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REVIEW

Surgical Joint Distraction in Knee Osteoarthritis

E. Carlos Rodriguez-Merchan[1]

1 Department of Orthopedic Surgery, "La Paz" University Hospital-IdiPaz, Madrid, Spain

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Correspondence to: Dr. E. C. Rodriguez-Merchan, Department of Orthopaedic Surgery, La Paz University Hospital-IdiPaz, Paseo de la Castellana 261, 28046-Madrid, Spain.
Email: ecrmerchan@hotmail.com

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ABSTRACT

BACKGROUND: There is some controversy in the literature regarding the role of surgical joint distraction (SJD) in knee osteoarthritis (OA).

QUESTION: What are the benefits of SJD in knee OA?

METHODS: A Cochrane Library and PubMed (MEDLINE) search related to the role of SJD in knee OA was analyzed. The chief criteria for election were that the articles were centered on the aforementioned question.

RESULTS: 377 articles were found until April 30, 2017; however, only 9 were selected and reviewed because of their focus on clinical experience with SJD in knee OA. Two were considered level of evidence I-II, whereas 7 had a lower level of evidence (III-IV). SJD provides considerable clinical and structural ameliorations to patients with knee OA, postponing total knee arthroplasty (TKA) for at least 2 years.

CONCLUSIONS: SJD provides benefits in delaying TKR for at least 2 years, but there is a risk of pin tract infection. Moreover, of the 9 articles reviewed in this paper, 7 were reported by Dutch authors, potentially limiting the generalizability of the results. My view is that the role of SJD in knee OA is currently quite controversial and should not be recommended until further research is conducted.

Key words: Knee; Osteoarthritis; Surgical joint distraction; Benefits

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INTRODUCTION

Degenerative knee osteoarthritis (OA) involves about one third of human beings older than 65 years. If pain persists after non-invasive treatment, some intra-articular drugs can be attempted prior to surgical treatment[1,2]. Surgical management, including osteotomy, unicompartmental knee arthroplasty (UKA), and total knee arthroplasty (TKA), can be carried out if conservative management goes amiss[3-7].

Surgical joint distraction (SJD) is a surgical technique in which the two osseous ends of the knee are little by little separated then maintained in this position for 2 months by means of an external fixator. Weight bearing is kept on to make sure modifications in hydrostatic pressure within the knee joint[8].

The aim of this review was to look into the potential benefits of SJD in knee OA.

LITERATURE REVIEW

A review was performed on the influence of SJD on knee OA. The search engines used were MEDLINE (PubMed) and the Cochrane Library, and the final date was 25 August 2017. The keywords used were "knee joint distraction".

Of the 377 articles reviewed, only 9 were ultimately included because they were fully focused on the question of this article. Two of the 9 articles had a high level of evidence (grades I-II)[9,10] and 7

had a low level of evidence (grades III-IV)[8,11-16].

RESULTS

In patients younger than 60 years of age with knee OA who underwent SJD, distraction of 5 mm was employed for 2 months utilizing an external fixator[12]. Tissue structure change at 1 year of follow-up was assessed by means of radiographs (joint space width [JSW]), by magnetic resonance imaging (MRI) (fragmentation of cartilage morphology) and by biochemical markers of the turnover of collagen type II. Clinical amelioration was assessed by the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) and the Visual Analogue Scale (VAS) pain score. A significant increment in cartilage thickness (2.4-3.0 mm) and a significant reduction in denuded bone zones (22-5%) were found on MRI. Collagen type II levels exhibited a trend toward augmented synthesis and reduced breakdown. The WOMAC index significantly augmented, and VAS pain significantly diminished. Two patients had pulmonary emboli in spite of adequate anticoagulative prevention (nadroparin). Patients were in hospital for a week. Then, they went home in sound situation, keeping on treatment with acenocoumarol for 6 months. Of the 20 patients studied, 17 had unique or various pin tract infections. All were treated with antibiotics (flucloxacillin) for an average of 4 weeks with success. One patient had to return to hospital to be given intravenous antibiotics. No patient had osteomyelitis.

Aly et al. used SJD and arthroscopic lavage and drilling of cartilage defects at the same time in patients with knee OA[11]. Nineteen patients (15 women and 4 men; age range 39-65 years) underwent the aforementioned combined surgical treatment. A comparison was made between pre- and postoperative findings, and a control group was used for comparison. Follow-up was from 3 to 5 years. In the majority of patients, pain and walking capacity ameliorated, and radiographic joint space augmentation and amelioration in the tibiofemoral angle were observed.

In 2013, Wiegant et al. used SJD in the treatment of 20 patients with painful, severe end-stage knee OA, and TKA was indicated; the patients were younger than 60 years[16]. SJD was applied for 2 months (range 54-64 days) and clinical parameters were evaluated using the WOMAC questionnaire and the VAS pain score. MRI, radiography and biochemical analyses of collagen type II turnover (enzyme-linked immunosorbent assay) were used to measure changes in the cartilage structure. The average follow-up was 24 (range 23-25) months. Clinical amelioration was found at the 2-year follow-up: WOMAC significantly improved by 74%, and VAS pain significantly decreased by 61%. Cartilage thickness assessed by MRI was significantly greater at 2-year follow-up. Radiographic minimum JSW was significantly increased at 2-year follow-up as well. The denuded area of subchondral bone observed by MRI was significantly reduced at 2-year follow-up (8%). The ratio of collagen type II synthesis to breakdown was augmented at the 2-year follow-up.

