THE COMPARISON OF STANGER BATH (HYDROELECTRIC BATH) AND SAUNA TREATMENT IN GENERALIZED OSTEOARTHRITIS PATIENTS

JENERALİZE OSTEOARTRİT HASTALARINDA SAUNA VE STANGER BATH (HİDROELEKTRİK BANYO) TEDAVİSİNİN KARŞILAŞTIRILMASI

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SUMMARY

Aim: The purpose of this study was to evaluate whether Stanger bath and sauna therapy help reduce pain and improve patient's perception of functional disability in patients with generalized osteoarthritis.
Methods: A total of 60 female patients with generalized osteoarthritis diagnosed according to American College of Rheumatology criteria were included in the study. Their ages ranged between 42 and 74 years. Patients were randomly assigned to two groups. Group 1 (n=30) received stanger bath with a total duration of 20 min once a day and five times per week. Group 2 (n=30) received sauna bathing for ten sessions on a 2-week period. Effectiveness of treatment method in terms of pain, stiffness and functional status was assessed through analysis of changes in WOMAC scores. Grip and pinch strength were measured before and after the therapy programs.
Results: The scores of WOMAC pain, physical function and stiffness were improved at the end of treatment in the stanger bath and sauna groups ($p<0.001$). However, we did not find any statistically significant difference between the groups in WOMAC scores recorded at the second week ($p>0.05$). In addition, the levels of grip and pinch strength were statistically increased in patients both receiving stanger bath and sauna therapy at the end of second week ($p<0.05$).
Conclusion: These data highlight that hydrotherapy combined with electrotherapy and sauna may be good treatment options patients with generalized osteoarthritis.
Key words: Sauna, stanger bath, rehabilitation, osteoarthritis, grip strength

ÖZET

Amaç: Bu çalışmanın amacı, jeneralize osteoartritli hastalarda Stanger bath ve sauna tedavisinin ağrıyı azaltmaya ve hastanın fonksiyonel disabilitesinin algılanmasını düzeltmeye yardımcı olup olmadığını değerlendirmekti.
Metod: Çalışmaya Amerikan Romatizma Derneği kriterlerine göre tanı konmuş 60 jeneralize osteoartritli kadın hasta alındı. Yaş ortalaması 42 ila 74 yaş arasıydı. Hastalar randomize olarak iki gruba ayrıldı. Grup 1 (n=30), haftada 5 kez, günde 20 dk stanger bath tedavisi aldı.Grup 2 (n=30), 2 haftalık peryotta 10 tedavi sauna tedavisi aldı. Ağrı, sabah sertliği ve fonksiyonel durum açısından tedavi metodlarının etkinliği WOMAC skorlarındaki değişikliklerin analizi ile değerlendirildi. Kavrama ve çimdik gücü tedavi öncesi ve sonrası ölçüldü.
Bulgular: WOMAC ağrı, fiziksel fonksiyon ve sabah sertliği skorları her iki grupta tedavi sonrası düzeldi ($p<0.001$). Ancak ikinci haftanın sonunda kaydedilen WOMAC skorlarında her iki grup arasında istatistiksel önemli bir fark bulunmadı ($p>0.05$). Buna ilave olarak, ikinci haftanın sonunda sauna ve stanger bath tedavisi alan her iki grupta kavrama ve çimdik gücü istatistiksel olarak artmıştı ($p<0.05$).
Sonuç: Bu bilgilerin ışığı altında, elektroterapi ile kombine hidroterapi ve saunatedavisi jeneralize osteoartritli hastalarda iyi bir tedavi seçeneği olabilir.
Anahtar Kelimeler: Sauna, stanger bath, rehabilitasyon, osteoartrit, kavrama gücü

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INTRODUCTION

Osteoarthritis (OA) is a chronic degenerative disorder of multifactorial etiology characterized by loss of articular cartilage and periarticular bone remodeling. It can present as localized, generalized or as erosive osteoarthritis (1). Primary generalized osteoarthritis (GOA) was first defined by Kellgren and Moore (2-5). Basic features of the disorder included a preponderance in middle-aged women, Heberden node formation, and involvement of the first carpometacarpal and knee joints. Hip joints and joint of the spine were affected less commonly (2,6).

