The Effect of Mud Pack Treatment in Knee Osteoarthritis

Diz Osteoartritinde Peloidoterapinin Etkisi

Ersin Odabaşı[1], Mustafa Turan[1], Hakan Erdem[2], Salih Pay[2], Mahir Güleç[3], Müfit Zeki Karagülle[4]

[1]Gülhane Askeri Tıp Akademisi, Tıbbi Ekoloji ve Hidroklimatoloji Anabilim Dalı, Ankara, Türkiye

[2]Gülhane Askeri Tıp Akademisi, Romatoloji Bilim Dalı, Ankara, Türkiye

[3]Gülhane Askeri Tıp Akademisi, Halk Sağlığı Anabilim Dalı, Ankara, Türkiye

[4]İstanbul Üniversitesi Tıp Fakültesi, Tıbbi Ekoloji ve Hidroklimatoloji Anabilim Dalı, İstanbul, Türkiye

Abstract

Objective: The aim of this study was to evaluate the efficacy of mud pack treatment in patients with knee osteoarthritis (OA).

Material and Methods: Fifty-seven patients with bilateral primary OA of the knee were enrolled in the study. Patients were divided into two groups based on their availability for mud application during the study period. The patients in the study group (32 patients) were subjected to daily mud pack treatment on weekdays only for three weeks, applied to both knees for 30 minutes (min) at 45°C (total 15 applications). Mud applications were done in the musculoskeletal outpatient clinic by the same person. The patients in the control group (25 patients) had analgesic treatment with acetaminophen 2 g/day. All patients were evaluated three times by assessors who were blinded to both the intervention and evaluation period: (1) at the baseline, (2) immediately after the 15th application, and (3) 30 days after the end of the treatment. Western Ontario and McMaster Universities osteoarthritis index (WOMAC), pain intensity (as measured with 100 mm VAS) and patient's and physician's assessment of disease severity index were the primary outcome measures of the study.

Results: As compared to the baseline, significant decreases were observed in both groups in terms of WOMAC, pain intensity, and disease severity index scores. The improvements were found to be superior in the study group as compared to the controls. Moreover, a significant number of patients in the study group had minimal clinically important improvement when compared to the control group.

Conclusion: Mud pack treatment significantly improves the pain and functional status of patients with knee OA.

(Turk J Rheumatol 2009; 24: 72-6)

Key words: Balneotherapy, mud treatment, osteoarthritis

Received: 03.11.2008 **Accepted:** 10.03.2009

Özet

Amaç: Bu çalışmanın amacı diz osteoartritli hastalarda peloid tedavisinin etkinliğini ortaya koymaktır.

Yöntem ve Gereçler: Bilateral diz osteoartritli 57 hasta çalışmaya alındı. Hastalar çalışmanın yürütüldüğü tarihlerde tedaviye devam edebilme durumlarına göre iki gruba ayrıldı. Çalışma grubundaki hastaların(32 hasta) her iki dizine üç hafta boyunca, hafta tatili günleri dışında her gün, 45°C sıcaklığındaki peloid 30 dakika süreyle uygulandı (toplam 15 uygulama). Peloid uygulamaları aynı uygulayıcı tarafından poliklinik ortamında gerçekleştirildi. Kontrol grubundaki hastalar ise (25 hasta) 2 g/gün dozunda asetaminofen aldılar. Tüm hastalar, (1) başlangıçta, (2) 15 nci uygulamadan hemen sonra ve (3) tedavi bitiminden 30 gün sonra olmak üzere, hasta grubundan ve değerlendirme dönemlerinden habersiz değerlendiriciler tarafından üçer defa değerlendirildiler. Western Ontario and McMaster Universities osteoarthritis (WOMAC) indeksi, ağrı (VAS, 100 mm), hastalık şiddetinin hastalar ve hekimler tarafından değerlendirildiği indeksler değerlendirilmelerde kullanıldı.

