

**MANAGEMENT OF HEAL PAIN THROUGH QUANTIFIED SOLAR THERAPY [QST] IN TRADITIONAL SIDDHA MEDICINE: TWO CASE REPORTS****S. Vinayak^{1*}, B.S.Vindhya², R. Gayatri², Eugene Wilson³, Shyamala Rajkumar⁴, E. Nidhin⁵, K. Kanakavalli⁶**

^{1*} Research Associate, Central Council for Research in Siddha, SCRI Building, Anna Govt. Hospital Campus, Arumbakkam, Chennai, Tamil Nadu- 600106, India.

² Medical Officer (Siddha), NHM – Siddha dispensary, Vettoor, Varkala, Kerala- 695312.

² PG Allumini, Department of Noinadal, National Institute of Siddha, Tambaram Sanatorium, Chennai, Tamil Nadu- 600047, India.

³ Research Officer (Siddha), Central Council for Research in Siddha, , SCRI Building, Anna Govt. Hospital Campus, Arumbakkam, Chennai, Tamil Nadu- 600106, India.

⁴ Research Officer (Siddha), Scientist II, Central Council for Research in Siddha, , SCRI Building, Anna Govt. Hospital Campus, Arumbakkam, Chennai, Tamil Nadu- 600106, India.

⁵ Medical officer (Siddha), Govt District Ayurvedha Hospital, Padannakad, Kasaragod, Kerala- 671314, India.

⁶ Director General, Central Council for Research in Siddha, , SCRI Building, Anna Govt. Hospital Campus, Arumbakkam, Chennai, Tamil Nadu- 600106, India.

ABSTRACT

Background: Plantar fasciitis (PF) is one of the commonest cause of heel pain reported in female adults, obese individuals and in young athletes. This condition accounts around 11-15% of the foot symptoms attended for professional opinion and management. Heel pains are more or less symptomatically correlated with the Siddha diagnostic terms Kuthikaal Vatham (Pododynia) and Kuthingkaal kuthu (Pternalgia). Kanthi Suttigai (KS) or Phototherapy is one among the five cauterization techniques used in Siddha external medicine division which was found effective for treating heel pains due to PF. The treatment module included plain photo therapy followed by Quantified Photo Therapy (QFT). QFT is the modified method of KS, in which the light rays are converged to the desired body part by using a standard magnified lens. Here we present two case reports of plantar fasciitis that was successfully managed with KS. Aim and Objective: To study and document the effectiveness of heat therapy through plain phototherapy followed by solar ray quantification in conditions of heel pain. Methodology: Two female cases who reported with heel pain in an outpatient Siddha dispensary clinic were recruited for the studies. The exclusive criteria's and differential conditions were well settled. General physical examination along with Windlass Test was used as the confirmatory sign for PF supported with radiological investigations. The therapy was done as per the Standard Operating Procedures (SOP). VAS numeric pain distress scale was used as the assessment criteria to monitor the outcome. Results: The extend of range of movements and symptomatic relief of pain and swellings was well appreciated by the subjects after the therapy. Both the subjects had good prognosis with each therapy sittings and the recurrence of pain was not reported till date of follow up. Conclusion: As per the observations from our studies, this simple therapy offers faster relief from heel pains particularly due to plantar fasciitis.

KEY WORDS: *Plantar fasciitis, Kuthikaal Vatham, Kanthi Suttigai, Quantified Photo Therapy, Case report*

Corresponding Author: S. Vinayak

Research Associate, Central Council for Research in Siddha, SCRI Building, Anna Govt. Hospital Campus, Arumbakkam, Chennai, Tamil Nadu- 600106, India.

Email: drvinayak.sasv@gmail.com

1. Introduction

Heel pain conditions are one of the frequently reported complaints in rheumatology practice. Plantar fasciitis (PF) is one of the commonest cause of heel pain reported in female adults, obese individuals and young athletes. [1] This condition accounts around 11-15% of the foot symptoms attended for professional opinion and management [2-3]. The incidence is getting higher, and in a matter of fact one person out of every ten people will suffer from this ailment in any part of their lifetime. [4] The pathogenesis is well described as the degenerative and inflammatory changes of plantar fascia in response to numerous contributing factors. [5] Over stretching or indirect stretching of the fascia due to pronated foot posture, over pronation while walking, mechanical overload at foot either due to obesity, occupational habits including long standing or walking, systemic illness like diabetes, using ill fit foot wears, high heeled foot wears are some of the underlying causes and risk factors for the development of PF. [6-9]