When GOA is symptomatic, the most prominent complaint is pain (7). Stiffness, swelling, functional limitation, weakness, deformity are the other symptoms of GOA which may be due to inflammation, degeneration of articular cartilage or metabolic disorders (6). Among the major determinants of health related quality of life in osteoarthritis of the knee or hip are pain and functional loss (8). There are no consistent results, but it is generally believed that hand osteoarthritis has little effect on hand function (9).

Therapy of GOA should be aimed at symptom relief. There is no single treatment options that is efective in all patients. The therapeutic program should include a combination of physical measures (exercise, supportive devices, alterations in activities of daily living, thermal modalities), medicinal measures, psychological approaches and surgical interventions. Thermal therapy applied either locally or to the whole body-as in the sauna-has been used to alleviate pain, decrease joint stiffness and relieve muscle spasm (2). Ott et al found the sauna treatment to have favourable effects on both chronic and non inflamatory rheumatic diseases such as osteoarthritis, degenerative spondylosis, sciatica and neck-shoulder pain. Regardless of the reason, sauna bathing alleviates symptoms in most patients with rheumatic disease (10).

Stanger bath (hydroelectric bath) was also used to treat osteoarthritis, spondyloarthropathies and chronic pain syndromes (11).

To our knowledge there have been no studies evaluating the efficacy of the Stanger bath and sauna therapy in GOA. We have found no recently published controlled therapeutic trials concerning with therapeutic approach in these patients. The purpose of this study was to evaluate whether Stanger bath and sauna therapy help reduce pain and improve patient's perception of daily functioninig.

SUBJECTS AND METHODS

This study is planned as a prospective, blinded, randomized study. A total of patients with GOA (60 female) aged between 42 and 74 were participated in the study. Before inclusion, the patients were examined according to the American College of Rheumatology (ACR) classification criteria for OA of the hand, hip and knee (12-15). They were informed of the nature of the study and signed a form giving their consent. The study was performed according to the principles of the Helsinki Declaration and was approved by the Board of Ethics in Research, Ministry of Health, Ankara.

Patients having a diagnosis of severe disc lesions, uncontrolled hypertension, . peripheric vascular disease and tumoral disorders were excluded from the study. Also, patients having other physical therapy modalities in the last three months were excluded from the study.

Complete blood count, erythrocyte sedimentation rate, C-reactive protein (CRP), rheumatoid factor (RF) and basic metabolic panel were evaluated for all patient. X-ray examination of each joint (hand, spine, hip, knee) was evaluated by the Kellgren and Lawrence (K&L) grading system for OA. Radiographic OA is defined as K&L grade 2 or higher (16).

Grip strength test of the patients was measured by using a Jamar dynamometer in a testing position of full shoulder abduction, 90 degrees of elbow flexion, 0 to 30 degrees of wrist extension with slight ulnar deviation. The test was repeated 3 times, and the average is recorded in kilograms. Pinch grip strength measurements were performed by manual pinchmeter to assess tip-to-tip pinch, lateral pinch and three-jaw chuck. The patiens are asked to hold the pinchmeter between thumb and index finger to perform tip to tip pinch and to clasp the pichmeter with the thumb against the radial side of the index finger to perform laretal pinch. Finally patiens are asked to hold the thumb in a position in which they pinch with the thumb against the pulps of the index and middle fingers. Each measurement was repeated three times and the average reading was recorded as kilograms (17).

