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Effect of focused shockwave therapy in knee osteoarthritis: A case study

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Abstract
Objective and Clinical Features: *A 52- years- old female housewife presented complaining of knees pain more at inner side of the knee while walking and climbing stairs. Patient reported that her pain started 6 months ago which increased gradually during prolonged standing. Her pain was worst for 2 days when he reported.*
Intervention and Outcomes: *the combination of conservative treatment approach consisted of eccentric exercise training, manual therapy and most important new school of intervention in physiotherapy i.e. focused shockwave therapy. Outcomes measures included numeric pain rating scale and goniometer. patient symptoms resolved and at 1 month follow-up reported no recurrence of knee pain.*
Result: *The followed treatment protocol, which involves eccentric exercises of knee muscles and modest intervention aided in the complete resolution of patient's impairment and functional limitation.*
Discussion: *The result of this case study adds to our current knowledge of rehabilitation with the use of conventional physiotherapy management, eccentric exercises, and a new technique focused shockwave therapy. The rehab protocol in this study includes strengthening exercises of quadriceps, hamstrings, vastus medialis oblique that resulted in faster recovery and early return to functional activities.*
Keywords: *osteoarthritis, focused shockwave therapy, manual therapy, goniometer, numeric pain rating scale.*

Introduction

Knee osteoarthritis (OA) is one of the most common disabling forms of arthritis, leading to reduced quality of life, dependency, and economic burden to health systems and patients[1]. Common symptoms such as pain, joint stiffness, and decreased range of motion (ROM) interfere with the individual's ability to perform daily activities, thereby affecting the quality of life[2]. Globally, a total of 654 million individuals, or 23 % of adults aged over 40 years, have suffered from knee OA. It is estimated that 10% of men and 13.0% of women over the age of 60 have symptomatic knee OA[3]. Normalized for knees with OA, estimated prevalence rates (95% CI) were: single compartmental 50% (31.5–58.3%), bicompartmental 33% (23.1–37.2%) and tricompartmental only 17% (8.8–24.8%). Isolated

medial tibiofemoral OA, isolated patellofemoral OA, and combined medial tibiofemoral and patellofemoral OA were more common than tricompartmental disease, occurring in 27% (15.2–31.1%), 18% (9.9–22.7%) and 23% (14.1–27.3%) of people respectively. Single/bicompartmental patterns of disease involving the lateral tibiofemoral compartment were less common, summing to 15% (8.5–18.7%)[4].

Indeed, no one risk factor contributes to the increase in the disease process; rather, the involvement of risk factors together such as age, gender, ethnicity, genetic predisposition, hormonal factors, and bone density. In addition, biomechanical factors—caused by sports, the workplace, joint misalignment, and obesity—contribute to joint injuries leading to OA[5]. Six main categories of modifiable risk factors were identified: (1) obesity and overweight, (2) comorbidity, (3) occupational factors, (4) physical activity, (5) biomechanical factors, (6) dietary exposures. In the era of age- and obesity-related diseases, the combined effects of local and systemic risk factors should be managed by combined measures. Persistent knee pain, limited morning stiffness, and reduced function are the three symptoms that are recommended for the diagnosis of knee OA by the EULAR[6]. In addition, crepitus, restriction of joint movement and bony enlargement are also very useful for diagnosis of knee OA. In advanced cases synovitis may appear and leads to pain at rest or night[7]. Short duration of stiffness less than 30 minutes may be seen in OA patients in the morning or following periods of inactivity. As the disease advances, these structures are affected and changes including bone remodelling, osteophyte formation, weakening of periarticular muscles, laxity of ligaments, and synovial effusion can become evident [8].

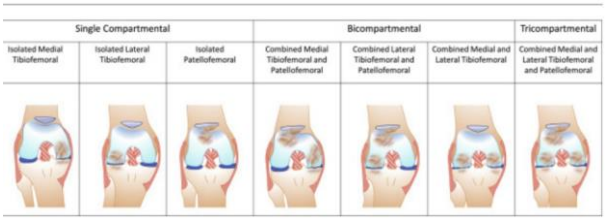


Fig 1 – Shows the compartmental grading of osteoarthritic knee.