Bulgular: Başlangıç değerleri ile karşılaştırıldığında WOMAC, ağrı ve hastalık şiddet değerlendirme indekslerinde her iki grupta anlamlı azalmalar gözlendi. Çalışma grubundaki düzelmeler, kontrol grubuna göre daha üstündü. Ayrıca, "minimal klinik anlamlılık" gösteren hasta sayısı kontrol grubuna göre, çalışma grubunda anlamlı olarak daha fazla idi.

Sonuç: Peloidoterapi, diz osteoartritli hastalarda ağrı ve fonksiyonel durum üzerinde anlamlı düzelmeler sağlamaktadır.

(Turk J Rheumatol 2009; 24: 72-6)

Anahtar sözcükler: Balneoterapi, peloidoterapi, osteoartrit

Alındığı Tarih: 03.11.2008 **Kabul Tarihi:** 10.03.2009

Address for Correspondence/Yazışma Adresi: Dr. Ersin Odabaşı, Gülhane Askeri Tıp Akademisi, Tıbbi Ekoloji ve Hidroklimatoloji Anabilim Dalı, Ankara, Türkiye Tel.: +90 312 304 45 82 E-mail: ersinodabasi@hotmail.com

Introduction

Osteoarthritis (OA), especially in the large joints, is among the most frequent musculoskeletal disorders and became an important health concern considering the increasing proportion of the elder population. One of the primary objectives of OA treatment is to relieve pain. Balneotherapeutic treatment methods may play a role as nonpharmacological options in the complex, multimodal therapy of rheumatic diseases (1, 2). Mud pack treatment is used as a balneotherapeutic intervention and is used in spas in the treatment of rheumatic conditions (3,4). Although not yet recognized as a mainstream treatment modality in North America, mud packs are widely used in most European countries mostly for the treatment of OA. The mechanism of the pain-relieving effect of mud pack application is obscure, probably due to its influence on bio-humoral mediators of the inflammatory response (5). Its beneficial effects have often been ascribed merely to the heating effect, but several studies suggest that a specific anti-inflammatory action of mud pack treatment should also be considered (6-8).

The aim of the present study was to evaluate the efficacy of the mud pack treatment in patients with OA.

Materials and Methods

Patients

Fifty-seven patients (44 F, 13 M; age range: 54 to 79 years) with bilateral primary OA of the knee and fulfilling the American College of Rheumatology classification criteria for knee OA were enrolled in the study (9). Radiographic evidences of severe OA (Kellgren and Lawrence score 4) were present in knee radiographs (10). The patients were symptomatic and had severe pain, more than 60 on the 100 mm visual analogue scale (VAS) for at least six months prior to the study. None of the patients had intraarticular injection, electrotherapy or balneotherapy within the previous six months. The ethical implications of the study were fully considered. All patients were informed about the aims of the study and study protocol, and their informed consents were obtained prior to the study. Care had been taken to ensure that there was no risk to participants. The study was conducted in line with the Declaration of Helsinki.

Mud pack treatment was offered as a treatment option and was accepted by all patients. The patients were divided into two groups based on their availability for mud application during the study period. The patients who stated that they would not be able to participate in the three-week application period between May and October 2007 due to various reasons were included in the control group (drug treatment; 25 patients). The remaining patients constituted the study group (mud pack treatment; 32 patients).

Treatment protocol

The patients in the study group were subjected to a three-week intervention. Over three weeks, a cycle of 15 mud pack treatments (weekdays only)_was applied. The applications were made in the musculoskeletal outpatient clinic at a tertiary level hospital. Thermal mud at 45°C was applied to both knees for 30 minutes (min). The patients in the study group were requested not to use analgesic drugs throughout the mud application and follow-up periods; they were informed that analgesic drugs would be permitted in the event of severe pain by informing one of the authors.

The patients in the control group had drug treatment with acetaminophen 2 g/d throughout the study and follow-up periods.

Assessment

Each patient was examined and evaluated three times: (1) at the baseline (week 0), (2) upon completion of the 15-day treatment period (week 3), and (3) 30 days after the end of the treatment (week 7). The assessors (HE and SP) were blinded to both the intervention and the evaluation period.

