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A COMPARATIVE STUDY OF TOTAL CONTACT CASTING VERSUS TRADITIONAL DRESSING FOR TREATMENT OF DIABETIC FOOT ULCERS

Orthopaedics

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ABSTRACT

This study compared the outcome of total contact casting (TCC) with traditional dressing treatment (TD) in the management of neuropathic diabetic plantar ulcers. Thirty one patients with plantar ulcers without any gross infection, osteomyelitis or gangrene were randomly assigned to the TCC group (n = 15) or TD group (n = 16). In the experimental group, TCC was applied on the initial visit and subjects were Instructed weekly follow up and to limit ambulation to one-third of their usual activity. Subjects in the control group (TD) were prescribed dressing changes and were advised against bearing weight on the involved extremity. Ulcers were considered healed if they showed complete skin closure with no drainage. Non healed ulcers were those which showed no decrease in size by 6 weeks or if infection developed requiring hospitalization. In the TCC group, 12 out of 15 ulcers healed in 48±7 days; in the TD group, 10 out of 16 ulcers healed in 58±9 days. Comparatively higher rate of ulcer healing with fewer infections was seen in the TCC group. New abrasions were a frequent complication of TCC which can be reduced with frequent cast changes.We conclude TCC is a more effective method than dressing for treating diabetic plantar ulcers reducing the risks of amputation. This study compared the outcome of total contact casting (TCC) with traditional dressing treatment (TD) in the management of neuropathic diabetic plantar ulcers. Thirty one patients with plantar ulcers without any gross infection, osteomyelitis or gangrene were randomly assigned to the TCC group (n = 15) or TD group (n = 16). In the experimental group, TCC was applied on the initial visit and subjects were Instructed weekly follow up and to limit ambulation to one-third of their usual activity. Subjects in the control group (TD) were prescribed dressing changes and were advised against bearing weight on the involved extremity. Ulcers were considered healed if they showed complete skin closure with no drainage. Non healed ulcers were those which showed no decrease in size by 6 weeks or if infection developed requiring hospitalization. In the TCC group, 12 out of 15 ulcers healed in 48±7 days; in the TD group, 10 out of 16 ulcers healed in 58±9 days. Comparatively higher rate of ulcer healing with fewer infections was seen in the TCC group. New abrasions were a frequent complication of TCC which can be reduced with frequent cast changes.We conclude TCC is a more effective method than dressing for treating diabetic plantar ulcers reducing the risks of amputation.

KEYWORDS

Diabetic foot ulcers, Total contact cast, Dressing

Introduction:

Most of the lower limb amputations (85%) are preceded by neuropathic ulcers, diabetes being the primary cause.[1]Treatment of diabetic foot ulcers depends upon 3 factors- ensuring adequate limb perfusion, controlling infection and reduction of plantar pressure i.e. offloading.[2]Offloading is one critical yet overlooked element to achieve successful ulcer healing. [3,4]

Traditionally, diabetic foot ulcers have been treated with regular dressings and frequent debridement with minimal weight bearing on the affected foot. But traditional dressings don't address the pathogenesis of the ulcer.

Several off-loading devices are in use, such as walkers, half shoes, orthoses, felted foam and the total contact cast (TCC). Total contact casts are anatomically confirming below knee cast with minimal padding. TCC offloads the foot by two mechanisms- load redistribution and load sharing. Brand postulated that the decrease in pressure by TCC is due to an increase in the weight bearing surface area. [5]However, load redistribution theory appears to play a lesser role than previously thought.[6] Shaw et al demonstrated that decrease in plantar pressure is due to the shank i.e. the proximal portion of the TCC bearing 30 % of the load during ambulation.[7]

Various reasons contribute to the efficacy of TCC in addition to their ability to reduce pressure. TCC decreases the amount of ambulation of the patient thereby reducing the number of cycles of repetitive stress on the open ulcer.[8] They provide protection from further trauma and deformity and reduce oedema to help bone and soft tissue healing.[9]

This study is aimed to compare the treatment of total contact casting (TCC) with traditional dressing treatment (TD) in the management of diabetic plantar ulcers with respect to outcomes and complications.