Exercise programs consisting of range of motion, strengthening of the quadriceps muscle and hip abductors were performed by all patients. During the therapy program, both groups were allowed to take the acetaminophen, if needed. Patients were randomly assigned into two groups. Group 1 (n=30) received stanger bath (hydroelectric bath) under the supervision of a physiotherapist with a total duration of 20

min once a day and five times per week. Patients were participated the therapy program for 2 weeks (for a total of 10 sessions). They received the baths at almost similar times of the day mostly in the morning. The rest of the time, the patients were allowed to continue their daily activities. These treatments were conducted at the hydrotherapy unit of our Physical Medicine and Rehabilitation Department using Stanger baths manufactured by Enraf-Nonius (Holland). The bath is made from a synthetic material approximately 185x80x60 cm in dimensions.The bath has 9 electrodes in 25x25 cm dimensions. One of the electrodes is attached at the head side, two at the foot side, three at the right, and three at the left side of the Stanger bath. The electrodes can be used either in transverse or in longitudinal position. Low voltage galvanic currents are applied thorugh the electrodes directly into water. The water that was used for hydroelectric bath was tapwater and the temperature was maintained at 37 ^{o}C. The electrodes are changed from the pannel so that the ones on the left hand side were anodes and the ones hand right side were cathodes. The anode and cathode poles were charged with the opposite electrical current from the control panel in every ten minutes. The current intensity is adjusted according to the patient's subjective sense of tingling on the body surface.

The second group (Group 2, n=30) received sauna bathing for ten sessions on a 2-week period. The patients are taken into a 4.5 m2 big sauna room at a temparature of 80 0C and at a relative humidity of %10. They are asked to stay in the room in a sitting position as long as 20 minutes, and are allowed to choose the height of step to sit on depending on their heat tolerability.

Effectiveness of treatment method in terms of pain, stiffness and functional status were assessed through analysis of changes in Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) scores (18). The assessment parameters were measured before and after the therapy sessions. The outcome variables were examined by the physical therapy and rehabilitation specialists who were blind of the patients' group affiliation.

Statistical analysis

Statistical analysis was carried out with the SPSS 11.0 PC program. T test and Mann-Whitney U test were used to compare the difference between the two groups. In both groups, percent of change between the beginning and end of the therapy was assessed. T test was used to compare the difference between two groups. p values of < 0.05 were accepted as statistically significant. For each subject the significance of the differences in the measurements obtained before and after the therapy session was assessed using Wilcoxon's signed-rank test. The results are given in tables 1 and 2 as mean values ± SD.

RESULTS

Our study group consisted of 60 female patients. The age of the patients was ranged from 42 to 74 (mean 59.5± 8.3) years and disease duration was ranged from 3 to 30 (mean 6.7± 7.4) years. There was no statistically significant difference in demographic and clinical parameters between two groups ($p>0.05$) (Table 1.).

Tablo-I
The demographic and clinical parameters of the two groups

	Group 1 (n=30)	Group 2 (n=30)	p*
Age (yrs)	59.85±7.61	59.15±9.14	0.794
BMI (kg/m^2)	29.97±3.52	30.63±4.52	0.587
Disease duration (yrs)	7.84±6.06	5.95±4.93	0.378

** Statistical analysis was performed by Independent Samples t Test*

The results of erithrocyte sedimentation rate, C reactive protein, rheumatoid factor and other biochemical parameters were within normal ranges for both groups. All of the patients had chronic articular symptoms. The distribution of OA joints and radiographic severity of patients shown in Table 2..Thirteen patients (43 %) had hypertension and two patients (6.6 %) were diabetic in the stangerbath group, and fifteen patents (50 %) had hypertension and two patients (6.6 %) were diabetic in the sauna group. They were taking medication for the control of these diseases. They were in stable clinical condition one month before the administration to the study. No adverse effects and no drop outs were

Tablo-II
The distribution of osteoarthritic joints and radiographic severity of two groups

	Group 1 n	Group 2 n
Hand OA (K&L > grade 2)	10	12
Knee OA (K&L > grade 2)	16	18
Spine OA (K&L > grade 2)	20	16
Hip OA (K&L > grade 2)	6	2

K&L: Kellgren and Lawrence

Tablo-III
Comparison of WOMAC physical function, pain and stiffness assessments in group 1 and group 2.

