OUR EXPERIENCE IN THE USE OF DEEP OSCILLATIONR IN THE EARLY REHABILITATION OF PATIENTS WITH KNEE ALLOPLASTY

Evgenia Vladeva, Mariana Mihaylova, Dafina Bacheva, Iliya Todorov

Department of Physiotherapy, Rehabilitation, Occupational Medicine and Occupational Diseases, Medical University of Varna

OUR EXPERIENCE WITH USING DEEP OSCILLATIONR IN EARLY REHABILITATION OF PATIENTS WITH ARTHHOPLASTY OF THE KNEE JOINT

Evgeniya Vladeva, Mariyana Mihailova, Dafina Bacheva, Iliya Todorov

Department of Physiotherapy, Rehabilitation, Thalassotherapy, Occupational Diseases, Faculty of Public Health, Medical University of Varna

SUMMARY

Joint arthroplasty is among the most common modern operations in orthopaedics and traumatology. Physiotherapy and rehabilitation are the final phase of arthroplasty and are of utmost importance for both the pace and the degree of functional recovery. Deep oscillations (DEEP OSCILLATION®) are a patented therapeutic procedure using resonant tissue vibration with minimal external mechanical effect and proven analgesic, anti-fibrotic, anti-inflammatory and anti-inflammatory effects.

The aim of the present study was to investigate the effect of the complex application of deep oscillations and kinesiotherapy on the reduction of swelling, reduction of pain symptomatology and restoration of range of motion in patients after alloplasty of the knee joint. The study was conducted on 50 patients, 21 males and 30 females, randomly divided into 2 groups of 25, experimental group (EG) and control group (CG), all after knee alloplasty.

The obtained results proved that deep oscillations are an effective method for removing swelling, suppressing pain and inflammation and increasing range of motion in early rehabilitation of patients after

ABSTRACT

Arthroplasty is the most frequent amongst the in- terventions in obstetrics and traumatology. Phys- iotherapy and rehabilitation are the final stage of arthroplasty with great importance concerning the rate and stage of functional recovery. Deep Oscillations is a patent therapeutic treatment which uses tissue vibra- tions with minimal external mechanical effect and is with proven pain relief and fibrinolytic effect, reducing oedema and inflammation. The aim of this study is to follow the effect of the complex application of Deep Oscillations and kinesitherapy on the recovery of patients with total knee arthroplasty.The study included 50 patients (21 men and 30 women) divided into 2 groups - experimental (EG) and control group (CG) all with total knee arthroplasty and proved that Deep Os- cillations is an effective method for reducing inflam- mation, oedema and pain and increasing the range of motion in the early rehabilitation after knee joint replacement. Combined application with appropri- ate exercises has better results concerning the rate and stage of functional recovery.

Keywords: *knee arthroplasty, Deep Oscillations, early rehabilitation*

alloplasty of the knee joint. The combined application of deep oscillations and kinetic therapy gives better results in terms of the time and degree of recovery of knee joint function after endoprosthesis.

Key words: *knee arthroplasty, deep oscillations, early rehabilitation*

INTRODUCTION

Joint arthroplasty is among the most common modern operations in orthopaedics and traumatology. This leading-edge activity in orthopaedics began in the late 19th century, when Temistocles Gluck described replacing a tuberculosis-damaged femoral head with one made of ivory (Learmonth ID 2007). Sir John Charnley, one of the founders of the method, formulated the main goal of endoprosthetics in 1971: to create an artificial articulation that removes the patient's subjective complaints, restores functional activity and improves quality of life for a maximum period of time (5). The continuously increasing demands on quality of life are reflected in increasing demands on endoprosthetics related to maximum speed of recovery, achieving full functional activity and even longer survival times of artificial joints. The satisfaction of these requirements depends on the combined application of several interrelated key factors - the materials from which the joint is made, the method of attachment of the components to the bone, the surgical technique and, last but not least, the timely initiation of rehabilitation of the endoprosthetic patients (11,3).

Physiotherapy and rehabilitation are the final phase of endoprosthetics. Their role is extremely important for both the pace and extent of functional recovery. In many cases, neglecting, underestimating or incorrectly conducting this last stage of the therapeutic process can totally compromise the outcome of a well-done hip or knee alloplasty.

In both hip and knee arthroplasty, the ultimate goal is to achieve maximum functional recovery. . However, there are some specificities affecting both types of interventions.

