CLASSICAL MASSAGE WITH ELEMENTS OF DEEP MASSAGE AND THERAPEUTIC ULTRASOUND IN TREATMENT OF KNEE OSTEOARTHRITIS (A PILOT STUDY)

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ABSTRACT

Introduction. Knee osteoarthritis (KOA) is a common form of osteoarthritis. The problems caused by KOA are pain, restriction of functional activities and an impact on quality of life.

Aim. The authors studied the efficacy of massages and therapeutic ultrasound in patients with KOA having Kellgren and Lawrence scale grade 3.

Patients and methods. Thirty patients (9 males and 21 females) mean age 67±7.9 years, disease duration <5 years and from 5 to 10 years, mean BMI 30,09. Classical massage with elements of deep massage of knee joints and therapeutic ultrasound have been used. Pain intensity, function of knee joints and general health before and after treatment – were recorded using VAS and WOMAC scales.

Results. Statistically significant improvements with regard to pain, function and general health were observed.

Conclusion. The use of massages and therapeutic ultrasound in treatment of knee osteoarthritis should be encouraged.

Key words: knee osteoarthritis, ultrasound, classical massage, deep massage

Introduction

Knee osteoarthritis (KOA) affects approximately 10% of the population over the age of 55. 25% of patients in this group become disabled [1]. The risk factors of KOA are: age over 50 years, female sex, overweight and obesity, past joint injury, its abnormal position or excessive mobility, strain related to work or sport as well as history of osteoarthritis in the family [2].

The symptoms of KOA include pain and restricted range of motion. In the physical examination crepitation, enlarged joint contour and less often exudate are noted. Later symptoms include permanent contracture, joint deformity (varus, less often valgus deformity) and lack of its stability. These changes may be associated with weakness or atrophy of quadriceps muscle of the thigh, which may be caused by a decreased load of the limb, but according to some authors, may be a factor contributing to development of KOA [3, 4]. Weaker muscle does not protect the joint from shocks [5].

Patients with KOA were also found to show a disturbed sensitivity, in particular at the level of prioreceptors. Hurley and Scott [6] demonstrated that an appropriate exercise programme led to an improvement in perception of the knee joint position, increased strength of the quadriceps muscle of the thigh and general fitness.

The degenerative process in knee joint leads to changes visible in X-ray, the evaluation of which makes it possible to assess the degree of advancement of the disease.

Treatment of patients with KOA involves using "non-pharmacological" methods as well pharmacological ones [7, 8].

The most commonly used pharmaceuticals, the role of which is alleviating the pain and accompanying symptoms of arthritis, are non-steroidal anti-inflammatory drugs (NSAIDs). It should be remembered however, that the majority of patients are elderly people in whom adverse effects of these drugs are a great threat.

In order to inhibit degenerative changes drugs and dietary supplements are used which inhibit the degradation of extracellular matrix of articular cartilage. They include chondroitin sulfate and glucosamine preparations. Intensive research takes place aiming to fight the arthritis.

Non-pharmacological treatment of KOA starts with an appropriate patient education. An important factor is weight loss for overweight and obese patients. This is proved by many observations of the strong relation between degenerative changes in knee joints and the Body Mass Index [9, 10]. Further procedure includes providing the guidelines on lifestyle and teaching exercises. And at last – application of physiotherapy procedures which have analgesic effect, increase joint range of motion and strengthen muscles [11-15].

Aim

The aim of the study is to assess the effectiveness of selected procedures – the application of ultrasounds (US) and massages in patients with KOA.

Participants and methods

The studied group included 30 patients with degenerative changes in knee joints. The group consisted of 9 men and 21 women aged from 56 to 82 years (mean 67, SD = 7.9) (Table I).

Table I. Distribution of sex in the studied group.

Sex	Number	% of total
Women	21	70,00
Men	9	30,00
Total	30	100,00

Body Mass Index in the studied group ranged from 20 to 41 (Table II), the duration of the disease was below 5 years for 15 people, from 5 to 10 years for 13 people, and more than 10 years for 42 people (Table III).

Table II. Descriptive statistics for height, weight and the BMI.

	M	SD	Min	Max	Me	Mo
Height	164,37	6,00	148	172	165	164
Weight	80,91	15,20	52	106	81	60
BMI	30,09	5,97	20	41	29	20

Abbreviations: M-mean, SD-standard deviation, Min-minimum, Max-maximum, Me-median, Mo-mode

Table III. Distribution of disease duration in the studied groups.

Disease duration (years)	Number	% of total
< 5	15	50,00
5 – 10	13	43,33
> 10	2	6,67
Total	30	100,00

The studied group did not include patients with KOA who received intra-articular glycocorticosteroid injection 3 months prior to the study. Patients who took NSAIDs were informed that during the ultrasound and massage treatment the dosage of the drugs should not be changed.

