The use of focus rigidity casts as pressure-relieving devices for foot wound healing

Trisha Barker, Samantha Haycocks, Paul Chadwick, Jill Halstead-Rastrick

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Article points

1. There is a notable reduction in forefoot pressures when Focus Rigidity Casts (FRCs) are used compared with a control canvas shoe.
2. In theory, FRCs could reduce the shearing and stretching of tissues.
3. FRCs heel cup has been used successfully a number of times on heel ulceration.

Key words

- Focus Rigidity Cast
- Heel ulcer
- Pressure relief

Author

Trisha Barker is specialist podiatrist; Samantha Haycocks is advanced podiatrist; Paul Chadwick is consultant podiatrist; Jill Halstead-Rastrick is principal podiatrist, all at Salford Royal Hospital NHS Foundation Trust, Salford

Focus rigidity casts (FRCs) are commonly used in the wound-care community and are primarily provided for sites of heel ulceration. The aim of this audit was to determine whether FRCs can reduce the size of ulcerations on various pressure sites of the foot and ankle, as well as the heel. Retrospective data from 21 patient records were collected. Wound size was measured at baseline before the use of FRC, 4 and 8 weeks post intervention. In a sample of 12 wounds located on the heel; 1 ulcer healed entirely, 10 reduced in at least one measurement parameter, and 1 increased in size. In a sample of 10 wounds on the bony prominence of the ankle, midfoot and forefoot, 3 ulcers healed entirely, 7 reduced in at least one measurement parameter and 2 patients showed an increased the wound size. This audit would suggest FRCs provide clinical benefit in the treatment of foot and ankle wounds, with a greater reduction in wound size at the heel; further study is required.

Focus rigidity casts (FRCs) have been suggested for use in wound healing since 1998 (Petty and Wardman, 1998). The innovative use of FRCs in the treatment of heel ulcers has been outlined in a number of studies (Stuart et al, 2008; Malone et al, 2011). These studies are by no means comprehensive, the largest multi-centre UK study (Jeffcoate et al, 2014) has been completed and their results are due March 2016. The use of the FRCs for heel ulcers, however, continued with anecdotal evidence and some professionals have started using the heel cast regimen on other pressure sites of the feet and ankles (Dagg, 2013).

The FRCs are manufactured using an impregnated resin bandage that is moulded to the shape of the foot overlying dressings and soft bandages. After a reinforced 4 layer region overlying the area of ulceration is added before the resin dries and takes its permanent shape.

How the FRC works and provides clinical benefit is not fully understood. There is evidence to show, in healthy participants, a significant reduction in forefoot pressures when using FRCs compared with a control canvas shoe (Dagg, 2013). The FRC may also reduce shearing and stretching of the tissues rather than the usual 'off-loading' notion of addressing vertical forces only (Jeffcoate et al, 2014), although this remains to be demonstrated.

There have been a number of positive results for the use of FRCs heel cup on heel ulceration (Malone et al, 2011; Dagg, 2013; Stuart et al, 2008) and this prompted expansion into using it on other pressure areas of the foot and ankle. The aim of this audit was to measure whether applying an FRCs was beneficial in reducing the size of the wounds that were overlying the medial metatarsophalangeal joint (MTPJ), the lateral MTPJ, the medial malleoli, lateral malleoli, the styloid process and the calcaneum.

Method

A retrospective audit of patient records kept in the hospital and community of Salford Royal NHS Foundation Trust was undertaken. The record of the FRCs made during the last 6 months formed the basis of the audit.

Method to manufacture the FRCs was consistent in the trust. Using the same technique for the FRCs, a cup was made for ulcers at the heel, an extended slipper

Figure 4 (top right). Once the FRC is in place, it can be secured with a light bandage (k-band), and a cast sandal was issued to allow ambulation.

Figure 5 (bottom right). Due to the retrospective nature of the audit there was limited uniformity in the baseline date available so we concentrated on the available measures of wound dimensions used as standard in the department.