Outcome measures

Western Ontario and McMaster Universities osteoarthritis index (WOMAC), pain intensity (pVAS), the patient's global assessment of disease status and response to therapy (DSIp) score, and the physician's global assessment of disease status and response to therapy (DSIph) score were the primary outcome measures of the study.

WOMAC is a multidimensional measure in which parameters are scored using a 5-point Likert scale. The sum of the scores used in the study was obtained by adding the scores of subscales for pain, stiffness and physical functional disability. WOMAC score ranged between 0-96 (11). Pain intensity was defined using a 100 mm VAS.

Both the patient's and physician's global assessments of disease status and response to therapy scores were defined using a scale from 0 (excellent) to 5 (unbearable).

Minimal clinically important improvement (MCII) scores were defined by emulating Tubach et al.'s (12) definitions. We defined MCII for relative changes, respectively: (a) -40.8% for pain; (b) -39.0% for patient's and physician's global assessments; and (c) -26.0% for WOMAC score.

Mud

The mud used in the study was obtained from Denizli region, Turkey. It has been classified as turf based on its physical, chemical, and geological properties. It is rich in organic substances; lignin and humin content was 80.99 g/L. Heat retention and water retention capacities (84%) are high, accordingly.

Statistical analysis

The data characteristics were examined using Shapiro-Wilks test, and non-parametric methods were used in statistical calculations accordingly. Several paired groups (baseline and follow-up measurements) were compared using Friedman's test. Where a significant difference was observed between different periods of assessment, the

data were further analyzed using Wilcoxon signed ranks test. Data obtained from independent samples were analyzed using Mann-Whitney U test. Comparison of frequency data was made using the chi-square test. All statistical calculations were performed using SPPS for Windows ver. 11.0. Alpha value was set to 0.05 in all calculations, and calculated p value less than 0.05 was accepted as statistically significant.

Results

The clinical and demographic characteristics of the patients are given in Table 1. Clinical characteristics were similar in both groups, except for significantly higher VAS scores in the study group.

Both groups showed significant improvements in all outcome measures during the study period (Tables 2, 3). However, it was found that mud pack treatment provided clinically relevant results considering percent changes from the baseline in all index scores (Table 4). Similarly, the number of patients who had MCII was significantly higher in the study group at week 3 and remained high till the end of the follow-up period (Table 5). Moderate pain attacks between follow-up visits were reported by some of patients; however, none of the patients in the study group demanded supplemental analgesics.

Side effects

No side effect was observed due to mud pack application during the study period in the study group. Three patients in the control group experienced short-term, moderate gastrointestinal discomfort, which did not require stopping the treatment.

Discussion

The present study indicates that mud pack treatment is effective on knee OA in terms of pain alleviation and improvement in functional capacity. In other words, application of mud pack treatment has beneficial effects on knee OA resulting in improvements in knee functions and in relief of pain. These improvements were maintained until the end of the follow-up period.

Pain is the most important aspect of OA. Previous studies have shown that mud pack treatment, whether applied solely or in combination with other balneological treatments, is effective in OA. Wigler et al. (3) reported that the index of disease severity score was better in patients with knee OA having daily thermal mineral

Table 1. Baseline characteristics of the patients

Variable	Study group (n=32)	Control group (n=25)	p*
Age (years)	67.4±5.8	66.5±7.1	0.891
Gender (F/M)	25/7	19/6	
VAS	79.2±10.6	75.5±7.1	0.011
WOMAC global index	71.6±12.9	70.7±8.4	0.411

Data expressed as mean ± SD
VAS: visual analogue scale, WOMAC: Western Ontario and McMaster Universities Osteoarthritis Index
*Mann-Whitney U test

Table 2. Comparison of the baseline (week 0), post-treatment (week 3), and follow-up evaluations in study group