If in hip arthroplasty the main problem is to regain the support of the arthroplasted joint in order to restore the normal gait of the patient, in knee arthroplasty the loading of the operated joint can start almost immediately. In this case, the difficulty lies in restoring full range of motion in the knee joint, as it is much more susceptible to off- ormation contractures than the hip joint (3).

In knee arthroplasty, the swelling of the tissues around the knee joint, the lower leg, the ankle joint and the foot is spread more slowly and with difficulty, which further limits the range of motion and is often accompanied by pain and discomfort of the arthroplasted limb.

Deep oscillation (DEEP OSCILLATION®) is a patented therapeutic procedure using resonant tissue vibration through electrostatic attraction and friction, which produces mechanical vibrations not only in the skin, but also in the deeper tissues of the treated areas of the patient's body (1). The procedure itself is characterised by a minimal external mechanical effect, which allows it to be used in cases of acute pain, fresh trauma, and for the treatment of any type of wound. Numerous pilot studies have demonstrated the analgesic, anti-fibrotic, anti-fatigue and anti-inflammatory effects of deep oscillations due to a reduction in the release of inflammatory mediators (histamine, serotonin, prostaglandins, leu- cotrienes), inhibition of vascular wall permeability to ions and fluids and lipid peroxidation, reduction of free radicals and increase of activity of monocytes and T lymphocytes (2,6,7,9).

On the basis of the above-mentioned studies and considerations at the Clinic of Physiotherapy and Rehabilitation of the University Hospital "St. Marina" - Varna, a study was conducted on the place of deep oscillations in the early rehabilitation of knee joint replacement.

PURPOSE

To study the effect of the complex application of deep oscillations and kinesis rap- tion on the reduction of swelling, reduction of pain symptomatology and restoration of range of motion in patients after knee alloplasty.

MATERIAL AND METHODS

The present study was conducted with 50 patients, 20 men and 30 women aged between 28 and 79 years (53.5), randomly assigned to 2 groups, an experimental group (EG) and a control group (CG), each consisting of 25 patients, all of whom underwent total knee arthroplasty.

Patients from both groups were treated in the Physiotherapy and Rehabilitation Clinic of the University Hospital "St. Marina" Hospital for the period from June 2016 to May 2017.

EG patients were administered a **7-day** physiotherapy treatment course 3-7 days after suture removal, postoperatively according to the following regimen:

1. **A kinesiotherapy programme** including positional treatment of the operated leg, aiming at counter- current effect, passive and active skeletal muscle exercises (SME) and joint mobilisation techniques to strengthen the thigh muscles and gluteal musculature, as well as to increase the range of motion in the knee joint. Active ankle joint CMUs for antithrombotic prophylaxis. Functional medical gymnastics including training in sitting and standing from a seated position, assisted gait training including stair ascent and descent (12).
2. **Deep *oscillations*** in the area of the endoprosthetic joint, subtalar joint and ankle joint with the following parameters and duration:
   1. 120 Hz - 180 Hz - 10 min.;
   2. 10 Hz - 30 Hz - 10 min.;
   3. 85 Hz - 5 min.

The CG patients were also administered a **7-day** physiotherapy treatment course 3-7 days after suture removal postoperatively, including only a kinesiotherapy program identical to that in the EG.

Recovery was followed up in parallel in patients from EG and CG.

Protocol for follow-up of the effect of the applied PT treatment:

1. **Anamnestic data** - pain, discomfort, stiffness and other subjective complaints of the patient reported by visual analogue scale (VAS).
2. **Functional Status:**
   - Examination of the range of motion of the endo-prosthetic knee joint;
   - comparative centimetry - circumference of the knee joint and the lower leg of the endoprosthetic limb and the healthy knee joint.

The study in the experimental and control groups was performed before and immediately at the end of the physiotherapy treatment.

RESULTS AND DISCUSSION

By reducing the release of inflammatory mediators (histamine, serotonin, prostaglandins, leukotrienes), deep oscillations inhibit vascular wall permeability to ions and fluids and lipid peroxidation and increase the activity of monocytes and T lymphocytes, This results in a powerful anti-inflammatory effect, which at the functional level is manifested by a rapid change towards improvement in subjective complaints - pain, discomfort and stiffness. In our study, the analysis of the change in the subjective complaints of the patients in both groups, as assessed by the **BAC**, showed a reverse trend in the patients we studied in both groups, with faster and greater recovery in patients who underwent the deep oscillation procedure. The mean BAC was 1.48± in EG, to 2± in CG($p<0.001$) (Fig. 1).