The most projecting feature of PF is the typical stabbing pain in the medial part of the heel. Bilateral presentation of pain is also common. The heel pain start with weight bearing period especially after waking up in the morning or after a period of rest. The pain subsides for a while and returns as the day progresses with extended time. [10-11]. On progressing stage, there will be stiffness of Achilles tendon which is reported in 80 % of the subjects. [12]

Heel pains is more or less symptomatically correlated with the Siddha diagnostic terms *Kuthikaal Vatham* (Pododynia) and *Kuthingkaal kuthu* (Pternalgia). *Kuthikal* denotes the heel of the foot and *vatham* describes the disease of the heel that renders one to rest on the heel owing to excessive neuralgic pain. *Kuthingkaal kuthu* is defined as the acute neuralgic pain of the heel region. [13] *Kuthikaal isivu* is the chronic stage of this condition in which there will be spasm followed by stiffness of the adjacent muscle tendons resulting in reduced range of motion and limited dorsiflexion of the foot. [13]

Kanathi Suttigai (KS) or Photo therapy is one among the five cauterization techniques used in Siddha external medicine division. [14] The term *kanthi* denotes sunlight or sunrays and *suttigai*

describes the act of burning or inducing heat to a body part. [15] Certain procedures of high heat induction or cauterization also come under this surgical division. The therapy is initiated when other modes of preventive or curative medicines fails to produce the desired results. KS is one of the noninvasive heat therapy (*Agni chikitsai*) for treating rheumatic ailments particularly of *vatham* humor vitiations.[16] The indication is more specific to musculoskeletal disease conditions. The references of this therapy is well mentioned in the *tamil* medical verses of *Siddhar theraiyar*. [17] Evidences from traditional Siddha clinical practices establishes the advantage of heat therapies for managing heel pains.

Plain solar therapy has generalized effects on health and for treating heel pains. If the area of concern has to be focused, the light rays have to be quantified in a manner so as to have a cauterization action on the point. The parallel sunrays are concentrated through a converging or convex magnified lens and induced to the area. This modified KS module which we introduced for managing heel pain is called Quantified photo therapy (QFT). Here we present two case reports of plantar fasciitis that were successfully managed with KS. Our primary objective was to study and document the effectiveness of heat therapy through solar ray quantification in conditions of heel pain.

2. Materials and Methods

2.1 Study Design: Descriptive Case Report

- **Number of Studies : 2**
- **Place of Study:** In an outpatient Siddha Dispensary Clinic, Vettoor, Varkala, Kerala.
- **Study Period:** One month.

B. Methodology

B.1 Requirements

1. Facility for conducting the therapy: Preferably attached area of a health care facility, where the light source is adequately available.
2. Light quantification Tool: Standard magnified lens.
3. External applications : Medicated oils
4. Herbal leaves: Yellow matured leaves of *Calotropis procera* or leaves of *Vitex negundo*.
5. Clinical research form (CRF)

B.2 Standard Operating Procedure (SOP)

1. Pre Procedures

1. Prescribed medicated oil is applied locally over the affected heel region including the adjacent parts.

2. The calcaneal area is covered with herbal leaves depending on the condition at uniform thickness. [Fig. A & B]

3. Photo adaptation prior to cauterization: The subject is asked to sit in the shade while exposing the area to plain sunlight for about 10 minutes. The preferable time is midafternoon to evening. Only the area intended for the therapy and the adjacent parts is exposed well.

2. Photo Cauterization [Fig. C & D]

Focus distance assessment and duration of heating:

After the plain solar therapy, the magnified lens is focused on to the area or photo quantification point (PQP) at a suitable degree so that the area is slowly heated up. The area of light spot should be greater than the diameter of a coin that will be 5-10 cm length away from the body part. Adjusting the lens towards the body part and away from it changes the focus area, thereby the intensity of heat induced. An ideal focal length is determined to ensure stable heating well tolerated by the subject without resulting to burn injury.

Therapy Period: Five minutes till minimum to medium erythremal period, as observed by redness of skin and local warmth on the applied area. The heating is continued till the required Erythremal dose (ED) is achieved. The heating is declined by withdrawing the focusing or by rotatory movement if the subject reports intense burning at the PQP. If the heat is well tolerable by the subject, rotatory movement is continued to adjacent parts above the ankle. The maximum time of therapy should not extend 5 minutes or after the ED is achieved. The subject is asked to withdraw from the sunlight. The physician should examine the area of therapy by carefully removing the leaves.