The diarthrodial joint connects two adjacent bones, covered with a special articular cartilage layer, and wrapped in a synovial bursa. The articular cartilage is composed of water (>70%) and organic extracellular matrix components, mainly type II collagen, aggrecan, or other proteoglycans. Chondrocytes detect mechanical stress and changes in the pericellular matrix primarily through receptors on the components of the extracellular matrix. The change in response to mechanical or inflammatory stimulation results in the upregulation of aggrecans and collagenase. Moreover, receptors on resting chondrocytes are protected from interacting with certain matrix components by the unique composition of the pericellular matrix. Type II collagen-containing networks in the interregional regions are generally not degraded as they are coated with proteoglycans. In OA, there is a gradual disappearance of cartilage associated with chondrocyte loss and phenotypic transformation, including cluster formation and activation of catabolic phenotypic and hypertrophic differentiation. Remodelling of subchondral bone occurs with the development of blood vessels located in structures (vascular channels) that contain osteoblasts and sensory nerves. Vascular channels should facilitate biochemical communication between the bone and cartilage. In response to multiple stimulations, chondrocytes modify the phenotype and express a subset of factors (such as cytokines, chemokines, alarmins, damage-associated molecular pattern, and adipokines). All these mediators act as paracrine factors, begin a vicious cycle of cartilage breakdown, reach the synovial fluid, and trigger

an inflammatory process with the production of synovial macrophages and fibroblasts of the factor. Vascular channels have sensory nerve terminations, and the associated innervation of articular cartilage may contribute to tibiofemoral pain in OA across a wide range of structural disease severities[8,9].

Cartilage degeneration and other skeletal changes can be examined radiographically[10].

Fig. 2 – shows the radiographic changes in the osteoarthritic knee.

Treatment with physical strengthening exercises has as an effect, improvement of leg muscle activities particularly the quadriceps, decreasing load and knee joint stress in movement. Losing weight yields a decrease of the pressure on the knee joint, improving physical function and biomechanics, combined with exercise[11]. The most affected part of the knee joint in knee OA is the mid-section. The effectiveness of unloader knee braces in knee OA has been recommended. It reveals moderate amelioration of physical function, pain and wellbeing[12].

Currently used electrical stimulation techniques include pulsed electrical stimulation (PES), non-invasive interactive neurostimulation (NIN), interference current (IFC), transcutaneous high-frequency electrical stimulation (h-TENS), low-frequency transcutaneous electrical stimulation (l-TENS), and neuromuscular electrical stimulation (NMES). By stimulating motor neurons on the skin around the injured knee with H-TENS, movement was made possible by inhibiting mechanoreceptors.

Therapeutic ultrasound has been an effective and safe treatment option for alleviating pain and enhancing function in individuals with KOA. The increased effectiveness of high-intensity laser therapy (HILT) in reducing pain and disability in KOA patients. focused shockwave therapy has also emerged as a safe and effective treatment for KOA, offering pain relief and improved function [13].

It is the effective, non-invasive intervention in knee osteoarthritis. There are acoustic shockwaves which are characterized by a pressure surge with extremely short rise time which is then followed by an exponential drop in pressure and a brief phase of negative pressure. These shockwaves develop in the targeted tissue at the point of pain. they cause an improved local blood circulation and metabolism. the primary means by which shock waves affect living tissue is based on transformation of mechanical stimuli in biochemical or biomolecular signals which ultimate influence gene expressions in the cells at molecular level consequently when used selectively they produce a specific tissue reaction known as mechanotransduction. It controls the progression of condition due to having properties like anti-inflammatory, anti-apoptotic, new small vessel forming, regenerative effects by changing cellular and metabolic process and improves healing. Additionally, it delivers other potential advantages like reduces cartilage cleavage, cell proliferation, neovascularization, pain amelioration and improves motor function [14].

Case Report

A 52 years old female presented complaining of both knee pain while walking, standing and climbing stairs. She reported that she was having pain since six months which increased gradually. Her pain increased 2 days back during prolonged standing following which the movement of knee was painful. She stated that only rest with icing

relieved her pain. She also took medications for it but have no relief.

On pain assessment numeric pain rating scale (NPRS) during activity was 8 and at rest was 2 out of 10. The pain was constant, dull in nature and increased during prolonged walking and standing.

