THE ROLE OF INFRARED AND ULTRASOUND WAVES IN THE TREATMENT OF CALCANEAL SPUR

Y. SÜKRÜ AYDOG*
ALPER GÖKMAN*
O. HAKAN GÜNDÜZ*
HALIL UÇAN*
METIN YÜCEL*

SUMMARY: Calcaneal spur, with its relevant symptoms of pain and irritation, is not an infrequent entity. Several therapeutic regimens approved for the treatment of calcaneal spur are: application of the spin boats, administration of non-steroidal anti-inflammatory drugs, local steroid injections, and operative approaches.

In the present study we investigated the utility of physical therapy agents (ultrasound and infrared) in patients with calcaneal spur. The patients were treated with either infrared or infrared plus ultrasound during the study. We achieved gratifying results in both groups, but the efficiacy of ultrasound treatment was more pronounced with regard to the overall data. Especially relief of pain was more striking with ultrasound treatment.

Key Words: Calcaneal spur, ultrasound, infrared.

INTRODUCTION

The genesis of calcaneal spur begins with the emergence of a tubercule on the bottom surface of the calcaneal bone at the insertion point of the plantar aponeurosis. Later, it grows up gradually to become more apparent distally. The spine is usually situated transversly along the bottom of the calcaneal bone. It is asymptomatic for most of the cases. It is generally thought to come out by the subperiostal ossification following the periostal contraction. The development of calcaneal spur is based on such several postulations as inflammation of the bursa over the bone, traumatic periostitis, or on the fracture end points, at the insertion site of the fascial leaflets, fascial infections due to sepsis.

The major complaint in patients with calcaneal spur is the induction of localized pain at the bottom of the heel during walking and standing up. The pain ceases at rest. Hyperesthesia is a common finding on the medial site of the spine. Mild swelling frequently exists. The symptoms of the patient become more marked by passive dorsiflexion of the toes.

The treatment of calcaneal spur consists of operative and non-operative managements. In the non-operative therapy, the foot is kept at rest, local injections with steroids and anesthetic drugs and physical therapy agents are used (ultrasound and infrared) are made, warm compresses are applied on the affected site, and infections are prevented.

Operative treatments are indicated in patients with resistance to conservative therapy. In the operative ther-

*From Department of Physical Therapy and Rehabilitation, Ankara Numune Hospital, Ankara, Türkiye.

apy, the osteoid tubercule is excised, the soft tissues over the calcaneal bone is swept away, and the plantar aponeurosis is cut and resected at it's origin (1-4).

MATERIALS AND METHODS

We studied 70 patients with diagnosis of calcaneal spur admitted to the physical therapy department of Ankara Numune Hospital. We constituted two groups of patients. In the first group, 35 patients were maintained on a combined treatment of ultrasound and infrared locally applied on calcaneal bone on the affected side. In the second group the remaining 35 patients received only infrared therapy locally applied on calcaneal bone on the affected side. In the combined treatment group the application times of ultrasound and infrared were 10 and 15 minutes respectively. In the infrared group the duration time of infrared application was 15 minutes. In both groups the therapy consisted of 10 sessions. The ultrasound machine ran at a reduced power of 2 watt/cm^2.

The x-ray roentgenograms of the patients were taken both in anteroposterior and lateral aspects before and after the treatment in both groups. During the treatment the patients were free of analgesic drugs of any kind (non-steroid antiinflammatory drugs and others). Results were evaluated on a subjective basis regarding the pain criteria of VAS (Visual Analog Scales) references. In the statistical analysis of our study Chi-square, Student's-t, Wilcoxon, and Mann-Whitney-U-tests were done.

RESULTS

Pain scores of all patients for three different situations (walking, standing on heels, resting) were made in both groups according the pain criteria of VAS references before and after the treatment. Of the total 70 patients, 32 patients were female and 38 were male. The ages of the patients were between 23 and 62 with a mean of 40 ± 7.7 for female and 42 ± 6.4 for male. No noticeable differences existed in the post-treatment x-ray roentgenograms when compared with those of the pre-treatment evaluation in both groups. The statistical difference was more impressive ($p<0.001$) in the combined treatment group than in the infrared treated group ($p<0.05$).

The walking pain was significantly reduced after the treatment in both groups. The p values.