Number of sittings: It depends on the stage of the condition and the outcome achieved per therapy module. Usually 2 sittings per week till good prognosis is followed.



Fig A-D: Procedure of Kanthi Suttigai

B.3 Case Selection and Enrollment:

Two adult females were enrolled in the study who presented with the chief complaint of heel pain. The exclusive criteria's and differential conditions were well settled before recruiting the subjects. Verbal consent was taken after prior information given regarding the type of therapy module and its expected outcomes. It has been also informed about the least possible adversities including local burning if the treatment is improperly conducted. The subjects were advised to follow the therapy once in 3 days for at least 3 consecutive sittings without break. No internal medications were supported during the period. The subjects were advised to follow their normal routines except avoiding the activities of over stressing on the foot. The personal details of the subject, case proforma and the therapy module was well documented in a CRF for future references.

B.5 Physical Examination and tests conducted

Physical examination included gait assessment, general attention of foot and ankle region, involvement of range of motion, observation of arch of foot, for any local swelling and atrophy. Palpation of the foot and adjacent regions were performed for finding any tenderness, bony growth and stiffness of the ankle. Windlass Test was used as the confirmatory sign for PF. [18-19]

B.6 Assessment Criteria and Investigations:

Apart from physical examinations, VAS numeric pain distress scale was used the assessment criteria to monitor the intensity of pain outcome. Score- 0 denotes absence of pain, 5 -moderate pain and 10-intolerable pain or unbearable pain. The scores in between varies with the intensity of the pain [18]. The outcome of the therapy was also measured with

VAS. The study was supported with radiological investigations. [19]

III. CASE PRESENTATIONS

Case Study 1

A 45- year- old women, presented at an outpatient Siddha dispensary clinic with a 4- month history of pain in the right heel region. She was not able to do her daily works and further the pain aggravates with standing, walking and climbing stairs. The symptom reduces with rest. She described that the sharp pain radiated from the back to mid part the sole region. There were no disturbances in sensory modalities. She is a housewife, and reported that due to her sedentary routine she started putting weight over these years. Due to the pain associated with walking, she became unable to do milder physical activities to control the weight gain. She also reported that 4 months before, the symptom started as a vague dull aching pain which she didn't gave attention till the complaint hindered her normal routine work. She had no history of trauma over the region. There was no history of systemic illness or rheumatic conditions. She was not under any medications or undergone any treatments for the same condition. On examination, the gait was normal and the range of motion was not affected. She was over 93 kg with a BMI of 35 kg/m². On physical examinations, there was no atrophy, deformity, local redness or stiffness over the region. On palpation, there was local swelling and tenderness over the point. There was occurrence of pain on passive dorsiflexion of the right ankle and toes (Positive Windlass Test). Tinel sign and squeeze test were found to be negative and there were no other signs of peripheral neuropathy or sciatica. Xray investigations were normal with no finding of calcaneal spurs. After enrolling the case in a standard CRF, we planned to initiate the therapy of kanthi suttigai for four consecutive sittings with a gap of three days each. While commencing the therapy, the patient had a VAS score of six, a scale of moderate pain and there was considerable reduction in pain and swelling with the first sitting itself. After the completion of fourth sitting, there was seldom little pain on walking and the score came down to three, which was tolerable by the patient. [Table 1] The tenderness and swelling reduced to much extend. Due to the good prognosis, she was advised to further maintain a dietary plan and mild walking exercise to

reduce her weight, which will give a long standing relief to her condition. There was no recurrence of heel pain as per the report of the patient till date of follow-up.