The procedures and observation of patients was accepted by the Bioethical Committee of the University of Medical Sciences in Poznań.

Patients taking part in the treatments reported significant pain complaints in knee joints, and physical examination noted swelling and/or deformity of joints, restricted mobility and crepitus during movement. In six cases the changes were associated with swelling of the joint area and in two cases with an increased amount of intra-articular fluid. In all cases X-ray showed changes corresponding to grade 3 of the Kellgren-Lawrence grading scale [16] (Table IV).

Table IV. Kellgren-Lawrence grading scale [16].

Grade 0 – no features of osteoarthritis,
Grade 1 – doubtful narrowing of joint space, possible osteophytic lipping,
Grade 2 – definite narrowing of joint space, multiple osteophytes, some sclerosis and possible deformity of bone contour,
Grade 3 – large osteophytes, marked narrowing of joint space, severe sclerosis and definite deformity of bone contour.

The diagnosis of KOA was established on the basis of the American Rheumatism Association criteria [17] (Table V).

Table V. Classification criteria of knee osteoarthritis according to the American Rheumatism Association [17]. Knee osteoarthritis should be considered when the following criteria are met: 1 and 2 or 1, 3, 5, 6 or 1, 4, 5, 6.

1. Knee pain for most days in the last months
2. Osteophytes within the joint visible in X-ray
3. Synovial fluid typical for osteoarthritis
4. Age ≥ 40 years
5. Crepitus during movement
6. Morning joint stiffness lasting ≤ 30 minutes

Classical massage and deep tissue massage covered muscles of flexor and extensor apparatus of the knee joint with attachments and ligaments. The application of the technique of transverse friction of ligaments and so called "deep tissue stripping" of iliotibial band should be noted.

The procedures were carried out within the knee join in which symptoms of the disease dominated.

The massage was performed for 20 minutes followed by ultrasound procedure (parameters: frequency 0.8 MHz, surface intensity 0.6-0.8 W (cm^2), duration 5 minutes). The series of procedures was applied over two weeks with a weekend break. The procedures were performed at the same time of day. All tests were carried out in Polyclinic of the College of Education and Therapy in Poznań.

The effectiveness of procedures was evaluated by assessment of pain intensity, stiffness of joints and general physical fitness. Visual Analogue Scale (VAS) was used in which the patients marked pain intensity on a 10 cm stretch of a straight line, where 0 was no pain and 10 the strongest pain [18], as well as WOMAC scale (Western Ontario McMaster Universities Osteoarthritis Index), which apart from the pain describes joint stiffness and general physical fitness [19].

Statistical analysis

Statistical calculation for the intensity of pain measured on the Visual Analogue Scale and the WOMAC scale for perceived pain and morning stiffness were carried out using Student's t-test and for physical fitness measured on the WOMAC scale using Wilcoxon test. The analysis of correlation between the age and the value of the BMI and the level of perceived pain in patients in the VAS and WOMAC scale was carried out using the Pearson r method; the analysis of correlation between the duration of disease and the level of pain intensity measured in VAS and WOMAN scale – using the Spearman's rho method.

Results

In order to examine the difference in the level of pain intensity measured in the VAS and WOMAC scale between the measurements before and after the procedure, Student's t test was carried out (for variables with a distribution close to normal, i.e. results in the VAS scale and results in the WOMAC scale for perceived pain and morning joint stiffness) and Wilcoxon test (for variables with distribution not close to normal, i.e. results in the WOMAC scale for physical fitness) (Table VI).

Table VI. Descriptive statistics for the level of pain intensity measured using the VAS and WOMAC scale.

Scale		Time of measurement	M	SD
VAS	Pain intensity	Before procedure	6,63	1,61
		After procedure	3,77	1,48
WOMAC	Perceived pain	Before procedure	2,47	0,91
		After procedure	1,35	0,87
	Morning joint stiffness	Before procedure	2,44	1,11
		After procedure	1,61	1,13
	Physical fitness	Before procedure	2,62	0,86
		After procedure	1,82	1,06

The analysis provided the following results:

- VAS – $t(29) = 11.35$; $p<0.001$;
- WOMAC – perceived pain: $t(29) = 6.60$; $p <0.001$;
- WOMAC – morning joint stiffness: $t(29) = 4.47$; $p<0.001$;
- WOMAC – physical fitness: $Z = 3.65$; $p<0.001$

The analysis showed statistically significant differences between the measurements before and after the procedure in the level of pain intensity, measured both in the VAS and WOMAC scale. Both the intensity of pain measured using the VAS and perceived pain, morning joint stiffness and physical fitness measured in the WOMAC scale were higher before the procedure than after it.