With regard to standing pain, when we compared pain scores of the post-treatment evaluation with those of the pre-treatment evaluation in each of the two groups relief of standing pain after the treatment was statistically important in both groups with a more substantial difference in the combined treatment group. As expected, the combined treatment group developed a greater reduction in local hyperesthesia of the affected side than the infrared group at the end of the study. Response to therapy was not altered in both groups with regard to sex ($p>0.05$).

DISCUSSION

Spine of calcaneus (calcaneal spur) are two important causes of localized heel pain. An osteoid spine arises from the lower aspect of the calcaneus. Pain is usually located on the spur but it may spread along the whole bottom of the foot (5,6).

Variant spurs may come out as a manifestation of DISH (Diffuse Idiopatic Skeletal Hyperosteosis) syndrome. They are commonly broad in size and irregular in shape. They are generally well-delimited and denuded of bony erosions and osteosclerotic changes in the adjacent tissues. The inferior and posterior sites of the calcaneus diffuse cortical thickening is observed, however the plantar ligament calcification is not encountered (7,8).

Some other causes of localized heel pain are stretching of the plantar fascia at it's point of insertion (plantar fasciitis), inflammation of the retrocalcaneal bursa, inflammation of the bony tissues between the skin and the achilles tendon, degeneration of the calcaneal lipid cushion, degenerative artropathy, and traumatic rupture of the tendon achilles.

Symptoms associated with a calcaneal spur can be relieved by administration of local anesthetic drugs, local infiltration of steroids, physical therapy agents (ultrasound, infrared), and measures taken to block the fascial stretching (3,4,10,11).

In our study all the patients wore spine boat and received sessions of superficial (infrared) or superficial plus deep heating (ultrasound+infrared). We achieved statisfactory results especially with the latter. When, and if, the above mentioned therapeutic options fail to improve symptoms of the patient, then, the spine can be treated effectively by local irradiation (12).

Some simple cysts of the calcaneus commonly cause symptoms and physical findings similar to those

of the calcaneal spur. Obesity aggravates spur formation and heel pain. Another encountered risk factor promoting the formation of spurs is the presence of Diabetes Mellitus (6,14).

Calcaneal spur can also develop due to fascial contraction as is seen in enthesopathy. In the occurrence of enthesopathy there are several causative factors as: periostitis, myositis, bursitis, and some systemic diseases (rheumatoid arthritis, spondylitis, arthropathies, calcium pyrophosphate cyristal deposition disease, diffuse idiopathic skeletal hyperosteosis-DISH syndrome). Gender is also implicated in the occurrence of enthesopathy (6,8,17,18). It is common above sixty years of age. Both sexes and both sides are evenly affected.

Infrared rays posses an electromagnetic wave spectrum of 7600-15000 A°. These rays exert their effects on tissues by producing thermal energy. Erythematous rash relevant with the application of infrared is due to it's stimulatory effects on vasomotor nerves. It expedites both the arterial and venous circulation. The local heating effect associated with it's use results in increased tissue and cell metabolism, and increased local circulation. Infrared therapy helps scavenge the cellular particles and metabolites produced by trauma and inflammatory reactions. It also augments the flow of blood cells, antibodies, and the essential substances like O_2 and cellular nutrients indirectly secondary to the increased circulation. So it has both protective and restorative effects on tissues (20,21).

Ultrasound, beside it's thermal and physical effects, exhibits a series of chemical effects such as hydrolization, oxidation, depolymerization. Ultrasound exerts it's primary and crucial effect on bony tissues and later, moderate to mild effects, on muscle, nerve, and lipid tissues in sequence. The use of ultrasound maintains some promise in the treatment of calcaneus spine (10,20,21).

Ultrasound, within the therapeutic limits, increases cellular membrane permeability and cellular metabolism in blood cells. It also causes vasodilatation both in the arteries and veins. The neural tissue manifestations brought out by the application of ultrasonography are: analgesia, reduced action potentials, neural block and paralysis. This accounts well the way for how ultrasound abolishes painful muscle cramps. Above the therapeutic limits, ultrasound may induce osteoporosis and cause hemorrhagic infarcts in the trabecular bone. We excluded this problem by delimiting the application time of ultrasonography within 10 minutes (1,10,11,20,21).

A total of 10 sessions of ultrasound theraphy were given to the patients at a reduced dose of 2 watt/cm^2. As advantage over infrared, ultrasound gives rise to deeper thermal effects on tissues, thus, is superior to infrared at diminishing symptoms of the patient. Infrared is merely effective in superficial heating. The effects of ultrasound, especially on bony tissues, is more pronounced than that of infrared (10,20,21). Our study lent some support to this claim in that we achieved better results with the combined group compared to the infrared group.

