

Safe aftercare following foot ankle surgery: Doing less is more: The Jones dressing cast, part 2



Dr. Tonio Gottlieb^{a,*}, Dr. Kaj Klaue, PD^b

^a Teltower Damm 35, 14169 Berlin, Germany

^b Clinica Luganese, sede Moncucco, via Soldino 7, 6900 Lugano, CH, Switzerland

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ABSTRACT

Background: There is no universal approach to surgery aftercare among foot and ankle surgeons. Although infections following foot and ankle surgery are rare, soft tissue healing can be jeopardized after extensive and multiple approaches.

Methods: We defined a precise fixation technique of the foot and ankle in the immediate post-operative phase using what we call “the Jones dressing cast”. This technique is a modification of the Jones dressing bandage.

In a previous study we compared two groups of patients (N=20/23) who underwent similar reconstructive surgery with the application of the described cast for one week and without. At the two-month follow-up we observed that the group treated with the cast required less pain relief, spent less time in hospital and achieved faster autonomy using crutches (Gottlieb and Klaue, 2013).

In this study we considered a group of 45 patients who underwent similar reconstructive procedures to those in the first study and who were treated with the cast for two weeks post-operatively. There was no visual check of the soft tissues before removal of the cast.

Results: Unlike the earlier study, the results from this second study were more significant. Revision surgery occurred far less frequently in the group wearing the cast for two weeks.

Conclusions: The reduced strain to the soft tissue around the foot due to the cast and less manipulation of the wound dressing decrease complications in the post-operative period.

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1. Introduction

The management of postoperative soft tissue healing is fundamental for the success of elective foot and ankle surgery.

As postoperative edema is more relevant in such surgery due to its localization, soft tissue healing can take longer and pain can restrict function.

Infection in elective foot surgery is relatively unusual though depending on the risk factors and tourniquet time, infection rate can be as high as 6% [1–3]. Any potential risk factors should be recognized before surgery [4]. During the procedure, soft tissue trauma should be minimized to preserve the local vitality of biological structures. Vitality of the local tissues before and after the surgical intervention appears to be the most significant factor in the development of infection [5,6].

Postoperative edema, however, is common and contributes to unfavorable conditions for wound healing. Prolonged edema not only restricts motion in the extremities – especially in small joints – it also compromises perfusion of the soft tissues and increases the risk of breakdown of the operative wound [7]. Edema is more likely to occur in the lower limbs rather than the upper limbs due to the more difficult venous return. During the postoperative period, special dressings and immobilization techniques may help limit soft tissue edema and swelling.

Our study addresses the results of avoiding postoperative edema with the use of the Jones dressing cast.

2. Techniques to immobilize and optimize the intra-, extra- and interstitial pressure-ratio and to limit wound contamination

The treatment of wounds enclosed in a plaster cast or in gauze along with thick gauze dressings with the intention of safe soft tissue management had been reported in 20th century war-surgery literature [8] and are used nowadays in the treatment of diabetic and neurogenic feet.

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* Corresponding author.

E-mail address: Dr.Gottlieb@Der-fusschirurg.de (T. Gottlieb).

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Toward the end of World War I, the American surgeon *Winnett Orr* observed that soldiers who were admitted to his hospital with wounds enclosed in a plaster cast had generally better soft tissue condition than others who had been treated without cast [8].

In 1921 *Sir Robert Jones* recommended a specific technique to control edema of the upper and lower limbs with the use of multiple layers of bulky cotton wool covered with calico bandages which was specifically designed to address edema associated with wartime injuries [9]. Many authors described the use of this or a slightly modified technique [10–12]. Other sources confirmed that applied pressure induces significantly less edema and ecchymosis [13,14]. Despite this quite extensive clinical experience, the principles of long-lasting, closed dressings during soft tissue healing are not widely accepted.

Frequent follow-up with a visual inspection of the operative wound plays a significant part in the accepted approach to optimal wound care.

Matsen and Krugmire [13] warned that compression must be uniform to prevent peaks inducing compartment syndrome although *Smillie* indicated that the initial pressure remains for approximately 48 h [15].

3. The Jones dressing cast

What we call “the Jones dressing cast” is a sterile dressing that is applied immediately post-op to allow for uneventful soft tissue healing and that remains in place for an appropriate amount of time (weeks) following the surgical procedure.

