

Case Reports on the Use of Dry Needling to Improve Observable Knee Joint Space Width in Tibiofemoral Osteoarthritis as Seen on Unilateral Standing Knee Radiograph

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Abstract

There has been much discourse and study on the management of Osteoarthritis Knee. Studies have focused on improving Joint Cartilage health, improving the joint functionality symptomatically or improving the quality of life of a patient with Knee Osteoarthritis. There have been no studies so far on altering Joint Space Width in an Osteoarthritic Knee joint with an attempt to improving the functionality at the Knee joint. Our case reports were aimed at understanding whether Radiologically Altered Knee Joint Space Width in Osteoarthritic Knees could be changed through Dry Needling Techniques.

Keywords: Joint Space Width (JSW), Osteoarthritis, Knee, Dry Needling, Medial Knee Joint Compartment

Introduction

Osteoarthritis Tibiofemoral Knee is the most common form of Arthritis with a high prevalence of associated pain and disability in patients involved [1]. It is known to affect the entire joint and its associated structures - not just the joint Cartilage. A routine Diagnosis of Osteoarthritis (OA) Tibiofemoral Knee is done by Clinical examination but confirmed by Radiological changes.

The Radiological/ Structural signs of OA Tibiofemoral Knee on a Conventional Radiograph (PA, AP, Lateral or Schuss views) are:

- Joint Space Narrowing - corresponding to Loss of Cartilage
- Osteophytes - which represent Marginal bone reaction proportional to loss of Cartilage
- Subchondral bone reactions (Sclerosis) due to overlying Cartilaginous damages

These changes are observed in Mild to Severe OA Knee Cases to varying degrees and the severity of the radiographic changes may not necessarily correspond with the severity of the clinical symptoms.

A huge amount of scientific research has been directed into studying the Hallmark of Osteoarthritis, i.e.: the destruction of Hyaline Cartilage. Pharmacological interventions like Oral Analgesics, Chondroitin Sulphate, Glucosamine Sulphate, Risedronate (SMOAD), Alendronate & Estrogen, Calcitonin, Topical treatments, Intra-articular injections of Hyaluronic acid/ Steroids, Stem cell therapy have been aimed at either Altering the progression of the disease through symptomatic relief OR at Restoring Cartilage health through its subsequent Regeneration [2].

Notably, Hyaline Cartilage does not contain pain fibres and hence cannot be the source of a patient's pain symptoms. Pain fibres are present in the joint capsule, periosteum, synovium, outer thirds of the menisci and the insertional sites of the ligaments and muscles around the Knee joint. Hence, improvement in the Knee Joint Space Width could be argued as having a positive effect on patient pain/ functionality outcomes, as it would be conducive to the health of the associated periosteum, ligaments and muscles immediately influencing the affected Knee joint.

There is a dearth of studies that mention the improvement in Knee Joint Space Width (JSW) as a parameter of OA disease progression alteration. Shouldn't Improvement in Knee Joint Space Width be considered as an equally important Criterion in studies that promote Cartilage Regeneration techniques? Would not a healthy Joint Space Width then contribute to subsequent continued Cartilage preservation, post Cartilage regeneration?

Dry Needling on the other hand has been known to change Muscle Activation movement patterns, Muscle thickness and Joint ranges of motion by improving the chemical environment of Trigger points within muscles. Deep Dry Needling to the involved Musculature was chosen as a potential treatment option in our Case reports since Muscular Afferens are important for the transmission of Acupuncture Analgesic signals. Improvement in Pain levels was a parameter that was studied in our case reports while also studying the perceptible changes in Joint Space Width [11-13].

Our efforts in these Case reports were therefore directed towards improving Knee Joint Space width at the Medial Tibiofemoral Joint of Osteoarthritic knees, in an attempt to influence Functional Pain outcomes in the patient.

Materials

Studies cited in this Case report were obtained through PubMed, Google Scholar searches and the authors' familiarity with the published literature in their own fields. PubMed was searched for both preclinical and clinical articles related to "Knee Joint Space Width and Dry Needling". Articles that were published in the past 20 years were accessed, although older articles of significance were also included. To our knowledge, there were no studies that observed the Alterations in Osteoarthritic Knee Joint Space Width through Non-Surgical therapeutic means.

The Observed Alteration of Knee Joint Space Width or Measurement of Knee Joint Space Width on a Knee Radiograph has been widely considered the best available surrogate criterion to assess the progression of Osteoarthritis (OA) in Clinical or Epidemiological studies [3]. Influence of patient positioning, radiographic procedure preferred, choice of measuring instrument, site of measurement and the quality of the reading of Knee Joint Space Width have all been specified over the years [4-6].

Joint Space Width (JSW) as a minimum interbone distance (between the Distal Femoral and Proximal Tibial surfaces) or a mean width can be measured manually or with a digital image computer. Accuracy of the Computer method over any Manual method can be partly explained by the digitization of the film, which allows for a sharp delineation of the bony edges. It also takes into account the possibility of change in Magnification, which may be of importance in a particular study.