REFERENCES

1. Turek SL : Foot and ankle joint, principles and applications in orthopedy. Ed by, R Ege, 3rd edition, Ankara, 1303-1381, 1980.

2. Mundal TL, MH Johnson, CW Hayes et al : Musculo-skeletal causes of spinal axis compromise: beyond the usual suspects. Radiographics; 14:1225-1245, 1994.

3. Graves RH, DR Levin, J Giacopelli et al : Fluoroscopy assisted plantar fasciatomy and calcaneal exostectomy: a retrospective study and comparison of surgical techniques. J Foot Ankle Surg, 33:475-481, 1994.

4. Boike AM, AJ Synder, PD Roberto et al : Hell spur surgery: a transverse plantar approach. J AM Pediatr Med Assoc. 83:39-42, 1993.

5. Wilmer L, JR Sibbit : Fibrosing Syndromes-Diabetic stiff hand syndrome, Dupuytren's contracture and plantar fasciitis, arthritis and allied conditions. 12th edition. Ed by, Mc Carthy, WJ Koopmon, Philadelphia Lee and Febiger, Vol 2, 1609-1618, 1993.

6. Tambalo C, M Poli, G Mantovani et al : Enthesopathies and Diabetes Mellitus. Clin Exp Rheumatol, 13:161-166, 1995.

7. Resnick D, G Niwayoma : Diffuse idiopathic skeletal hyperosteosis (DISH syn), Ankylosing hyperosteosis of Forestier and Rotes, Diagnosis of Bone and Joint Disorders. 2nd edition, WB Saunders Company, Vol 3, 1563-1602, 1988.

8. Crubezy E, E Trinkaus, T Shanidor : A case of hyperostotic disease (DISH) in the middle paleolithic. Am J Phys Anthropol, 89:411-420, 1992.

9. Grann JT, G Husby : Ankylosing Spondylitis: Current drug treatment, Drugs 44:585-603, 1992.

10. Altioklar R, M Beyazova : Foot Pain, Ed by N Tuna, Rheumatic Diseases, Hacettepe Tat Publishing House, Ankara, 679-711, 1994.11. Oguz H : Ankle Joint and Foot Pain, Konya Selçuk University Medical Faculty, Atlas Medical Publishing House, Konya, 319-347, 1992.12. Seegensschmiedt MH, L Keilhola, A Katalinic et al : Heel spur: Radiation Therapy for refractory pain-results with three treatment concepts. Radiology, 200:271-276, 1996.

13. Smith SB, HS Shane : Simple bone cyst of the calcaneus. A case report and literature review, J Am Pediatr Med ASSOC, 84:127-30, 1994.

14. Prichosuk S, T Subhadrabandhu : The relationship of Pes Planus and calcaneal spur to plantar heel pain, Clin Orthop, 306:192-196, 1994.

15. Smith SD, B Young-Paden, WN Ellis : Fatigue perturbation of the oscalsis, J of Foot Ankle Surgery, 33:402-410, 1994.

16. Winchester R : Psoriatic arthritis, Dermatol Clin, 13:779-792, 1995.

17. Deesomchok U, T Tumrasvin : Clinical comparison of patients with Ankylosing Spondylitis, Reiter's syndrome and Psoriatic Arthritis, J Med Thai, 76:61-70, 1993.

18. Kidd BL, PJ Wilson, PR Evans et al : Familial aggregation of undifferentiated spondyloarthropathy associated with HLA-B7, Ann Rheum Dis, 54:125-127, 1995.

19. Shaibani A, R Workman, BM Rotschild : The significance of enthesopathy as a Skeletal phenomen, Clin Exp Rheumatol. 11:399-403, 1993.

20. Tuna N : Therapeutic ultrasound and infrared, Electrotherapy, Nobel Medical Publishing House, 177-195, 1989.

21. Güler M : Physical Therapy, Handbook of Rheumatic Diseases, Physical Therapy and Rehabilitation, Publishing House of Turkish Clinics, 60-107, 1991.

Correspondence:
Sükrü Aydog
Department of Physical Therapy and Rehabilitation,
Ankara Numune Hospital,
Ankara, TÜRKIYE.