Case Study 2

The second patient was also a female aged 48, who presented with the complaints of persistent pain in the back side of right heel region since one year. The pain aggravates with rest or immobility and reduced by walking. The pain was moderate in nature (VAS score- 5). There were no disturbances in sensory modalities. The patient reported that she is working as a staff in the nearby preschool institution and due to her long standing job she developed the pain slowly and progressively. The condition affected her work pattern and normal life. She was over 56 kg with a normal BMI of 22 kg/m². She reported that the pain is worse while taking her initial steps in the morning and eases after a few minutes of walking. With the interrogations, it has been noted that she had no previous history of trauma or calcaneal fractures, or any type of systemic including rheumatoid arthritis. There was no family history of heel pain or either systemic arthritic condition. On examination, the gait was normal and the range of motion at the ankle was not affected. There was no atrophy, deformity, local redness or soft tissue masses over the region. There was no sign of varicose vein or ulcers in the adjacent part. On palpation there was local swelling, stiffness below the calf muscle, and tenderness over the medial calcaneal tubercle region. There was occurrence of pain on passive dorsiflexion of the right ankle and toes (Positive Windlass Test). Tinel sign was negative and there were no other signs of peripheral neuropathy or sciatica. There were no typical findings of erosions, calcifications or spur in Xray investigation. By arriving on the siddha provisional diagnosis Kuthikaal Vatham. The case were planned to manage with kanthi suttigai for three consecutive sittings with a gap of three days each. The patient had a VAS score of six, a scale of moderate pain before commencing the therapy and after the first sitting, itself there was considerable reduction in pain and tenderness. After the completion of third sitting, the condition improved much and the score came down to four. [Table 1] With this stage, she was able to cope up with her condition with her daily activities. After getting the

good prognosis, she was advised to maintain a healthy diet with much concern over fluid diets and milk products. The patient was advised for weekly follow-ups and till date there was no recurrence of heel pain from the report.

3. Results

Table 1: Visual Analogue Score Assessment of KS subjects.

Case	No: Sittings	Therapy period *(PFT + QFT) in mins	Vas score assessment per therapy sessions			
			1 st	2 nd	3 rd	4 th
CASE 1	4	15+ 5Mins	6	5	4	3
CASE 2	3	15+ 5Mins	6	5	4	-

*PFT = Plain Photo Therapy, QFT= Quantified Photo Therapy

4. Discussion

PF is managed with numerous modern conservative therapies. The present medical interventions includes heat and ice therapy, introduction of orthotic splints, heel pads and foot wears, stretching exercises etc. ECSW (Extra-corporeal shock wave therapy), steroidal injections, non-steroidal anti-inflammatory drugs (NSAIDS), and surgery will be preceded in advanced conditions. But the outcome varies with each therapies, expenses are high to be afforded by common people. [21] Siddha way of holistic approach includes selection of therapies and its management on the basis of humoral establishment. The therapies for PF may vary with each individual concerned. Apart from Internal medications, dietary advices, and lifestyle modifications, various cost effective external therapies are also introduced. The conservative management in Siddha external therapy includes manipulation methods like Thokkanam, Pressure point stimulations (Varmam), local application of medicated poultices and medicated pouch (Kizhi), application of medicated oils, medicated plasters (Patru and Poochu), Medicated bandaging (Pattukattuthal) and heat therapies (Suttigai) [14, 17]. Here we selected one of the heating therapies for managing PF. The symptomatology of PF explains

the vitiation of vatham humor affecting the joint, tendon and muscles of the heel region as per the traditional Siddha concepts, so the best therapy to pacify the derangement is to introduce local heating. KS (Solar therapy) is a wide treatment approach where the sunrays are selectively utilized (directly or indirectly) as a source of Suttigai (cauterization) for specific medical conditions. It is an effective method to relieve veekkam (Swellings) formed in various parts of the body. [17] The therapy is best advised to control vatha diseases predominantly affecting the musculoskeletal regions.

Rheumatic diseases typically associated with pain, stiffness and immobility is better improved with this treatment. KS can be applied in two stages for maximum results, one by simple photo therapy called photo adaptation and the second stage of photo cauterization or burning. Photo adaptation is a preparatory procedure which enables the subject to adapt the heat over the area like a warming up period before commencing the high intensity heat induction. As per the textual hold over preventive science of Siddha medicine, plain solar therapy can be employed preferably at evening times.[23] Photo adaptation or plain photo therapy for a period of 10-15 minutes is highly beneficial for treating heel pains.

Many of the rheumatic conditions including several types of arthritis are treated successfully with plain solar therapy. In special cases and in prescribed locations, the application methods are modified to enhance deeper and sharper photo penetration to achieve faster therapeutic results. Therefore we introduced the modified approach of quantifying the light. This part of the therapy is called photo cauterization in which the converged light rays are focused on to the area of heel pain by using a magnified convex lens. For reaching an optimal index, the time of the quantified light applied to the site is described as erythremal dose (ED). This is the minimum period taken for local heating up of the area that is well tolerated by the subject. This will extend from 5 – 10 seconds depending on the body nature and the condition. Development of redness and sweating over the area of application is well appreciated after this period. ED decides the outcome of the treatment and the above observed signs were found to show good prognosis in the selected conditions. Instant reduction of pain and swelling and

progressive relief of stiffness at ankle region were well observed in consecutive sittings.