The authors' previous single-centre study showed that patients treated with a Jones dressing cast recover their mobility significantly earlier, their hospitalization time is shorter and the need for pain-relief is less, even when the patients are elderly and surgery more complex [1]. The study was carried out with a group of 43 patients and the sterile Jones dressing cast was applied immediately after surgery, encircling the foot and ankle. No slit was applied and the cast was kept in place for one week. There was no visual inspection or follow up in this period.

The purpose of the second study is to substantiate the previous statements with more significant data and to verify the effectiveness of prolonged application of the cast.

4. Method

The population of the first study (Group 1) was compared with a new group of patients (Group 2) who underwent a postoperative phase of two weeks with the Jones dressing cast.

In Group 1 (total 43 patients), 23 patients were treated with a wound dressing that was changed frequently (every second day) while 20 patients were treated for one week postop with the Jones dressing cast.

45 patients in Group 2 were treated with a Jones dressing cast for 2 weeks with no visual inspection. All patients had undergone complex surgery of the foot. Most procedures were reconstructive surgery of the foot such as tarso-metatarsal arthrodesis, osteotomies around the hindfoot and revision operations of the forefoot, which permitted only restricted weight bearing post-op (Table 1)

The cases were categorized according to the complexity of surgery, with Type 5 being most complex, as follows:

Type 1: Operation in the forefoot region.

Type 2: Lapidus procedure.

Type 3: Lapidus any added procedure (e.g. Gastrocnemius or metatarsal osteotomies or any revision surgery of the Lapidus).

Type 4: Operations including the navicular-cuneiform or Lisfranc-joint (e.g. Miller-Operation).

Type 5: Reconstruction/arthrodesis in the rearfoot region (including ankle).

Both groups were compared according to the following parameters:

- surgical complication, particularly those regarding the soft tissues,
- number of days of post-operative analgesia,
- number of days spent in hospital,
- time needed to regain individual and autonomous mobilization,
- time needed to regain mobility on stairs.

4.1. Statistics

Metric variables were expressed as median (interquartile range). Categorical variables were expressed as frequency with percentage. All reported p values are two-tailed, unless otherwise indicated. For all analyses, p-values <0.05 were considered statistically significant.

Metric variables were analyzed using the Mann–Whitney U test. Categorical variables were compared with a chi-squared test or Fisher's exact test.

Kaplan–Meier curves, the log rank test and Cox regression analysis was used to compare acute rejection free survival or BOS-free survival. In a multivariate analysis, all variables with a p-value <0.10 were included and variables with a p-value of >0.10 were excluded.

Table 1
Demographics of the two groups.

	Group 1 (control group)	Group 2 (cast 2 weeks)	P value
Patients	43	45	
Female (%)	86	93.3	.309
Age, mean years	49.31	50.35	.744
Procedures, n (%)			
Type 1: Revision of forefoot surgery	7 (16.3)	2 (4.4)	
Type 2: TMT-arthrodesis	27 (62.8)	8 (17.8)	
Type 3: TMT-arthrodesis with add.procedures	3 (7)	27 (60)	
Type 4: Lisfrancarthrodeses or procedures of the Chopart-joint	2 (4.7)	5 (11.1)	
Type 5: Rearfoot procedures	4 (9.3)	3 (6.7)	
OP-Typ Average	2.279	2.977	
Foot surgery with multiple highly complex procedures or one complex procedure combined with complex diagnosis n (%) (DRG: ICD A)	6 (14)	4 (8.9)	
Foot surgery with multiple complex procedures or one complex procedure combined with complex diagnosis or with central paresis (DRG:ICD B)	37 (86.0)	37 (82.2)	
Other	0	4 (8.9)	

4.2. The Jones compression cast: technique of application

List of materials (Fig. 1)

- 1 Sterile Tubular gauze (TG 7 Lohmann Rauscher REF 24005).
- 2 Sterile wound coverage (absorbent cotton gauze 10 × 10 cm to EN 14079, Hartmann[®]).
- 3 3–4 rolls of plaster cast padding (Artiflex[®] steril 10 cm × 3 m).
- 4 5–6 fast setting plaster of Paris layers (Biplatrix[®] 12 cm).