Mean levels of pain intensity measured using the VAS and WOMAC scale for the measurements before and after the procedure are presented in Table VI.

In order to examine the relation between age and the BMI of the participants and the level of pain intensity measured using the VAS and WOMAC scale before the procedure Pearson's r correlation analysis was carried out. Table VII presents correlation coefficients from the analysis.

Table VII. Correlation coefficients between the age and BMI of the participants and pain intensity measured using the VAS and WOMAC scale before the procedure.

Scale		Age	BMI
VAS	Pain intensity	0.05	0.07
WOMAC	Perceived pain	0.16	0.17
	Morning joint stiffness	0.05	0.19
	Physical fitness	0.08	0.22

$p < 0.05$

The analysis did not show any relation between the age and the BMI of the participants and the level of pain intensity measured using the VAS and WOMAC scales before the procedure. In order to examine the relation between the duration of disease and the pain intensity measured using the VAS and WOMAC scale before the procedure, Spearman's correlation analysis was carried out. Table VII presents correlation coefficients from the analysis.

Table VIII. Correlation coefficients between the duration of disease of the participants and the level of pain intensity measured using the VAS and WOMAC scale before the procedure.

Scale		Duration of disease
VAS	Pain intensity	0.15
WOMAC	Perceived pain	0.03
	Morning joint stiffness	0.19
	Physical fitness	0.07

$p < 0.05$

The analysis did not show any relation between the duration of disease in the participants and the level of pain intensity measured using the VAS and WOMAC scales before the procedures.

Discussion

Treatment of patients with degenerative changes in knee joint is very difficult. As said before – it still involves mainly pain relief and joint functionality increasing. Physiotherapeutic methods of KOA treatment include exercises, thermotherapy, electrotherapy, hydrotherapy and massages. These procedures are applied in various combinations [7-8, 11-15, 20]. Ultrasounds occupy a special place [21, 22].

The use of the reverse piezoelectric effect in quartz crystal made it possible for the French physicist Langevin to generate ultrasounds and demonstrate their biological effect. The first publication about biological effect of ultrasounds demonstrated their therapeutic effect; they were applied often, not only as an analgesic procedure. They became "fashionable". A larger and larger number of reports on numerous contraindications that followed led to a more critical approach to ultrasounds. Further studies, demonstrating their biological effect supported by scientific evidence, as well as developing detailed contraindications and dosage, led to the renaissance of ultrasounds [23, 24].

The effect of ultrasounds is a comprehensive action which includes thermal, mechanical and physicochemical effects. Factors such as wave pressure, variable wave pressure, change of kinetic energy into thermal energy, cavitation, possibility of generating standing waves and bone piezoelectricity cause biological effects in the form of microcirculation improving, increased permeability of membranes, metabolism increasing, activation of enzymatic processes, raising the pain threshold, increasing elasticity of collagen fibres and lowering the tissue acidity. Clinical effects include lowering pain, lowering muscle tension, relieving or weakening inflammatory processes, speeding up regeneration, increasing joint mobility. Apart from local effects of ultrasounds also the general effect is noted. This results from neurohumoral mechanisms and central compensatory mechanisms [25]. The mechanism of ultrasound function is very complex, individual therapeutic effects are not scientifically documented, but at the present state of knowledge complying with contraindications and dosage makes the procedures safe. It should be emphasised however, that even at therapeutic doses applying ultrasounds on parenchymatous organs can be dangerous.

So far less attention has been devoted to the role of massage in treatment of patients with KOA. Perlman et al. [26, 27] compared the effectiveness of classical massage in a large group of patients divided into groups depending on time and frequency of procedures. Statistically significant improvement – assessed according to the WOMAC scale – took place in the patients who underwent

one massage per week for 60 minutes for 24 weeks. So far little attention has been devoted to the usefulness of deep massage therapy on periarticular tissues in KOA [28]. It had been proved before that this type of massage is effective in patients with pain in the lumbar spine [29].

An objective assessment of the effects of individual methods of physiotherapy, which should follow the principles of evidence based medicine is extremely difficult. A number of factors can affect the results and individual methods can be combined. Even the selection of cases, as a uniform group, is very difficult.

Conclusions

Classical massage and deep massage of periarticular tissues of the knee joint in osteoarthritis lead to decreased pain intensity and stiffness and improve the joint mobility. The current preliminary study of the effectiveness of simultaneous application of ultrasound and knee joint massage in patients with KOA provided very promising results. It is recommended to continue the studies to verify how long the improvement will last.

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