It has been observed from previous clinical experiences that photo cauterization in plain skin causes extensive burning followed by blister formation. Application of any oil media acts as a barrier and prevents direct damage to the skin. Here medicated oils were used for its additional benefits. Traditional Siddha science advises oil application prior to sun bathing for numerous benefits especially for managing certain musculo skeletal disorders. [23] This may be conceived on the science that thin film of oil over skin improves the absorption of essential photons from the sunrays responsible for tissue healing and repair apart from Vitamin D synthesis. [23] The oil coating helps the subject to tolerate maximum heat applied moreover the heat spreads uniformly. Medicated leaves that are thin, matured and oil soaked were covered on the area has extra advantages. Due to the heat of sunlight and the applied high intensity heat, this gives an effect of leaf fomentation on the area. The chance of burn injury is greatly prevented with this covering. Both the steps will allow safe penetration of quantified light, so that the high intensity heat can be well tolerated by the subject during the therapy.

In photo cauterization, the magnified lens is focused from the source of light so that the rays are quantified to the body part. The converged light spot has high heat radiance and thus the position of the lens is altered to control the degree of heating of the surface. Focal length (FL) is the distance between the centre of the lens and the PQP. Controlling FL maintains the ideal heating of the part without burning. Setting a standard FL is not applicable in all conditions as it varies with the power of the lens and the variation of sunlight source. But as a general rule FL is set so that the light spot area as larger like a coin, 8- 10 cm away from the body with enough heat tolerable by the subject. FL below 5 cm causes instant burn if applied for more than 5 seconds. Even in ideal FL, the duration of heating should not be more than 10 -15 seconds over a point.

After the cauterization, the physician should examine the area of heat induction after carefully removing the leaf covering. Signs of good prognosis include moderate redness over the area, presence of sweat, reduction of swelling and presence of local warmth.

The subject presents mild burning sensation at the area and good relief of pain. Improper photo cauterization in rare occasions or by inexperienced hand practice may result in first degree burns, in which the subject expresses intolerable burning sensation over the area that proceeds to blister formation. This condition can be well settled by local application of emollients like Kukkil Vennai [24] or by bandaging with aloe gel. The application is repeated till complete relief from the symptom.

The mechanism of Ks in heel pains is better explained on the basis of mode of action of main components of sunlight including Ultraviolet radiation (UV A & B) and Infra red radiation [25]. When sunlight is exposed to skin for some period constantly, the area becomes mildly reddened due to cutaneous vasodilatation. The minimum time taken for producing an erythema over skin of exposure is termed as Minimal Erythremal Period (MEP). This is primarily due to the UV and IR component of sunlight. [26]

During the plain phototherapy period, UVA radiation stimulates the cutaneous nitric oxide release which further causes local vasodilation resulting in improved microcirculation. This helps in faster tissue repairing, simultaneously reducing any local inflammations. [28] IR is the prime heat source of sunlight that has the range to penetrate deep into the tissue surfaces, and by the virtue of its heating capability it will promote vaso dilation and relieves venous congestion. [29] By increased circulation, the hypoxic state is relieved, enhancing faster tissue recovery from local injury, inflammation or oxidative stress. UVA, UVB and IR altogether increases the overall expression and percutaneous production of endogenous opioid peptide called beta endorphins.

Adequate plain photo therapy stimulates enough beta endorphins generated in the skin by cleavage of proopiomelanocortin gene (POMC) pro-peptide that is sufficient for relieving pain, moreover causes relaxation and increased well being of the individual. [30-32] Beta endorphin is well reputed endogenous analgesic. The person can withstand more pain threshold by following consecutive photo therapy module. [33]

Photo cauterization part utilizes more of the IR rays and its heating pattern. The heating is continued to Medium erythremal period. Instant relief

of pain, swelling is well reported after a cauterization module. Reduction of ankle stiffness, improved range of motion are the long standing results. One of the limitations of QFT of KS is subjected to availability of sunlight according to climatic variations or in particular seasons. KS can't be employed during cloudy days or in rainy seasons and the subject has to wait for the suitable climate to start or continue the treatment sessions. In such conditions, it is wise to manage the condition with plain photo therapy or with other conservative approaches and medications. QFT is not advised for photo allergic individuals or in severely debilitated ones. It is avoided in acute inflammatory stage that is rarely seen in PF. Plain photo therapy is the simplest method that anyone could follow to check heel pains but executing QFT requires expertise hand and utmost care.