After the application of a sterile surgical dressing (absorbent tulle gras), a tubular gauze (TG 7 Lohmann Rauscher REF 24005) is applied followed by several rolls of sterile special cast padding (Artiflex[®] sterile 10 cm × 3 m). This cellulose padding is applied from distal to proximal beginning just distal to the first and fifth metatarsophalangeal joints. The plaster cast is applied thoroughly with approximately two layers observing a static position of the foot in orthogonal (plantigrade) orientation (90° within both sagittal and frontal planes). It is important that the first rolls are applied snugly without manual traction so as not to compress the soft tissues. After 3 rolls of the cast padding have been applied from the toes to just distal of the tibial tuberosity, a 12 cm wide plaster splint made of 8 layers (Specialist E REF 73501) is applied on the entire posterior and plantar aspect of the lower leg and foot.

Once the splint has been molded, an additional circular plaster bandage is applied directly over the splint to secure its position. The cast covers the plantar tips of the toes leaving the dorsal aspects free (Fig. 2).



Fig. 2. The Jones dressing cast.

5. Results

43 patients were included in Group 1 and 45 in Group 2. The different procedures performed are listed in Table 1.

Group 1 and Group 2 had a similar mean age ($p=0.744$).

Both groups had similar amount of patients in each diagnosis-related group (Table 1).

The type of surgery was more complex in Group 2 (in Group 2, 60% was type 3, in Group 1, 60% type 2; $p=0.001$).

5.1. Outcome

Although patients in Group 2 had more complex surgery, mobility was achieved earlier and hospitalization time was shorter. The incidence of infection was lower in the group wearing the cast for 2 weeks.

The patients treated with the cast for 2 weeks spent a mean of 4.42 days in hospital compared to 9.33 days in Group 1 ($p < 0.001$) (Fig. 3).



Fig. 1. Materials.

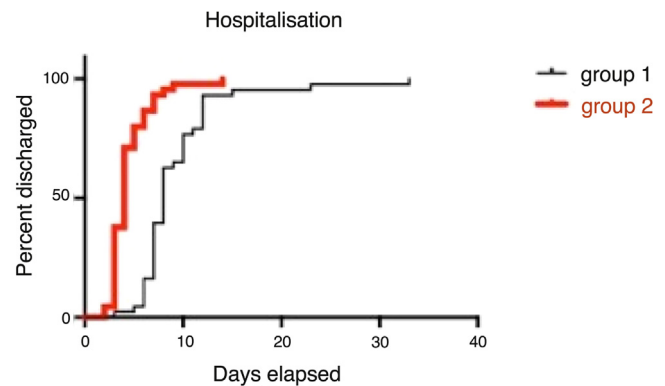


Fig. 3. Kaplan–Meier curve for the hospitalisation time.

The mean administration time of analgesics was similar in both groups (6.65 days in Group 1; 7.89 days in Group 2 $p=0.137$; 0.136).

In Group 2 the patients regained autonomous mobility significantly earlier (1.22 days) than those in Group 1 (1.83 days; $p=0.008$; 0.009) (Fig. 4).

Patients in Group 2 could use the stairs on their own, with walking sticks, 2 days earlier than patients in Group 1 (mean 3.05 and 5.76 days; $p < 0.001$) (Fig. 5).

There were more patients with complications in Group 1 than in Group 2 ($p=0.331$). Complications in Group 1 were two screw dislocations, one infection and two non-unions.

The patient with infection in Group 1 had diaphysal osteotomies of the metatarsalia II–IV, together with a complex hammer toe correction (fusion of PIP-joints and flexor tendon transfer on the first phalanx). There was a purulent discharge for two days after surgery and a positive culture was obtained. The infection was

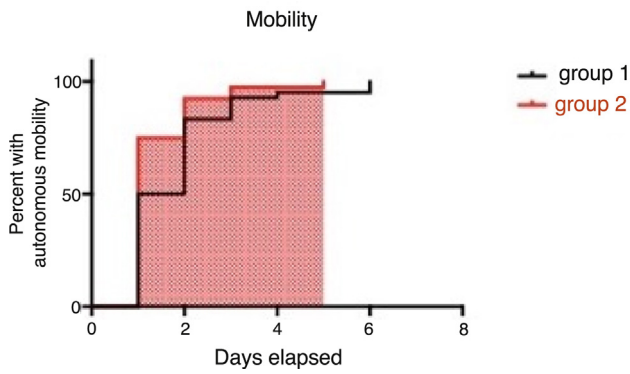


Fig. 4. Kaplan–Meier curve for autonomous mobilization.