Fig. 2 shows the results of the comparative centimetry performed on the operated and healthy knee joint of each patient. At the end of the treatment course, the mean value of this index was 1.3± in EG, to 1.91± in KG ($p<0.001$). The swelling of the operated joint decreased faster and to a greater extent in the patients of the experimental group, which we believe,

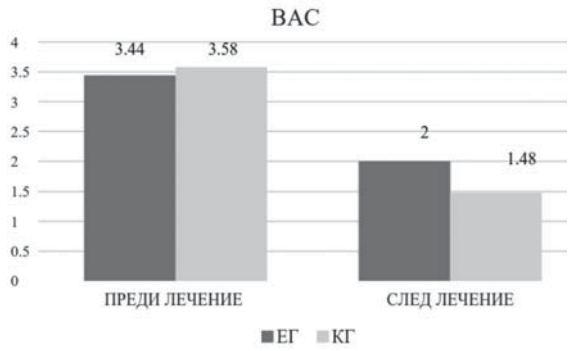

Fig. 1. Changes in pain sensation, stiffness and discomfort measured by BAC

that is due to the application of deep oscillations. The oscillations of the tissue increase the re-zorption surface, and the mechanical activation stimulates the drainage of the interstitial fluid through the endothelial intercellular spaces, improving the blood and lymphatic circulation deep in the skin and subcutaneous layers, which leads to the pronounced anti-swelling effect of the procedure.

Fig. 2. Knee joint santimetry (the score is given by the difference in plus centimeters of the operated joint)

Similar results were found regarding the change in movement volume when comparing the experimental and control groups.

Fig. 3 shows the change in the knee joint extension volume in the EG and CG patients. Before the physiotherapy treatment, the deficit in extension in the patients of both groups was approximately the same (about 10 degrees), but at the end of the treatment, the deficit in extension in the EG patients 1.25± was statistically significantly smaller than that in the KG patients.

3.75± (p<0.001). The contribution to the better recovery of the EG is again associated with the application of deep oscillations, which, as a result of their analgesic and anti-inflammatory effect, allow the kinesiotherapeutic procedures to be performed in a larger volume, leading to

Fig. 3 . Changes in the volume of motion of the CS - extension

Fig. 4. Changes in the volume of motion of the CS - flexion

better results in terms of compensating for motor deficits.

The dynamics of flexion volume in the patients from the EG and the CG before and after the treatment is presented in Fig. 4. Again, with almost equal flexion deficits before treatment, a statistically significant greater increase in flexion volume was observed in the EG compared to the KG. Similarly, here too we attribute the better results in EG to deep oscillations, which through their analgesic, anti-fibrotic and anti-inflammatory action indirectly influence the volume of motion of the operated joint, at the same time facilitating the kinesiotherapy.

CONCLUSION

Deep oscillations are an effective method of removing swelling, suppressing pain and inflammation, and increasing range of motion in the early rehabilitation of patients after knee arthroplasty. Their ability to be applied to metal implants and endoprostheses at a very early stage of post-operative treatment, as well as to work in close proximity with open wounds, makes them a good method of choice in the early rehabilitation of

patients after knee alloplasty. Reduction of swelling and limiting the release of inflammation mediators lead to extremely rapid pain relief and significant reduction of stiffness and discomfort in arthroplasty patients. The rapid and potent anti-inflammatory and analgesic effects facilitate kinesiotherapy, which contributes to better outcomes in terms of reduction of motor deficits and stabilization of gait in knee alloplasty patients. The combined use of deep oscillations and kinesiotherapy has been shown to have better results in terms of the timing and extent of recovery of knee joint function after knee arthroplasty. Based on the results obtained, we can recommend the complex methodology we used as a reliable and effective method in early post-operative rehabilitation after knee arthroplasty. Last but not least, there are no contra-indications for the application of deep oscillations.

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Address for correspondence:

Dr. Evgenia Petrova Vladeva, MD, Specialist in Physical and Rehabilitation Medicine
medicine and spas,
Principal Asst. in the Department of Moral Therapy, Physiotherapy, Rehabilitation, Moral Therapy and Vocational
diseases,
MU "Prof. Dr. Paraskev Stoyanov" - Varna University Hospital "St. Marina"
Varna, Blvd. Hr. 052 / 302-851 (ext. 378, 381)
E-mail: jeni.vladeva@gmail.com