Variable	Group 1 (n=30)	Group 2 (n=30)	p*
WOMAC pain scores (0-100, 100= unbearable pain)			
Pre-treatment	33.90±7.40	32.15±7.46	0.583
Post-treatment	24.45±12.33	19.95±8.32	0.231
WOMAC function scores (0-100, 100= extreme difficulty)			
Pre-treatment	36.35±11.65	38.65±12.03	0.512
Post-treatment	29.45±10.84	27.60±11.45	0.355
WOMAC stiffness (0-100, 100= extreme stiffness)			
Pre-treatment	43.65±10.62	45.21±10.23	0.265
Post-treatment	23.45±7.98	27.05±11.06	0.820

**Statistical analyses was performed by Mann Whitney-U test*

observed during the study. All the subjects in the Stanger bath and sauna group received the treatment as planned.

The results of WOMAC scores before the therapy and after 2 weeks of therapy are shown in Table 3. WOMAC pain, physical function and stiffness scores were improved at the end of treatment in the stanger bath (p=0.0001, p=0.001, and p=0.0001 respectively) and sauna group (p=0.0001, p=0.0001, p=0.001 respectively); this improvement was statistically significant. However, we did not find any statistically significant difference between the groups in WOMAC scores (pain, physical function, stiffness) when compared at the second week (p=0.228, p=0.792, p=0.349 respectively).

In addition, when grip and pinch strength (lateral, chuck, pulp) values of the two groups were assessed at a post-treatment control, a statistically significant difference was not found (p=0.157, p=0.862, p=820 and p=0.369, respectively). A statistically significant increase existed in grip and pinch strength values in stanger bath and sauna group at the end of second week. The results of grip and pinch strength values for both groups are shown in Table 4.

DISCUSSION

Although there is no known cure for OA, the primary goals of treatment in patients with osteoarthritis are to reduce pain and other symptoms and to correct or minimize functional limitations and disability (12).

Because reliable effective pharmacologic treatment options are limited, nonpharmacologic treatment is part of all guidelines for treatment of osteoarthritis (OA). There are several different physi-

Tablo-IV
The evaluation of grip and pinch strength values for stanger bath and sauna group at the pre and post treatment.

	Pre-treatment	Post-treatment	p*
Grip strength (kgms)			
Stanger bath group	47.00±11.38	52.85±11.42	**0.000**
Sauna group	41.25±8.38	48.00±8.81	**0.000**
Lateral pinch strength (kgms)			
Stanger bath group	6.53±3.28	7.12±3.56	**0.009**
Sauna group	6.02±3.21	6.92±2.71	**0.001**
Chuck pinch strength (kgms)			
Stanger bath group	6.02±2.01	6.61±2.32	**0.004**
Sauna group	5.84±3.17	6.51±2.98	**0.005**
Pulp Pinch strength (kgms)			
Stanger bath group	6.15±2.83	6.65±2.73	**0.001**
Sauna group	5.62±3.11	6.13±3.47	**0.002**

**Statistical analyses was performed by Wilcoxon's signed-rank test*

cal modalities, such as massage, yoga therapy, acupuncture, magnets, pulsed electromagnetic fields, transcutaneous neural stimulation (TENS), electrotherapy/thermotherapy, and spa therapy (2,19,20). As the symptoms are extensive in GOA, the treatment becomes much more difficult. Thus, we preferred these two treatment options (hydroelectric bath and sauna) which can be applied for whole body.

Historically, hydrotherapy was used for centuries in the treatment of pain but there are limited studies showing the beneficial effects of hydrotherapy and electrotherapy in GOA (21). Electrotherapy, including transcutaneous electric nerve stimulation (22) and electroacupuncture were used in the treatment of patients with OA (23-24). Stanger bath, a combination of electrotherapy and hydrotherapy, is used to treat osteoarthritis, spondyloarthritis and chronic pain syndromes. It is a whole body bath equipped with electrodes on all sides. Depending on the indication, it is possible to create a flow of low voltage direct electric current through the length of the body or from side to side. The effect of galvanic current which was used in the hydroelectric bath mentions five different effects which occur in the tissues between the electrodes when the galvanic current is applied. 1- vasodilatation (in the skin) 2-electroosmosis 3- electrotonus (excitability and conductivity of muscles and nerves) 4- production of counterirritation (pain-relieving influence) 5- refreshing action (25).

