee osteoarthritis were considered. Studies on animals and patients with knee fractures were excluded.

Mechanism of action and devices

The repair of cartilage damaged by degenerative arthropathy is based on three aspects when applying arthrodiastasis, the first that due to distraction, compression and shear forces on the cartilage are avoided and therefore reduce further tissue injury; second, the nutrition of the cartilage is maintained both with or without weight bearing of the extremity and third, during arthrodiastasis a transient periarticular osteopenia is triggered, which modifies the sclerosis present in the subchondral bone and therefore decreases the mechanical impact of the cartilage. In addition to what was stated previously, while distraction is applied, a large number of repair cells are released, which improves the biochemical and mechanical environment of the joint [11,12].

Arthrodiastasis is performed using an external fixation device consisting of two dynamic bars, one medial and the other lateral, joined by eight wires, half in the femur and the other in the tibia. At surgery, a distraction of two millimeters is performed, and then one millimeter per day until reaching five, an element that is verified by means of serial X-rays of the joint. After obtaining the desired distraction, medical discharge was given under prophylactic anti-thrombotic measures and the support of the extremity was allowed with the help of crutches. Serial cures of the wires are performed to avoid infection. At six weeks the external fixation is usually removed [13,14].

This joint distraction procedure can be combined with others such as those performed arthroscopically and include: debridement, microfractures, and nanofractures [15,16].

At the distraction time, therapies such as biological rescue through the administration of platelet-rich plasma and others like the administration of intra-articular hyaluronic acid can be applied [17,18].

Indications

The indications for arthrodiastasis are various, but most authors agree on its performance in young patients under 60 years of age, in whom it is convenient to apply surgical techniques that preserve the joint, other elements to take into account are the patients weight, since most authors recommend its use in patients with a body mass index below 35 kg/m2, in addition to joint mobility, which must be normal or at least 120 degrees of flexion. Indications according to the opinion of some researchers are shown in Table 1.

Author/Year	Indications
Jansen, et al. [19] (2021)	Age less than 65 years, radiographic status according to Kellgram and Lawrence of two or more, intact ligaments, normal range of motion (at least 120 degrees of flexion) and body mass index less than 35 kg/m2.
Besselink, et al. [20] (2020)	Patients under 65 years of age with varus deformity, normal range of motion (flexion greater than 120 degrees), stable knees and body mass index less than 35 Kg/m2.
Van der Woude, et al. [21] (2017)	Failure of conservative treatment, visual analog pain scale ≥ 60 mm and age less than 60 years.
Intema, et al. [22] (2011)	Age less than 60 years, visual analogue pain scale ≥ 60 mm, and radiographic signs of tibiofemoral osteoarthritis.

Table 1: Surgical indications for arthrodiastasis in patients with primary knee osteoarthritis according to some researchers.

Differences between arthrodiastasis, osteotomy and arthroplasty

There are differences between the surgical techniques of arthrodiastasis, osteotomy and arthroplasty when taking into account several factors such as: joint mobility, cost, degree of disease and conservation of the joint (Table 2) [23-25].

Factors	Arthrodiastasis	Osteotomy	Arthroplasty
Joint mobility after the procedure	Delayed six to eight weeks.	From one to two weeks.	Immediate
Cost	Low	High	Very high
Grade of knee osteoarthritis according to radiographic classification.	Intermediate degrees	Intermediate degrees	The most advanced of the disease.
Joint preservation.	Yes	Yes	No

Table 2: Main differences between arthrodiastasis, osteotomy and knee arthroplasty.

Results

Results of arthrodiastasis in patients with knee osteoarthritis

The studies consulted for the preparation of this article show the results in patients with knee osteoarthritis treated by arthrodiastasis in a follow-up period of 12 to 60 months, with a number of patients ranging from 15 to 62 (Table 3).

Authors/Years	Number of patients	Follow-up	Results
Jansen, et al. [19] (2021)	20	2 years	Clinical results are not inferior to arthroplasty and high tibial osteotomy.
Besselink, et al. [20] (2020)	20	2 years	The clinical benefits and the increase in cartilage thickness are maintained two years after treatment.
Hoorntje, et al. [26] (2020)	16	5 years	No differences were found between the results compared with osteotomy, it is a viable option for young patients.
Takahashi, et al. [27] (2019)	62	1 year	Similar results at 12 months after osteotomy and total arthroplasty.

Van der Woude, et al. [28] (2017)	20	5 years	Prolonged clinical benefits. Useful in young patients with severe knee osteoarthritis.
Dong et al. [29] (2017)	15	18 months	The combination of distraction with arthroscopic debridement is effective in relieving pain and improving joint function.
Intema, et al. [22] (2011)	20	1 year	Good clinical benefits are obtained.

Table 3: Results of arthrodiastasis of the knee in gonarthrosis.

In relation to the type of external fixation to be used, it could be monopolar, bipolar (Figure 1) or circular, there are no biomechanical differences according to a study carried out by Chowdhury et al. [30].

Figure 1. Bipolar external fixation used for knee distraction in a patient with gonarthrosis.

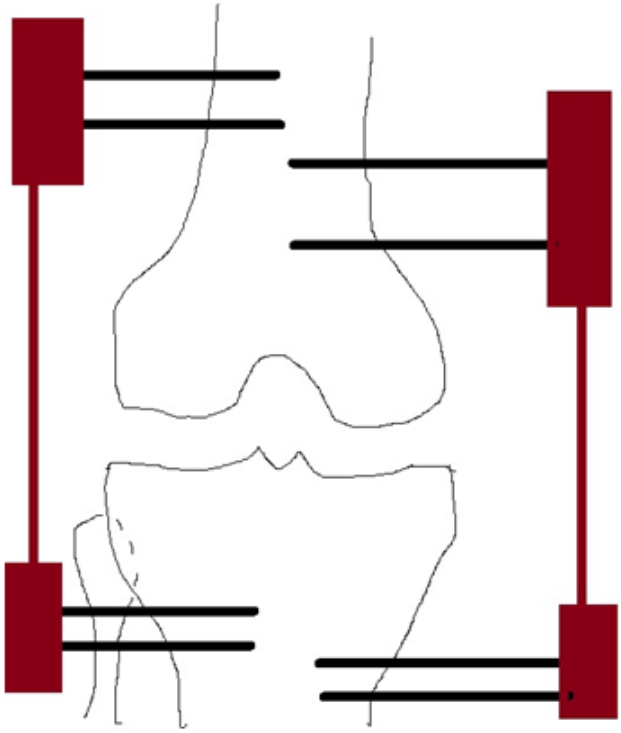

Figure 1: Graphic representation of a bipolar external fixator to perform arthrodiastasis of the knee.

The most common complications in patients treated by arthrodiastasis are: pin infection used in the distraction, possibility of osteomyelitis even after three weeks after removing the device, failure of the desired distraction, bone fractures in the area of the pins, and joint stiffness requiring manipulation under anesthesia [29,30].

Conclusion

Arthrodiastasis is a surgical method that preserves the knee joint, its indications are very specific and it is not a frequently used modality. To achieve distraction of the joint, an external fixation device is needed, which is applied for an average time of six weeks. Complications are minimal and are mostly related to the use of the distraction device.

Declaration of competing interest

Nil grants/funding

The author declares no conflict of interest.

The material has not been previously presented.

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