	WOMAC	VAS	DSIp	DSIph
Week 0	71.6±12.9	79.2±10.6	7.3±1.9	7.7±1.7
Week 3	33.3±10.5*	50.7±11.8*	3.1±1.2*	2.8±1.5*
Week 7	28.7±11.4*	45.3±15.2*	2.7±1.4*	2.5±1.6*
Chi square value†	51.8	53.5	56.4	56.8
p	0.001	0.001	0.001	0.001

Data expressed as mean ± SD
WOMAC: Western Ontario and McMaster Universities Osteoarthritis Index, VAS: visual analogue scale, DSIp: patient's global assessments of disease status, DSIph: physician's global assessments of disease status
†Friedman's test
*p <0.001, Wilcoxon-Signed Ranks test

Table 3. Comparison of the baseline (week 0), post-treatment (week 3), and follow-up evaluations in control group

	WOMAC	VAS	DSIp	DSIph
Week 0	70.7±8.4	75.5±7.1	5.6±1.1	5.5±1.0
Week 3	58.4±9.6*	61.1±6.8*	4.2±1.3*	4.4±1.3*
Week 7	58.6±9.3*	61.3±6.6*	4.4±1.4*	4.3±1.3*
Chi square value†	40.9	42.2	45.9	43.7
p	0.001	0.001	0.001	0.001

Data expressed as mean ± standard deviation
WOMAC: Western Ontario and McMaster Universities Osteoarthritis Index, VAS: visual analogue scale, DSIp: patient's global assessments of disease status, DSIph: physician's global assessments of disease status
†Friedman's test
*p <0.001, Wilcoxon-Signed Ranks test

Table 4. Comparison of study group and control group in terms of percent changes from the baseline (%)

	WOMAC		VAS		DSIp		DSIph	
	Study	Control	Study	Control	Study	Control	Study	Control
Week 0-Week 3	- 55.2	- 17.7	-34.3	-18.9	-56.4	-26.0	-68.1	-21.6
p*	0.001		0.001		0.001		0.001	
Week 0-Week 7	-64.2	-17.5	-43.6	-18.7	-63.4	-23.8	-71.8	-22.4
p*	0.001		0.001		0.001		0.001	

WOMAC: Western Ontario and McMaster Universities Osteoarthritis Index, VAS: visual analogue scale, DSIp: patient's global assessments of disease status, DSIph: physician's global assessments of disease status
* Mann-Whitney U test

Table 5. Number of patients who had minimal clinically important improvement

		Study group n (%)	Control group n (%)	P*
WOMAC (≥ 26%)	Week 3	32 (100.0)	2 (8.0)	0.001
	Week 7	32 (100.0)	2 (8.0)	0.001
VAS (≥ 40.8%)	Week 3	12 (37.5)	0 (0)	0.002
	Week 7	19 (59.4)	0 (0)	0.001
DSIp (≥ 39%)	Week 3	27 (84.4)	6 (24.0)	0.001
	Week 7	29 (90.3)	3 (12.0)	0.001
DSIph (≥ 39%)	Week 3	28 (87.5)	4 (16.0)	0.001
	Week 7	30 (93.8)	4 (16.0)	0.001

WOMAC: Western Ontario and McMaster Universities Osteoarthritis Index, VAS: visual analogue scale, DSIp: patient's global assessments of disease status, DSIph: physician's global assessments of disease status
*Chi-square

water baths and mud pack applications on alternate days as compared to those having daily thermal mineral water baths and rinsed mud pack applications on alternate days. Moreover, the well-being status remained for 16 weeks only in the first group. It was previously reported that the improvement in the clinical symptoms is better in patients suffering from OA at the knees having mud bath twice a day as compared to those having daily thermal mineral water bath and mud bath (4). These results are parallel with the present study.

Significant improvements were observed in both groups during the study period. The most important issue in such treatment efficacy studies is the clinical meaning of such changes. In other words, observed statistically meaningful changes may not equate to a clinical benefit, since statistically significant difference is often a matter of simple size. The most difficult issue is to decide whether the observed difference is clinically important (12). Thus, use of MCII is necessary to interpret clinical study results. It is obvious that the number of patients who had MCII was significantly higher in the study group. From this point of view, it is correct to claim that the results of this study demonstrate that mud pack application is an effective treatment modality in knee OA.