Materials and methods:

All the patients with diabetic foot ulcers up to grade 2 of Wagner's classification system (ulcers extending into soft tissues without abscess or osteomyelitis), attending the out patient department of VIMSAR, Burla were included in this study. Patients with ulcers higher than grade 2 of Wagner's classification, with active infection, non ambulatory patients, patients with wounds in locations on the hind foot or area other than the plantar aspect of the foot, moderate to severe limb ischemia i.e. absence of both pedal pulses on the affected foot and/or ankle brachial index of < 0.9 were excluded from the study. If patients had more than one plantar wound, the largest wound was used as the index ulcer for inclusion in this study.

A detailed history was taken from each patient regarding the duration and type of diabetes, duration of ulcer, any prior treatment taken for ulcer and any other co-morbid condition like ischemic heart diseases, renal or ophthalmological problem. General and systemic examinations were performed. Detailed examination of involved foot was done to determine the ulcer location, size, shape, depth, any discharge, tenderness or rise in temperature. Ulcers were graded according to Wagner's system.[10]

Any foot deformity caused by neuropathy or Charcot joint such as clawing, cavus or valgus foot was noted. Vascular evaluation was done by checking pedal pulses (dorsalispedis and posterior tibial artery, capillaries filling time to the digits, ankle brachial index, oximetry and Doppler ultrasound studies. Antero-posterior and oblique X ray views of the foot were taken to exclude the presence of osteomyelitis or Charcot joint. The patients were randomly assigned to the TCC group or to the TD group.

Before applying total contact cast, hypertrophic marginal callus, necrotic tissue, infected and foreign material around the ulcer were debrided. Wound was then irrigated with saline and properly dressed with a povidone iodine soaked gauze pad. Total contact cast was applied only after the ulcer became clean,.Interdigital padding was given first. Stockinette was applied from the knee to the toes taking care that it neither wrinkled nor bunched. Cotton padding was applied over the stockinet. Extra padding was applied over the malleoli and over the shin to prevent abrasions. Plaster of Paris cast was applied over cast padding, starting from one inch distal to fibular head and extending up to the tip of the toes. The cast was moulded to the exact contour of the leg and foot to provide maximum contact.(Fig 1) Patients were advised to limit ambulation to one-third of their usual

activities. Initial cast was changed after 3 to 4 days owing to loosening of the cast due to reduced oedema. Thereafter TCC was renewed on each weekly follow-up till the ulcer healed. On each visit, ulcer size was measured and complications like skin breakdown, new ulcer or joint problem were noted. Cast treatment was terminated when there was no reduction in size or depth of the wound during 4 consecutive weeks, when an infection developed or when the patient had some discomfort with the cast. These cases were defined as cast failure.

In the second group (TD), callus, necrotic tissue and foreign material were debrided and traditional dressing with povidone iodine solution was applied. Patients were advised to avoid weight bearing.

Student's t-test was used to compare mean duration of diabetes, presence of other complications of diabetes, mean size and duration of ulcer. Main outcome measures included the percentage of the ulcers healed, time to heal and complications arising in the course of treatment. Data was collected and analysed using SPSS software.

Results

Thirty three patients were enrolled in this randomised controlled trial. Two patients were lost to follow-up, so finally there were 31 patients in the study. Two patients had recurrent ulcers. Twenty four (77.4%) patients were males and 7 (22.6%) were females. The mean age was 60 ±7.52 years. Out of 31 ulcers, 15 ulcers were treated with total contact cast and 16 ulcers were with traditional dressing. Ulcers treated with TCC healed in a mean duration of 48±7 days (6-7 casts)(Fig 2) while those treated with TD took an average of 58±9 days to heal (p= 0.011). 3(20%) ulcers in the TCC group and 6 (37.5%) in the TD group did not heal.