On observations her built was endomorphic, swelling was seen over knee joint, muscle wasting and any deformity was not present. on palpation the patient reported tenderness grade 2 (over medial side of the knee), temperature was slightly increased, crepitus was present, skin texture was normal and muscle spasm was present. Sensory evaluation was done in which everything was intact.

Screening and physical examination was done.

In radiographic images it was seen that there is grade 3 osteoarthritis of the knee.

In physical examination manual muscle testing is done.

Knee muscles	Right	Left
Flexors	4	4
Extensors	4	4+

Restricted isometric contraction

Flexion	Strong and painful
Extension	Strong and painful

Provisional Diagnosis: Osteoarthritis of knee (grade 3)

Goal of Treatment: Short Term Goals:

- Reduce pain
- Reduce swelling

Long Term Goals:

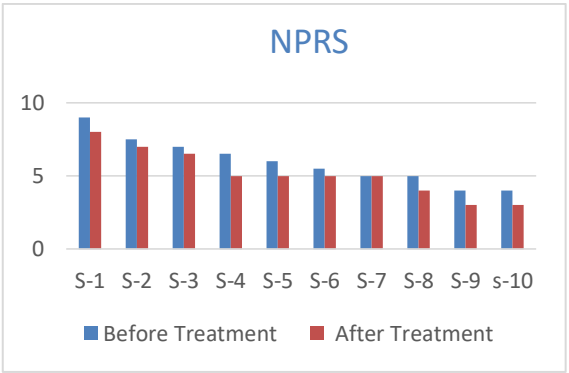
- Strengthening of knee muscles – quadriceps, hamstrings, vastus medialis oblique.
- Increase ROM
- Return to the daily living activities.

Management:

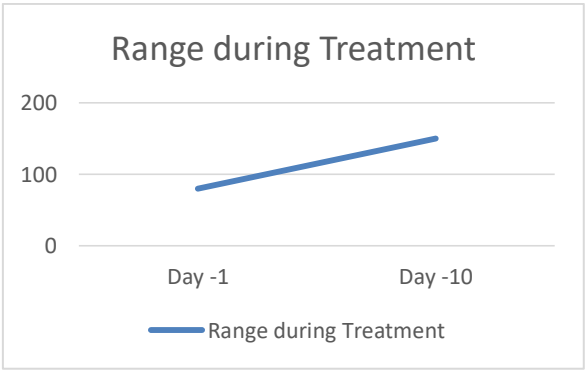
- TENS
- Ultrasound therapy
- Myofascial release
- The most important intervention used in this study was focused shockwave therapy that was given for 10 sessions with impulses of 3000 shocks per session at the frequency of 5 to 8 hz and intensity between 16 to 20. The degree of pain and mobility was recorded after and before the session. the NPRS remains 2 at activity and 0 at rest and the degree of knee flexion raised up from 80 degrees to 150 degrees.

Results

As shown in Graph 1 it is reported that there is clear improvement in condition with pain reduction with the help of focused shockwave therapy by changing the cellular and metabolic processes and improves healing.



In Graph 1 the degree of pain is recorded before and after the treatment by using NPRS i.e. instrument to assess pain intensity at rest or while activity.



In Graph 2 the mobility range test is done through goniometer and the drastic change is seen. the degree of knee flexion raised up from 80 degrees to 150 degrees.

Discussion

Condition of osteoarthritis can be challenging, since it is the weight bearing joint, thus can delaying healing time. There are many recommended conservative treatments, which includes rest, hinged knee brace can used to bear weight properly[11]. Other conservative measures include heat, cold, modalities, MFR including focused shockwave therapy. Active treatment options include strengthening exercises. This case had a favourable outcome. This study findings suggests a dose dependent response on pain and function of the joint [1]. Despite of some limitations the current results of this study add to the growing evidence that this shockwave therapy might be a significant influencing factor to treat osteoarthritis. This study demonstrates that some of the etiologic forces lead to biophysical effects on the targeted tissues and shows significant results in the condition[5]. A complete data can help us to better understand the factors, occurrence and development of osteoarthritis as well as identify potential targets for analysis and therapeutic strategies for OA knees.

Conclusions

The study found that focused shockwave therapy in treatment of knee osteoarthritis with significant pain relief and improvement in joint mobility. Considerably the whole intervention was good and highly satisfactory.

We are aware of limitations of this study and suggest a follow-up study so further validation required with large sample size, including control groups and long term follow up.

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