CASE REPORT

A TALE OF TWO ORTHOSES: WHAT FACTORS ENFORCED THE DECISION?

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Abstract

The increase in foot plantar pressure causes chronic diabetic foot ulcers, which are prone to infection to undergo a slow healing process and would eventually lead to severe consequences. Many methods were proposed to relieve pressure and promote successful wound healing. The objective of this clinical case report is to justify the selection of patellar tendon bearing ankle-foot orthosis (PTB AFO) over the Aircast XP diabetic walker. A 45-year-old lady with underlying diabetes mellitus, morbid obesity and stroke, presented with Charcot foot arthropathy. Features of this case are discussed together with the suitability of different orthoses which are available in Malaysia. Due to the complexity of the patient's problems, it is challenging to decide the most suitable orthosis for this patient. In conclusion, the treatment plan was to prescribe PTB AFO as it meets the functional and social requirements of the patient compared to Aircast XP diabetic walker.

Keywords: Charcot foot, diabetic foot ulcers, aircast XP diabetic walker, patellar tendon bearing ankle-foot orthosis

Background

Effective offloading to promote successful wound healing is required in patients with chronic foot ulcers.[1] There are some common examples of orthoses to offload diabetic wounds which include removable cast walkers (RCW) and total contact cast (TCC).[2] However, due to the restrictive nature of TCC, it is not popular among patients. A study by the U. S. Wound Registry indicated that only 3.7% of patients who can benefit from TCC receive it.[3] Some factors responsible for the low usage of TCC include lack of clinical expertise and patient's commitment to treatment as well as application procedure complexities. Moreover, the application of TCC is time consuming and requires well-trained clinicians.[4] Some clinicians are reluctant to prescribe TCC due to its long wear time as TCC cannot be removed for 7 days post-cast.

On the other hand, earlier return to full weight bearing and daily activities after using the RCW is 43 to 73%.[5] A study done by Egol *et al* (2000) reported that mean time taken to return to work after surgery is 50% lower after using the RCW.[6] Thus due to its practicality, RCW remains the preferred choice of orthosis. There are two models that are frequently used by the Rehabilitation Medicine Specialist Clinic in Hospital Raja Permaisuri Bainun Ipoh which are the *Aircast XP diabetic walker* with four air cells and patellar tendon bearing ankle foot orthosis - anterior closing shell (PTB AFO). The *Aircast XP diabetic walker* has key elements which include a semi-rigid plastic shell surrounding the limb, a removable front panel, four individual internal air cells requiring inflation with manometer at 20–30mmHg to hold the limb, a rocker sole for improved off-loading, and a dual-density insole with option of creating holes for offloading.[7] While the PTB AFO has a removable anterior panel and a posterior shell both made of polypropylene technology complimented by a layer of EVA under the foot plate with varying thickness for different levels of offloading.[8] Both functions in reducing weight bearing pressure on the foot in chronic diabetic ulcers or Charcot arthropathies.[9,10,11]

Description of case

A 45-year-old obese Malay lady with underlying diabetes suffers from Charcot arthropathy with chronic diabetic wound measuring 3cm over plantar aspect of right foot. She weighs 120kg with body mass index of 46.9kg/m^2. Her condition and functional capacity is further limited by an ischemic stroke sustained in February 2021 resulting in right hemiparesis. Her main goal is to be able to return to work as a nurse which requires walking, standing and driving to work and including achieving domestic and community functional independence.

Figure 1: Patient's wound on right foot

Previously, she was prescribed with diabetic shoes with total contact insoles. However, the wound healing progress was slow due to inadequate offloading effect. We subsequently prescribed a PTB AFO (anterior closing shell). The main objective was to promote wound healing and also offloading of pressure on the Charcot foot. The PTB AFO was designed where it can be worn with her nursing shoes. This is vital to ensure infection control and safety while at

work. Our patient was educated on the importance and compliance of wearing the PTB AFO in order to prevent complications such as micro fractures due to weight loading of the foot.

Figure 2: Upclose photo of the wound

Discussion

This case is challenging due to the complexity of the issues posed by the multiple comorbids namely ischemic stroke with right hemiparesis, diabetes mellitus with diabetic neuropathy and peripheral arterial disease resulting in chronic diabetic wound over right foot with right Charcot arthropathy. These issues are compounded by the patient being morbidly obese (class III).

PTB AFO is the preferred orthosis as this removable orthosis benefits the patient especially to enable patient to drive, return to work and perform her daily activities. Although the *Aircast XP diabetic walker* gives similar effects in providing offloading and ankle stabilization, PTB AFO is lighter in weight, thus requires less energy expenditure for this hemiparetic patient which in turn leads to higher compliance of wearing orthosis.