A treatment approach commencing with TKA and an approach starting with SJD for patients of various ages and both sexes were simulated by van der Woude et al[13]. They used a Markov (health state) model to extrapolate results to long-term health and economic outcomes. The amount of surgical procedures, quality of life years (QALYs), and management costs per approach were determined. At a willingness to pay of €20,000 per QALY gained, the likelihood of a cost-effective result when commencing with SJD compared to starting with a TKA was seen to be over 75% for all age groups and over 90%-95% for the younger age groups.

Van der Woude et al. also compared two different periods of distraction: 6 weeks vs. 8 weeks[14]. Each group had 20 patients. Clinical outcomes were evaluated using WOMAC questionnaires and VAS pain scores. Cartilaginous tissue restoration was evaluated by radiographic JSW and MRI-perceived cartilage thickness. Both groups showed a significant augmentation in total WOMAC score, mean JSW and mean cartilage thickness on MRI.

In 2016, van der Woude et al. tried to prognosticate the grade of cartilaginous tissue restoration following SJD[15]. Fifty-seven patients underwent SJD. At baseline and at one year of follow-up, the mean and minimum JSW of the most-involved compartment were calculated on standardized radiographs. The mean JSW of the most affected compartment significantly augmented at one year. The minimum JSW importantly augmented at one year of follow-up. For a greater mean JSW one year after SJD, exclusively the Kellgren & Lawrence degree (KLG) at baseline was prognosticative. For a larger minimum JSW, KLG and male sex were significantly foretelling. Eight weeks of distraction time was in close proximity to significance.

In a controlled trial comparing SJD with TKA, 60 patients under 65 years of age with end-stage knee OA were randomized to either SJD (n = 20) or TKA (n = 40)[9]. Outcomes were evaluated at baseline and at 3, 6, 9 and 12 months. All patient-reported outcome measures ameliorated significantly over one year in both groups. Outcome Measures in Rheumatology-Osteoarthritis Research Society International clinical reply were 83% after TKA and 80% after SJD. A total of 12 patients (60%) in the SJD group had pin tract infections. In the SJD group, both the mean minimum (0.9 mm) and mean JSW (1.2 mm) augmented significantly.

In 2017, SJD was compared with high tibial osteotomy (HTO) in a randomized controlled trial[10]. Sixty-nine patients with medial knee joint OA with a varus deformity of < 10 degrees were studied. Patients were randomized to either SJD (n = 23) or HTO (n = 46). All patient-reported outcome measures (PROMS) ameliorated significantly over 1 year in both groups. At 1 year, the HTO group had unimportantly greater ameliorations in 4 of the 16 PROMS. The minimum medial compartment JSW augmented 0.8 mm in the SJD group and 0.4 mm in the HTO group, with the minimum JSW improvement in favor of SJD. In the lateral compartment, a small augmentation in the knee joint distraction group and a little lessening in the HTO group were encountered. This outcome led to a significant increment in the mean JSW for SJD only.

DISCUSSION

As far as I know, currently no treatment is capable of modifying the tissue structure of a knee joint affected by OA. However, Intema et al reported that SJD could achieve such a goal[12].

The experience of Aly et al reveals improvements in pain and walking capacity of patients with OA treated by means of SJD. In most patients, the radiological study showed a knee joint space enlargement and an amelioraton in the tibiofemoral angle[11].

In terms of the duration of the improvement, Wiegent et al found that after SJD the clinical changes in patients with knee OA lasted for at least 2 years[16]. They observed an increment in JSW under weight-bearing conditions, and they also found via MRI that after 2 years, cartilage repair remained and the newly formed tissue still was mechanically resilient.

Van der Woude et al also report encouraging results after SJD, especially in relatively young patients with knee OA[15]. They encountered that the best chance of cartilaginous tissue restoration

took place in men with a higher KLG. Moreover, they found SJD to be a cost-effective surgical technique. Regarding the time of distraction required (6 weeks versus 8 weeks) no differences were encountered[8]. In a comparative study of SJD and TKA with 1 year of follow-up, performed on relatively young patients with knee OA, the results of SJD were not inferior to those obtained with TKA. However, the SJD group had a high rate of pin tract infection[9]. When comparing SJD and HTO in patients with medial compartmental knee OA, the results indicated that both procedures yielded similar results, and Van der Woude et al concluded that SJD could be an alternative for this type of patient[15].

Reported studies have brief follow-ups and little sample sizes. Moreover, the important incidence of pin tract infection is of concern, because the majority of patients at last require TKA.

CONCLUSION

Overall, the published studies on SJD have short follow-ups and small sample sizes. Moreover, the high frequency of pin tract infection after SJD is of concern, because most patients eventually required TKA. These two circumstances indicate a need for longer-term prospective studies.

In my career, I have not performed a single SJD in a patient with knee OA. It is noteworthy that of the 9 articles reviewed for this paper, 7 were reported by Dutch authors, potentially limiting the generalizability of the results. My view is that the role of SJD in knee OA is currently quite controversial and therefore it should not be recommended until further research is performed.

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