Previous studies about the effect hydroelectric bath therapy are not common in the literature. Gunter et all found a significantly higher reduction in pain intensity in the period from breakfast to lunch in patients receiving hydrogalvanic bath therapy followed by Jacobson relaxation therapy. Also, Eksioglu et al revealed that Stanger bath therapy when combined with amitriptyline has a long lasting effect and better outcome in fibromyalgia patients (21). Stener et al. have compared the electro-acupuncture (EA) and hydrotherapy, both in combination with patient education or with patient education alone, in the treatment of hip osteoarthritis and concluded long-lasting effects of EA and hydrotherapy, shown by reduced pain and increased functional activity and quality of life (26). Our study comparing different physical modalities on the pain and physical function in the GOA patients revealed success of both stanger bath and sauna treatment.

Sauna bathing has mostly been used to alleviate pain. It has been shown in experimental studies that both hyperthermia and the local application of heat prevent the development of chronic and proliferative inflamation, whereas they exacerbate acute exudative inflammation (27). In the treatment of rheumatic diseases, sauna bathing can be considered a form of thermal therapy with no more profound effects on the pathology of the disease than other types of thermal therapy (10). Large amounts of heat energy are delivered to the skin, mainly through convection and radiation without any confounding contribution from mechanical stimuli. Measurements during sauna bathing show that skin temperature usually reaches the level of 40-42 ^{o}C in 15 min. It has been shown that in healthy subjects, hot pain perception threshold is a round 41-43 ^{o}C depending on the rate of temperature rise and size of stimulus area (28).

The majority of the reported effects of sauna are explained by cutaneous vasodilatation, an increased secretion of catecholamines (noradrenaline, in some studies adrenaline) cortisol, growth hormone, muscle relaxation and a variety of phenomena that are due to a sudden rise of temperature and humidity (10,28). Thermotherapy mostly produces analgesia on nerve endings by increasing the pain thereshold (29). It causes a relief in muscle spasm through the gamma fibers of muscle spindle and activates the descending pain inhibitory system. In joints and connective tissue, it causes an increase in tendon extensibility. It helps to wash out pain mediators, by causing peripheric vasodilation. Evcik et al. investigated the effects of a standardized balneotherapy for 42 patients with primer fibromyalgia. The patients with fibromyalgia received 20 min bathing once a day for 3-weeks. In balneotherapy group, there were statistically significant difference in numbers of tender points, visual analogue scores, Fibromyalgia Impact Questionnaire compared to the control group at the end of the 6th month. This study showed that balneotherapy was effective and might be an alternative method in treating fibromyalgia patients (30).

In our study, the patients of both groups had significant improvements in outcome measurements and WOMAC scores after sauna and stanger bath therapies. We think that this outcome might occur due to possible different referred mechanisms of actions.

We used WOMAC index to assess the functional status of patients (15). Grip and pinch strength measurements which provide an objective index of the functional integrity of the upper extremity were also used (31). Measurements of grip and pinch strength are the common methods for the evaluation of the functional integrity of hand (9,32). However, few studies have attempted to evaluate the impact of

hand OA using hand strength (32). Bagıs et al, found that pinch and grip strength declined the number of joint groups with radiographic OA increased (9). Labi (33) and Jones (34) suggested that grip strength was lower in hand OA patients than in controls. Dominick et al. show that grip strength was most strongly associated with OA in the CMC joints, while pinch strength was most strongly associated with OA in the MCP joints and loss of strength may limit individuals' ability to perform daily tasks (32). Pattrick (35) investigated hand function in nodal and erosive osteoarthritis and found minimal global impairment in the nodal osteoarthritis group as opposed to the control group. In this study, we found that patients with hand OA have a higher grip and pinch strength measures at the end of the treatment than baseline in the both group.

As a result, these trials showed no statistical difference between stanger bath or sauna for the outcomes of pain and physical function and stiffness patient-assessed improvement. After 2-weeks of therapy with hydroelectric bath and sauna, we observed similiar improvements in the symptoms of GOA in both groups. These data highlight that hydrotherapy combined with electrotherapy and sauna may be good treatment options in GOA patients.

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