Here we presented two different cases of heel pains which were successfully managed with KS. The first the case were obese with high BMI. This is one of the chief risk factor for developing PF. After the therapy schedules, the subject was educated to undergo weight reduction plans, and to follow few stretching exercises every day. Weekly twice plain photo therapy after application of any medicated oils was advised. Usage of orthotic heel pads were advised while long standing or walking occasions. These measures will give a permanent control over the heel pains caused by PF. The condition of second subject was due to constant strain at the foot due to long standing which was the nature of her job. She was educated to take adequate foot rest and to follow a healthy and nourishing diet. She was advised to massage the foot with suitable massage oils twice a week. Both of them had good prognosis after each sittings and the recurrence of pain was not reported till date of follow up. The subjects are now able to carry out their normal physical routines.

5. Conclusion

As per the observations from our studies, this simple therapy offers faster relief from heel pains particularly due to Plantar fasciitis. The extend of range of movement, symptomatic relief of pain and swellings is well appreciated by the Kanthi suttigai subjects. The possible mechanisms of Kanthi suttigai may be well understood by the activity of photo components like UVA and IR radiations by

stimulation of natural pain killers simultaneously by hindering pain and inflammatory mediators. Improving tissue repair, preventing progress of degeneration and oxidative stress is the long standing result through adequate Vitamin D synthesis. This effective mode of therapies should be further clinically validated to strengthen the external therapy division of Siddha medicine.

6. References

1. Mohammad Ali Tahririan, Mehdi Motifard, Mohammad Naghi Tahmasebi, Babak Siavashi. Plantar fasciitis. *J Res Med Sci.* 2012; 17(8): 799–804.
2. Liden B, Simmons M, Landsman AS. A retrospective analysis of 22 patients treated with percutaneous radiofrequency nerve ablation for prolonged moderate to severe heel pain associated with plantar fasciitis. *J Foot Ankle Surg.* 2009; 48(6):642-7.
3. Cole C, Seto C, Gazewood J. Plantar fasciitis: evidence-based review of diagnosis and therapy. *Am Fam Physician.* 2005; 72(11):2237-42.
4. Riddle DL, Pulisic M, Pidcoe P, Johnson RE. Risk factors for Plantar fasciitis: a matched case-control study. *J Bone Joint Surg Am.* 2003; 85-A (5):872-7.
5. Lemont H, Ammirati KM, Usen N. Plantar fasciitis: a degenerative process (fasciosis) without inflammation. *J Am Podiatr Med Assoc.* 2003; 93(3):234-7.
6. Cornwall MW, McPoil TG. Plantar fasciitis: etiology and treatment. *J Orthop Sports PhysTher.* 1999; 29(12):756-60.
7. Fuller EA. The windlass mechanism of the foot. A mechanical model to explain pathology. *J Am Podiatr Med Assoc.* 2000; 90:35–46.
8. Bolgla LA, Malone TR. Plantar fasciitis and the windlass mechanism: a biomechanical link to clinical practice. *J Athl Train.* 2004; 39:77–82.
9. Menon NA, Jain J. Plantar fasciitis: A review. *Indian J Pain.* 2018;32:24-9.
10. McPoil TG, Martin RL, Cornwall MW, Wukich DK, IrrgangJJ, Godges J. Heel pain--plantar fasciitis: clinical practice guidelines linked to the international classification of function, disability, and health from the orthopaedic