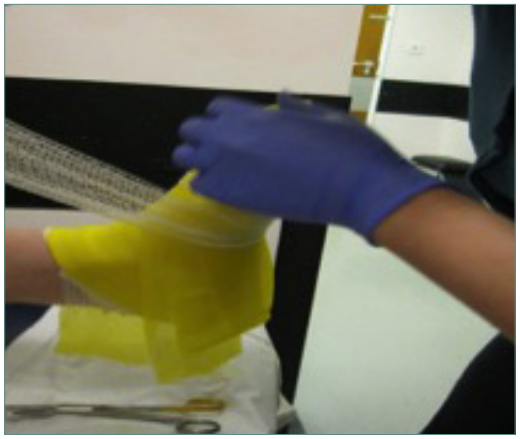
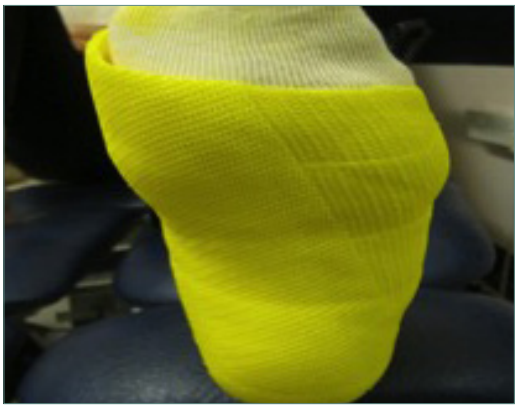


Figure 1 (above). The wound is dressed, a single layer of softban is secured with 2 layers of stockinette (Benecast Stockinette 5 cm). The resin bandage (Benecast Flex 7.5 cm) is wrapped around the foot with 50% overlap to retain flexibility and the four layer patch in a teared effect is placed over the wound site. Great care is taken to avoid creases in the stockinette and bandage or gaps. A damp light bandage is then wrapped around the resin bandage to activate and harden the cast.

Figures 2 and 3 (top and above). After three minutes, the damp bandage was removed to allow the resin to set, the cast is cut up the dorsum and shaped with scissors.



cast to include the MTPJs for medial and lateral bunion ulcers and a slipper cast extended above the ankle for malleoli ulcers. The procedure is illustrated in *Figures 1-5*.

Outcomes

The wounds were measured in millimetres using a disposable paper ruler or a firm ruler (on a scalpel handle), the length and width was measured at widest points of the wound. Depth was not measured as this was not constantly recorded within the notes. The measurements were recorded at the date of manufacture of the cast and the nearest date to 4 weeks and 8 weeks after the intervention was initiated.

The percentage difference was calculated using Excel (Windows Office 2010) between start date and 4 weeks (week 4 - week 0), 4 weeks and 8 weeks (week 8 - week 4) and the overall start date to 8 weeks (week 8 - week 0).

Results

Data were gathered on 21 patients and 24 wounds. In 11 patients and12 wounds were situated on the heel (*Table 1*) 6 patients had type 2 diabetes (DM T2), 1 patient had type 1 diabetes (DM T1), 1 patient had

Table 1. Measurements of heel ulcers at time points 0, 4, 8 weeks.

Case Number	Diagnosis	Duration of Ulcer	Ulcer site	Baseline ulcer size 0 weeks (mm)	Ulcer size 4 weeks (mm)	Final ulcer size 8 weeks (mm)	0 to 8 weeks difference size % (final – baseline)
1	DM T2	4 months	Calcaneum	35x10	45x20	35x25[$]	0% x +150%
2	None	6 weeks	Calcaneum	15x20	14x15	8x10	-47% x -50%
3	MS	5 weeks	Left calcaneum	47x45	45x45	20x25	-57% x -44%
3	MS	5 weeks	Right calcaneum	25x23	15x10	7x5	-72% x -78%
4	RA	9 weeks	Calcaneum	5x5	Healed	Healed	-100% x -100%
5	DM T2	4.5 months	Calcaneum	10x10	8x6	9x9*	-10% x -10%
6	None	8.5 months	Calcaneum	35x40	35x35	30x25	-14% x -37%
7	DM T2	9.5 weeks	Calcaneum	19x16	10x10	10x5	-47% x -69%
8	DM T2	not noted	Calcaneum	20x15	25x14	10x8	-50% x -47%
9	DM T1	3 weeks	Calcaneum	20x15	25x15	22x9	-49% x -79%
10	DM T2	5 days	Calcaneum	10x10	2x2	5x2	-50% x -80%
11	DM T2	2.5 months	Calcaneum	33x20	30x10	25x23	-24% x +15%

*no FRC in situ at this visit, [$]Angiography undertaken between week 4 and 8.

Table 1. Measurements of the forefoot, midfoot and ankle ulcers at time points 0, 4, 8 weeks.