The Three case reports discussed below had the following in common:

1. They were Level 1 or Level 2 on the Ahlback Scale that describes Joint Space Narrowing on their AP view Unilateral Weight bearing Knee (True size) Radiographs [13, 14].
2. They all had Medial Knee Joint Space Osteoarthritis of only one knee.
3. They had no underlying systemic issues or history of trauma/surgical procedures to the knee
4. They had pain during Activities of daily living for over a year (walking, climbing a flight of stairs, sitting on the floor with knees folded)
5. They had all been prescribed and had consumed Analgesics and Anti-inflammatory medications for 3 weeks at least once in the past 5 years.
6. They were all between the age group of 45 to 65 years of age. Sex of the patient and Side of the Limb (Right or Left Knee) was not an inclusion criterion.

Ahlback Grading Scale was described as given below [14].

Grade I	Narrowing of the joint space (with or without subchondral sclerosis) – where joint space narrowing was defined as a space inferior to 3 mm or inferior to half of the space of the space in the other compartment of the same knee
Grade II	Obliteration of the joint space
Grade III	Bone defect/loss < 5 mm
Grade IV	Bone defect/loss between 5 and 10 mm
Grade V	Bone defect/loss > 10 mm with subluxation and arthritis of the other compartment

Radiographs were taken by a qualified Consultant Radiologist who had pre-set the parameters for the Unilateral Weight Bearing True size AP view of the Osteoarthritic knee with non-affected leg off the floor, such that patients were using both hands for support to balance themselves. Parameters for AP Knee Standing True Size Radiograph were preset at 8 mAs, 55 kVp, 100 mA.

These radiographs were taken at the start of the treatments and after 8 weeks of the treatment at the same Scan center, in the very same preset position.

Methods

Prior to the treatment, pain was assessed on the Visual analogue scale (VAS) from 0 to 100 (with 0 being no pain, 50 being moderate pain and 100 being severe pain). Patient 1 (Male, 63 years) was 80 on the VAS, Patient 2 (Female, 57 years) was a 90 on the VAS, Patient 3 (Male, 45 years) was a 75 was on the VAS on Day 1 prior to initiation of Deep Dry Needling treatment.

Deep Dry Needling of Muscles was done for both the Affected (Arthritic knee) as well as the Non Affected (Non Arthritic Knee) Lower Limb. All the three case patients in this report were dependent on their Non Arthritic knee to climb stairs and felt a presumed weakness in the non-arthritic limb due to supposed overuse and over reliance on non arthritic limb during activities of daily living. Deep Dry Needling was done only by the Primary author of this article.

Deep Dry Needling was done with Disposable one-time use needles ranging from 40 mm – 75 mm in length and 0.25 in thickness (Cloud & Dragon, Denmark). Deep Dry Needling treatment was done to trigger points in the following muscles of both the affected and non-affected legs:

Group I: Iliopsoas, Tensor Fascia Latae, Gluteals (Minimus/ Medius/ Maximus), Piriformis, Adductors (Magnus/ Longus/ Brevis),

Group II: Quadriceps (Vastus Lateralis, Vastus Medius, Vastus Intermedius, Rectus Femoris), Hamstrings (Short Biceps Femoris, Long Biceps Femoris, Semimembranosus, Semitendinosus),

Group III: Gastrocnemius (Medial/ Lateral), Soleus, Tibialis Anterior, Peroneus Longus/ Brevis.

The above muscles were divided into 3 individual groups. Each group of muscles on both legs was needled aggressively for multiple Trigger points (within each muscle) twice a week, for 8 weeks based on CZ Hong's Fast in and Fast out Needling technique [15, 16]. This technique helped to provide high-pressure stimulation and inactivate these existing Myofascial Trigger points. Patients did a mild Active Range of Motion movement at the Hip, Knee and Ankle immediately after the Needling procedure in order to reduce the soreness that was experienced by the patient, post the aggressive Needling done to the aforementioned muscles.

Results

VAS scores before and after 8 weeks:

Patient	Side affected	VAS at 0 weeks	VAS after 8 weeks
Patient 1 (Male, 63 years)	Left (Both limbs needed)	80	25
Patient 2 (Female, 57 years)	Right (Both limbs needed)	90	10
Patient 3 (Male, 45 years)	Right (Both limbs needed)	75	10

Radiographs of AP True size Weight bearing Osteoarthritic Knee

The Radiographs of the Case reports mentioned herein are given for Manual Observation. No Computed Measurements of Joint Space Width have been provided.