- section of the American Physical Therapy Association. *Orthop Sports Phys Ther*. 2008; 38(4):A1-A18.
11. Wearing SC, Hennig EM, Byrne NM, Steele JR, Hills AP. Musculoskeletal disorders associated with obesity: a biomechanical perspective. *Obes Rev*. 2006; 7:239–250.
 12. Singh D, Angel J, Bentley G, Trevino SG. Fortnightly review. Plantar fasciitis. *BMJ*. 1997; 315:172–5.
 13. TV. Sambasivam Pillai. Tamil- English Dictionary of medicine, chemistry, botany and allied sciences Volume 2. Madras: The research institute of siddhars science. 1931.
 14. Dr. k. Uthamarayan, Siddhar Aruvai Maruthvam, Chennai: Department of Indian Medicine and Homeopathy. 2009.
 15. TV. Sambasivam Pillai. Tamil- English Dictionary of medicine, chemistry, botany and allied sciences Volume 5. Madras: The research institute of siddhars science. 1931.
 16. Dr. Anaivaari R. Anandan, Subramaniya Pandit, P. Jeyaraj. Pathartha Guna Cintamani. Chennai: Department of Indian Medicine and Homeopathy. 2009.
 17. R. Thyagarajan. Theraiyyartharu. Chennai: Siddha Maruthuva Aarachi Nilayam. 1997.
 18. T. Sokka. Assessment of pain in rheumatic diseases. *Clin Exp Rheumatol*. 2005; 23 (39): S77-S84.
 19. Shama SS, Kominsky SJ, Lemont H. Prevalence of non-painful heel spur and its relation to postural foot position. *J Am Podiatry Assoc*. 1983; 73:122–123.
 20. Tsai WC, Wang CL, Hsu TC, Hsieh FJ, Tang FT. The mechanical properties of the heel pad in unilateral plantar heel pain syndrome. *Foot Ankle Int*. 1999; 20:663–668.
 21. DiGiovanni BF, Nawoczenski DA, Lintal ME, Moore EA, Murray JC, Wilding GE, Baumhauer JF. Tissue-specific plantar fascia-stretching exercise enhances outcomes in patients with chronic heel pain. A prospective, randomized study. *J Bone Joint Surg*. 2003; Am 85-A:1270–1277.
 22. Hossain M, Makawana N. Not Plantar Fasciitis: The differential diagnosis and management of heel pain syndrome. *Orthopaedics and Trauma*. 2011; 25(3):198–206.
 23. Anaivari R. Anandan. Siddha Principles of Social and Preventive Medicine. Chennai: Department of Indian medicine and Homeopathy. 1999.
 24. Dr. K. N. Kuppusami mudaliyar, Dr. k. S. Uthamarayan. Siddha Vaidhya Thirattu, Chennai: Department of Indian Medicine and Homeopathy. 2005.
 25. The Multispectral Sun, from the National Earth Science Teachers Association. *Windows2universe.org*. 2007.
 26. Infrared Radiation. Van Nostrand's Scientific Encyclopedia. John Wiley & Sons, Inc. 2007.
 27. Juzeniene, A. Moan, J. Beneficial effects of UV radiation other than via vitamin D production. *Dermato-Endocrinology*. 2012; 4(2):109-117.
 28. Holick, M. Biological Effects of Sunlight, Ultraviolet Radiation, Visible Light, Infrared Radiation and Vitamin D for Health. *Anticancer Research*. 2016; 36(3):1345-1356.
 29. Cui R, Widlund HR, Feige E, Lin JY, Wilensky DL, Igras VE, D'Orazio J, Fung CY, Schanbacher CF, Granter SR, Fisher DE. Central role of p53 in the suntan response and pathologic hyperpigmentation. *Cell*. 2007; 128(5):853-64.
 30. Skobowiat C, Dowdy JC, Sayre RM, Tuckey RC, Slominski A. Cutaneous hypothalamic-pituitary-adrenal axis homolog: regulation by ultraviolet radiation. *Am J Physiol Endocrinol Metab*. 2011; 301(3):E484-93.
 31. Slominski A, Wortsman J. Neuroendocrinology of the skin. *Endocr Rev*. 2000; 21(5):457-87.
 32. Baggerly, C. et al. Sunlight and Vitamin D: Necessary for Public Health. *Journal of the American College of Nutrition*. 2015; 34(4):359-365.
 33. Gillian L. Fell, Kathleen C. Robinson, Jianren Mao, Clifford J. Woolf, David E. Fisher. Skin β -endorphin mediates addiction to ultraviolet light. *Cell*. 2014; 157(7): 1527–1534.

How to cite this Article

S. Vinayak , B.S. Vindhya , R. Gayatri , Eugene Wilson , Shyamala Rajkumar , E. Nidhin , K. Kanakavalli. Management of Heel pain through Quantified Solar Therapy [QST] in Traditional Siddha Medicine: Two Case Reports. *Int J Trans Res Ind Med* 2019; 1(1): 12-19.

This journal is © IJTRIM

This article can be downloaded from www.ijtrim.com