Case Number	Diagnosis	Duration of Ulcer	Ulcer site	Baseline ulcer size 0 weeks (mm)	Ulcer size 4 weeks (mm)	Final ulcer size 8 weeks (mm)	0 to 8 weeks difference size % (final – baseline)
1	DM T2	6 days	1st medial metatarsal head	30x30	45x40	35x27	+14.2% x -10%
2	None	not noted	Lateral malleolar	10x10	0x0	0x0	-100% x -100%
3	DM T2	10 weeks	Styloid process	30x25	20x20	25x25	-28.6% x 0%
3	DM T2	10 weeks	5th lateral metatarsal head	30x11	25x15	25x15	-16.6% x +26.6%
4	DM T2	11 months	Lateral malleolar	30x22	20x14	20x15	-33.3% x -31.8
5	None	11 years	Styloid process	12x6	10x3	4x3	-30% x -50%
6	DM T1	4 weeks	Styloid process	30x25	18x15	10x11	-30% x -56%
7	DM T1	15 weeks	1st medial metatarsal head	12x12	9x9	5x5	-58.3% x -58.3%
8	DM T2	3 weeks	Right styloid process	8x6	3x2	0x0	-100% x -100%
8	DM T2	3 weeks	Left styloid process	8x5	8x8	0x0	-100% x -100%
9	None	4 years	1st medial metatarsal head	6x6	18x9	6x3	0% x -50%
10	None	not noted	Lateral malleolar	7x5	7x5	5x5	-28.6% x 0%

multiple sclerosis (MS), 1 patient had rheumatoid arthritis (RA) and 2 patients (none) had no specific associated disease.

The results of the heel ulcers over 8 weeks showed 1 wound healed completely, 9 wounds had a reduction in size in both length and width and 1 wound showed a reduction in a single parameter. One wound stayed the same size. Decreases in wound size ranged from 14% to 100% from baseline to 8 weeks, while increases occurred in 2 cases and ranged from 0 to 15% in size.

Table 1 shows the measurements of the heel ulcers at time points 0, 4, 8 weeks.

For sites of ulceration other than the heel, in 10 patients 12 wounds were located at bony prominences at the ankle, midfoot and forefoot *(Table 2)*. These bony prominences were identified as the medial metatarsophalangeal joint (MTPJ), the lateral MTPJ, the medial malleoli, lateral malleoli and the styloid process. In this group 4 had type 2 diabetes, 2 had type 1 diabetes and 4 had no associated diseases.

Out of 10 patients with ulcers measured at the forefoot, midfoot and ankle (not including the heel), 3 wounds healed entirely. In 7 out the 10 patients, there was a reduction in at least one measurement parameter. We showed 4 patients had a reduction in both size parameters (length and width). Over the 8 weeks, 2 patients showed an overall increase in one measurement parameter (length or width). Decrease in size ranged from 10% to 100%, while increases occurred in 2 cases and ranged from 14% to 27%. Case 9 showed an increase in initial wound size followed by a decrease due to irregular application of the soft cast. Clinically this was thought to be associated with the patient's complex medical needs, as the patient had dementia and application depended compliance from a variety of care staff.

Table 2 shows the measurements of the forefoot, midfoot and ankle ulcers at time points 0, 4, 8 weeks.

The application of FRC for pressure ulcers of the foot and ankle did not cause any abrasions and were not removed prematurely by clinical staff.

Discussion

This audit was undertaken to investigate whether applying FRCs at the traditional site at the heel and at other ulcers at sites of bony prominence is a safe practice and can show clinical benefit. This small audit showed for the first time a reduction in wound size for the majority of ulcers located at the heel and bony prominences in the forefoot, midfoot and ankle.

There were some indications that a greater proportion of wounds reduced in size at the heel although, this may be due to the size of the wound and audit methodology. Limits imposed by being a retrospective study meant only a small section of data could be compared across numerous case records.

Reductions in the wounds were measured by different clinicians using paper ruler and stiff ruler on the sides of scalpel handles, but there was no information on which was used in each individual entry. This may have affected the outcomes shown this audit due to measurement errors.

The repeatability of distance measured by a ruler in millimetres is 11% in small wounds (defined as <10cm2) (Plassmann & Peters, 2002). This would suggest a minimum change of 10% is beyond measurement error, which was the smallest measurement change found in this audit. Therefore, the wound size reduction in this study is likely to reflect real patient benefit.

This audit is limited by methodological rigor (lack of control group and lack of randomisation) and comparison between ulcer size at the heel and other sites was limited. Further studies to compare the use of FRCs in sites of ulcers other than the heel is now needed.

Conclusions

The use of FRCs may have a role to play in contributing to the healing of ulcers in pressure areas of the foot and ankle. The audit would suggest a reduction in wound size was more consistent in the heel. Further investigation is needed to understand the efficacy and mechanism of action. A larger prospective study with a control group would be needed to understand the role of FRC in pressures sites across the foot and ankle and not just the heel. This will also allow for uniformity in measurement methods and the inclusion of greater detail regarding wound appearance, wound depth and any adverse effects of the use of this method. ■

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