Out of the 9 non-healing ulcers, 3 ulcers treated with traditional dressing and 1 with TCC developed osteomyelitis; two cases required amputation and other two were treated by curettage and dressing.

Before & after treatment by total contact casting

Discussion

Pressure reduction is a critical component of therapy in the management of diabetic foot ulcers. The total contact cast has proved to be the standard treatment because of its ability to reduce pressure on the ulcer area along with providing mobility, thereby facilitating patients' adherence to the method.[11]

The most important attribute of the TCC may be its ability to "force compliance.[8]Several offloading orthotics are in use, most of which are removable and strict compliance is not achieved thus reducing their effectiveness. TCC has the advantage that it cannot be easily removed by the patient and limits the activity of patients, which helps in rapid healing of ulcers. When correctly applied, it has proved not only to interrupt the chain of pathogenesis that produces the ulceration but also to induce modifications in the histology of the ulcer.

Patients with obvious foot deformity yield better results because ulcers were due to mechanical malalignment caused by diabetic neuropathy, which was corrected with TCC. Poor patient's compliance has been a problem with TCC which require repeated counselling and reassurance. Using TCC, majority of the ulcers in this study healed in a relative short time (mean 48 days). Various studies by Baker et al, Armstrong DG et al etc report healing rates between 73-100% from 1 month to several weeks (Fig 3). [12,13,14]

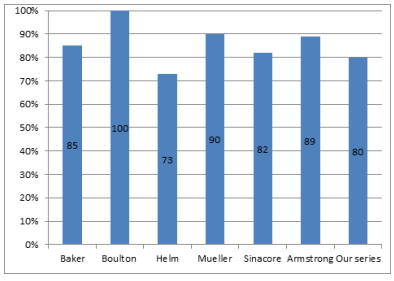
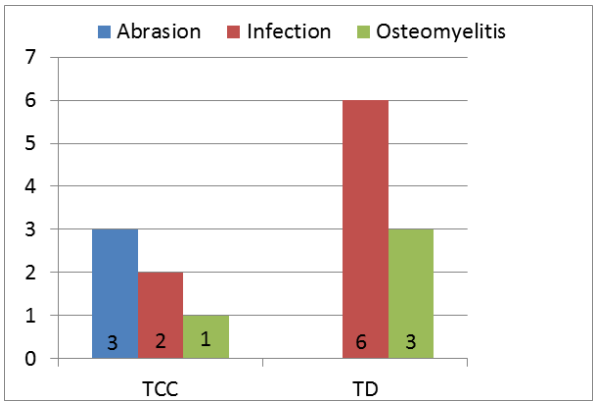


Fig 3 Various Studies of Healing Report

Traditional dressing though cheaper and commonly done, doesn't address the pathogenesis of the ulcer. It also has no effect on the deformities which cause the ulcers leading to unfavourable results.

Although TCC makes for a highly attractive off-loading modality, it has its disadvantages like occurrence of new ulcers ,fungal maceration, hampering of daily wound care, impaired mobility and relatively high cost. Joint rigidity and muscular atrophy occur in prolonged casting. Frequent cast change is important to mitigate these iatrogenic complications.

The limitations of the study were the small number of patients.



Complication of Total Contact Casting & Traditional Dressing

Conclusion

Total contact casting is an effective treatment modality for neuropathic, non-ischemic, early grade diabetic foot ulcers. TCC achieves forefoot unloading by transfer of load from the leg directly to the cast wall and greater proportionate load sharing by the heel.[7]

It requires careful application, close follow-up and patient compliance with scheduled appointments to minimize complications. TCC minimises the risks of amputation and provides a better and earlier outcome than traditional dressing. The high efficacy of the total contact cast with the low risk of major complications will continue to make it a gold standard for the treatment of neuropathic foot ulcers.[15]

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