Patient 1 – Male, 63 years Left Knee Medial Tibiofemoral joint (Figure 1)

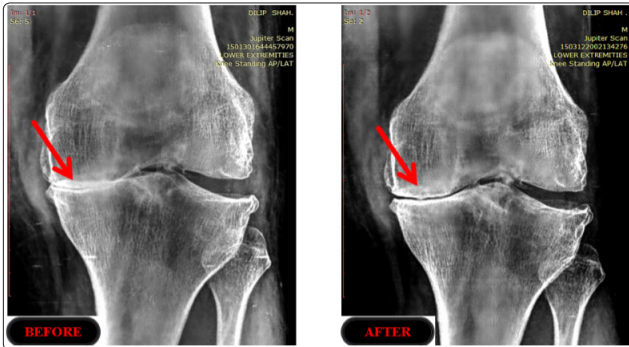


Figure 1: Male, 63 years Left Knee Medial Tibiofemoral joint Before – After Treatment 8 weeks

Patient 2 – Female, 57 years Right Knee Medial Tibiofemoral joint (Figure 2)

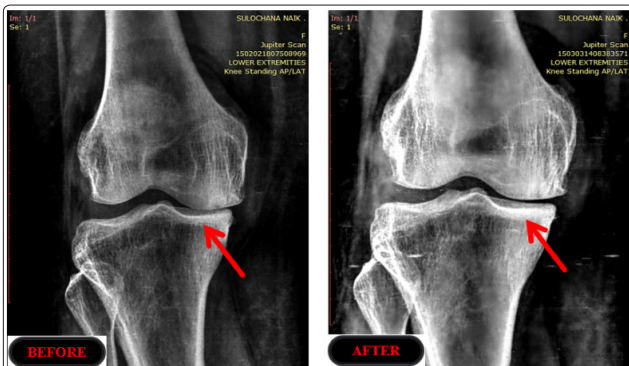


Figure 2: Patient 2 – Female, 57 years Right Knee Medial Tibiofemoral joint Before – After Treatment 8 weeks

Patient 3 – Male, 45 years Right Knee Medial Tibiofemoral joint (Figure 3)

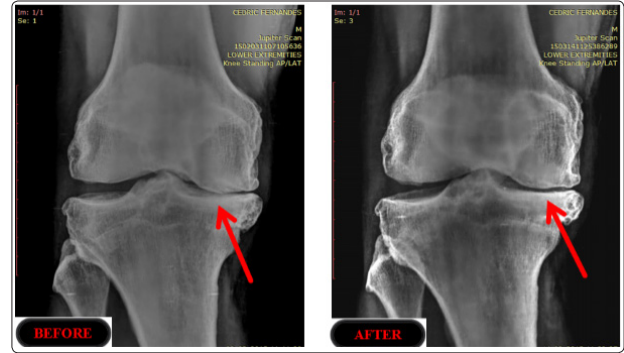


Figure 3: Patient 3 – Male, 45 years Right Knee Medial Tibiofemoral joint Before – After Treatment 8 weeks

Additional images of Patient I (Figure 4) were taken in Unilateral standing Medial View of Left Knee joint. The images showed an observable alteration in the Medial Tibiofemoral Joint Space width after treatment. See adjoining image below.

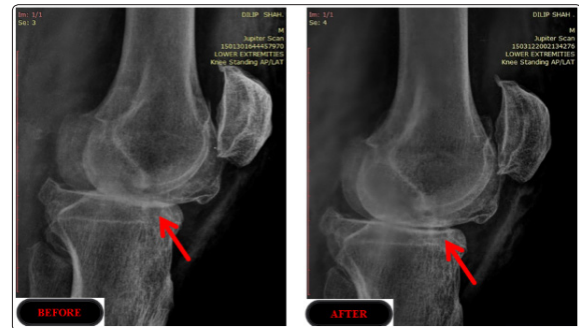


Figure 4: Medial View of Unilateral Weight Bearing True Size Knee Joint of Patient I demonstrating an improvement in Medial Knee joint width after 8 weeks Treatment

Discussion

The above case reports had Deep Dry Needling treatment done to their Lower limb musculature, which helped alter Trigger points through Latent Twitch Reflex through Hong's technique. An improvement in Joint Space Width at the Tibiofemoral joint was seen in all of the three cases in the AP True Size Unilateral Weight bearing view in the Osteoarthritic Knee.

An improvement in Joint Space width could be attributed to a possible improvement in the Muscle Activation timings of the Needled muscles along with decrease in pain levels due to a change in the Central sensitization from the Trigger points [17]. However, these are theories at this point and further research is required in this respect.

Our Drawbacks in Reporting These Case Studies Were

1. We did not study the effect of change of Joint Space width on the Joint Cartilage. Joint Space width before and after treatment was computed by us to account for a measurable change in Joint space width, but has not been reported in this paper.
2. We did not compare the Osteoarthritic knee with the Non-arthritis knee to check for observable or measurable changes in both knees before and after treatment

3. We did not assess the joint space width in these patients after 6 months or 12 months to check if the altered Joint Space width changes persisted.

In conclusion, we have begun work on a much-detailed longitudinal study to understand the effects of alterations in Knee Joint Space width on Cartilage health in Osteoarthritic Knees. We hope to improve upon the drawbacks we faced during the reporting of our abovementioned Case reports and provide a better understanding into how Improvements in Knee Joint Space width could potentially alter our approach to OA Knee treatment.

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