The beneficial effects or mechanism of action of local mud therapy in a broad spectrum of diseases has not been fully explained. It can be claimed that these benefits result from the combination of chemical and thermal effects (7, 13).

Considering the chemical effect, one might expect that organic substances or minerals are absorbed through the skin during mud pack application, but there is little evidence of this (14, 15).

It has been reported that substances in aqueous mud extracts can permeate across human full thickness skin in quantities that have definite effects on spontaneous contractile activity of smooth muscle tissue (16). It was previously reported that direct mud pack application is superior to nylon covered mud pack applications in knee OA patients (7). This finding implies the contribution of chemical properties of the mud on beneficial effects of mud pack treatment. However, which elements are essential and their ideal concentration in order to obtain an optimal response to treatment remain unclear.

Extensibility of collagen-rich tissues increases with thermal stimulation (17). Due to increase in the extensibility of collagen-rich tissues, the range of motion of involved joints improves, pain diminishes, and muscle spasm relieves. The analgesic effect of heat may be due to increased β-endorphin concentration (18). It has been hypothesized that human skin can release significant amounts of opioid peptides, modifying the threshold of pain under different stimuli, such as heat or UV radiation (19). Heat may also have an anti-inflammatory effect, which may result from the increased secretion of cortisol and catecholamines induced by thermal stress (6,20). Moreover, it has been hypothesized that mud pack treatment may affect secretion of certain cytokines, but related information is scarce. Bellometti et al. (21-23)

reported that mud pack treatment decreases plasma levels of interleukin-1, tumor necrosis factor-α, and matrix metalloproteinase-3, consequently reducing cartilage inflammation and tissue destruction. Without ignoring the possible contribution of the chemical substances, we suggest that the observed improvements in the clinical variables in this study are mainly due to the thermal effects of the mud application.

One of the major criticisms of the studies investigating efficacy of balneotherapeutic applications is the impossibility of the exclusion of the effects of the spa environment from the study setting. It is often stated that staying at a resort hotel provides a positive placebo effect. This study was carried out in an outpatient setting and the patients in both groups were subjected to the same environmental conditions. Accordingly, it can be claimed that this study is exempt from such effect.

While this is the strength of the current study in comparison to the others, lack of randomization is the major weakness of this study. Since transportation opportunities were poor, some of the patients declared their inability to attend the daily mud applications beforehand, and we thus had to conduct this study on a voluntary sample. It is impossible to claim that our results are free from bias since there was a non-random allocation. The baseline characteristics excluding VAS were similar in both groups and the mean VAS score of the study group was worse than in the controls. As a result, it may be stated that such bias did not lead to overestimation of the benefits of mud pack treatment.

In conclusion, our results suggest that mud pack treatment significantly improves the functional status and pain in patients with knee OA. Mud treatment should be considered as an effective nonpharmacologic treatment modality in terms of reducing pain and improving functional status.