Figure 3: Aircast XP diabetic walker's lateral view (left), front view (right)

Figure 4: Patient's PTB AFO

Table 1: Similarities and differences between PTB AFO and Aircast XP diabetic walker

Similarities
• Effective in offloading. • Helps in ankle stabilization. • Removable. • Suitable for patients who requires mobility.
Differences
• PTB AFO is lighter in weight and less bulky. • PTB AFO can be fitted into shoes for working purposes. • *Aircast XP diabetic walker* is not suitable for obese patients with large calves. • *Aircast XP diabetic walker* requires proper training and donning to prevent over- or under inflation. • PTB AFO can be cleaned, therefore better hygiene and sustainability.

The treatment plan was to prescribe PTB AFO as it meets the functional and social requirements of this patient compared to *Aircast XP diabetic walker*. However, the success of this orthosis depends strongly on the personal experience of the patient. The patient might requires some adaptation time for effective usage of the PTB AFO. To get positive effects of orthosis, the patient needs to be evaluated and educated on the purpose and benefits of the orthosis. Both the PTB AFO and *Aircast XP diabetic walker* have their advantages and disadvantages but both orthoses successfully provide offloading which in turn leads to faster wound healing. Therefore, the prescription of PTB AFO and *Aircast XP diabetic walker* depends on the requirements of patients.

Our patient had a stroke and this affects her gait, balance and weight distribution over bilateral lower limbs compounded by the right Charcot arthropathy. The *Aircast XP* has a rocker bottom sole that is difficult to use on uneven surfaces and individuals often require a walking aid to mobilise. We would be further impairing her job scope as a nurse if the orthosis used required an additional walking aid for ambulation. Having her hands free and her posture stable during work was essential to ensure she was able to fulfil her duties effectively.

Conclusion

Decision making on prescription of orthosis requires knowledge, experience and most importantly consideration of an individual's needs. It must serve the purpose of improving function in all aspects. Discussing the pros and cons of each device with the patient will ensure good compliance in the end.

References

1. Morona JK, Buckley ES, Jones S, Reddin EA, Merlin TL. Comparison of the clinical effectiveness of different off-loading devices for the treatment of neuropathic foot ulcers in patients with diabetes: a systematic review and meta-analysis. Diabetes Metab Res Rev. 2013;29(3):183-93.

2. Snyder RJ, Frykberg RG, Rogers LC, Applewhite AJ, Bell D, Bohn G. *et al.* The management of diabetic foot ulcers through optimal off-loading: building consensus guidelines and practical recommendations to improve outcomes. J Am Podiatr Med Assoc. 2014 Nov;104(6):555-67.

3. Fife CE, Carter MJ, Walker D, Thomson B, Eckert KA. Diabetic foot ulcer off-loading: The gap between evidence and practice. Data from the US Wound Registry. Adv Skin Wound Care. 2014;27(7):310–316.

4. Fife CE, Carter MJ, Walker D. Why is it so hard to do the right thing in wound care? Wound Repair Regen. 2010;18(2):154-8.

5. Simanski C. J. P., Maegele M. G., Lefering R., et al. Functional treatment and early weightbearing after an ankle fracture: a prospective study. Journal of Orthopaedic Trauma. 2006;20(2):108–114.

6. Egol KA, Dolan R, Koval KJ. Functional outcome of surgery for fractures of the ankle. A prospective, randomised comparison of management in a cast or a functional brace. J Bone Joint Surg Br. 2000;82(2):246–249

7. Caravaggi C, Sganzaroli A, Fabbi M, Cavaiani P, Pogliaghi I, Ferraresi R. *et al*. Non windowed non removable fiberglass off-loading cast versus removable pneumatic cast (AircastXP Diabetic Walker) in the treatment of neuropathic non infected plantar ulcers: a randomized prospective trial. Diabetes Care. 2007 ;30(10):2577-8.

8. International Committee of the Red Cross. Manufacturing guidelines patellar tendon-bearing orthosis: Physical Rehabilitation Programme. 2006. Adapted from: https://www.icrc.org/en/doc/assets/files/other/eng-ptbo.pdf.

9. Saltzman CL, Johnson KA, Goldstein RH, Donnelly RE. The patellar tendon-bearing brace as treatment for neurotrophic arthropathy: a dynamic force monitoring study. Foot Ankle. 1992;13(1):14-21.

10. Aita D, Bhave A, Herzenberg JE, Paley D, Cannada L. The load applied to the foot in a patellar ligament-bearing cast. J Bone Joint Surg Am. 1998;80(11):1597-602.

11. Health Quality Ontario. Fibreglass Total Contact Casting, Removable Cast Walkers, and Irremovable Cast Walkers to Treat Diabetic Neuropathic Foot Ulcers: A Health Technology Assessment. Ont Health Technol Assess Ser. 2017;17(12):1-124.