References

1. Karagulle MZ, Karagulle M. Balneotherapy and spa therapy of rheumatic disease in Turkey: a systemic review. Forch Komplementarmed Klass Naturheilkd 2004; 1: 33-41.
2. Evcik D, Kavuncu V, Yeter A, Yigit I. The efficacy of balneotherapy and mud-pack therapy in patients with knee osteoarthritis. Joint Bone Spine 2007; 74: 60-5.
3. Wigler I, Elkayam O, Paran D, Yaron M. Spa therapy for gonarthrosis: a prospective study. Rheumatol Int 1995; 15: 65-8.
4. Odabasi E, Karagulle MZ, Karagulle M, Turan M, Karagulle O. Comparison of two traditional spa therapy regimens in patients with knee osteoarthritis. Phys Med Rehab Kur Med 2002; 12: 337-41.
5. Basili S, Martini F, Ferroni P, Grassi M, Sili Scavalli A, Streva P, et al. Effects of mud-pack treatment on plasma cytokine and soluble adhesion molecule levels in healthy volunteers. Clinica Chimica Acta 2001; 314: 209-14.
6. Cozzi F, Carrara M, Sfriso P, Todesco S, Cima L. Anti-inflammatory effect of mud-bath applications on adjuvant arthritis in rats. Clin Exp Rheumatol 2004; 22: 763-6.
7. Odabasi E, Turan M, Erdem H, Tekbas F. Does mud pack treatment have any chemical effect? A randomized controlled clinical study. J Altern Complement Med 2008; 14: 559-65.
8. Poensin D, Carpentier PH, Christiane F, Sylvie G. Effects of mud pack treatment on skin microsirculation. Joint Bone Spine 2003; 70: 367-70.
9. Altman R, Asch E, Bloch D, Bole G, Borensin D, Brandt K, et al. Development of criteria for the classification and reporting of osteoarthritis. Classification of osteoarthritis of the knee. Diagnostic and Therapeutic Criteria Committee of the American Rheumatism Association. Arthritis Rheum 1986; 29: 1039-49.
10. Kellgren JH &Lawrence JS. Radiological assessment of osteo-arthrosis. Ann Rheum Dis 1957; 16: 494-502.
11. Bellamy N, Buchanan WW, Goldsmith CH, Campbell J. Validation study of WOMAC: a health status instrument for measuring clinically-important patient-relevant outcomes following total hip or knee athroplasty in osteoarthritis. J Orthop Rheumatol 1988 ;1: 95-108.
12. Tubach F, Ravaud P, Baron G, Falissard B, Logeart I, Bellamy N, et al. Evaluation of clinically relevant changes in patient reported outcomes in knee and hip osteoarthritis: the minimal clinically important improvement. Ann Rheum Dis 2005; 64: 29-33.
13. Matz H, Orian E, Wolf R. Balneotherapy in dermatology. Dermatol Ther 2003; 16: 132-40.
14. Bender T, Karagulle Z, Balint GP, Gutenbrunner C, Balint PV, Sukenik S. Hydrotherapy, balneotherapy, and spa treatment in pain management. Rheumatol Int 2005; 25: 220-4.
15. Codish S, Abu-Shakra M, Flusser D, Friger M, Sukenik S. Mud compress therapy for the hands of patients with rheumatoid arthritis. Rheumatol Int 2005; 25: 49-54.
16. Beer AM, Junginger HE, Lukanov J, Sagorchev P. Evaluation of the permeation of peat substances through human skin in vitro. International Journal of Pharmaceutics 2003; 253: 169-75.
17. Sukenik S, Abu-Shakra M, Flusser D. Balneotherapy in autoimmune disease. Isr J Med Sci 1997; 33: 258-61.
18. Jezora D, Vigas M, Tatar P, Jurcovicora J, Palat M. Rise in plasma beta-endorphin and ACTH in response to hyperthermia in sauna. Horm Metab Res 1985; 17: 693-4.
19. Ghersetich I, Freedman D, Lotti T. Balneology today. JEADV 2000; 14: 346-8.
20. Cozzi F, Lazzarin P, Todesco S, Cima L. Hypothalamic-pituitary adrenal axis dysregulation in healthy subjects undergoing mud-bath application [letter]. Arthritis Rheum 1995; 38: 724-5.
21. Bellometti S, Giannini S, Sartori L, Crepaldi G. Cytokine levels in osteoarthrosis patients undergoing mud bath therapy. Int Clin Pharmacol Res 1997; 17: 149-53.
22. Bellometti S, Cecchettin M, Galzigna L. Mud pack therapy in osteoarthrosis: changes in serum levels of chondrocyte markers. Clin Chim Acta 1997; 268: 101-6.
23. Bellometti S, Richelmi P, Tassoni T, Berte F. Production of matrix metalloproteinases and their inhibitors in osteoarthritic patients undergoing mud bath therapy. Int J Clin Pharmacol Res 2005; 25: 77-94.