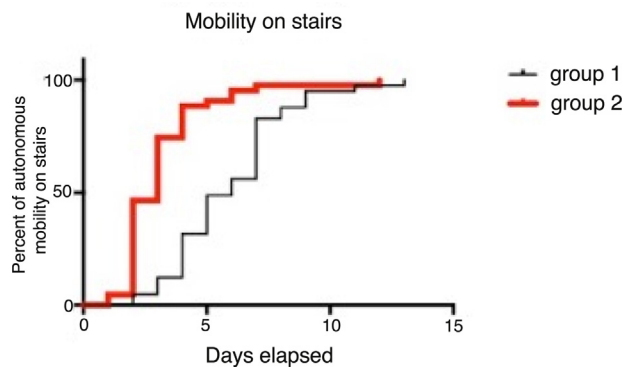


Fig. 5. Kaplan–Meier curve for autonomous mobilization on stairs.

successfully treated with antibiotics and local wound management.

In Group 2, one patient appeared with prolonged wound healing and two patients with subcutaneous haematoma around the wound edges. The patient with a prolonged wound healing had a gaping wound which needed local treatment after suture removal. The haematoma resolved without treatment. No extra surgery was performed and no antibiotics were given to any patient.

In Group 2 there was no infection (2.3% in Group 1 and 0% in Group 2; $p = 0.359$).

Patients in Group 2 needed significantly less revision than patients in Group 1 ($p = 0.011$).

No cast related complication (e.g. compartment syndrome) was observed within the two groups.

6. Discussion

The data from this study suggests that there are advantages in using a Jones dressing cast for two weeks post-surgery. The advantages of pain reduction, earlier mobility and reduced hospitalization time were seen in the first study and are underlined in this study (apart from the reduction in the use of analgesics). The prolonged application of the cast could reduce all complications, even for older patients who had experienced more complex surgery. This observation was not, however, shown to be statistical significant. This is due to the fact that the recorded complications increased by occurring haematoma around the wound edges and occasional wound gaping.

The statistical significance might have been reduced by the fact that group 1 was an inhomogeneous group. Half of the group had beneficial influence by the cast for 1 week.

This and the more complex surgery in group 2 may have been the reason why the observation of a reduced use of analgesics through an extended use of the cast could not be substantiated.

In Group 2 there was no infection. The infection rate in the first group (2.32%) was similar to that reported by other authors (2.2% Miller, 1–13% Culver et al.) [16,2]. The reason for the missing statistical relevance is because an infection rate of 0% is not realistic. A study which demonstrates statistical relevance following this criteria would need to be designed with 176 patients in each group, and to show, in Group 2, one single case of postoperative infection [17].

Considering the evident disadvantage (i.e. more pain [1] and a difficult recovery) in the non-cast group, such a study would not be ethical.

The number of days that the patients spent in the hospital is quite high in both groups (9.33 days in group 1 and 4.42 days in group 2). This is due to the fact, that the study is a retrospective analysis. At the beginning of the study the patients needed a lot of care, because there was no defined post-op management strategy after complex foot surgery. The authors recommend a minimum period of hospitalization, because pressure analysis of Brodell et al. [18], Smilie [15], Ogata and Whiteside [19], showed pressure peaks under the Jones dressing bandage from 30 min to 48 h after surgery. So in group 2 the minimum hospitalization time was 48 h after surgery and an additional extra time period in order to be aware of any signs of a compartment syndrome.

No patient presented with compartment syndrome in our series. In case of any suspicious clinical presentation, the cast should be removed. There should always be the possibility to split the cast in case of prolonged pain and in this case hospitalization is recommended.

The Jones dressing is not routinely indicated after surgery of the forefoot. But in cases with several approaches and vulnerable soft tissue it is even than an option to support the wound healing.

The cast employed in this study is a modified Jones compression bandage. A plaster cast, as used in this study, is a very rigid material offering limited space for swelling beneath the cast.

The ultimate tensile strength of the skin is low compared to bones, tendons, fascia and nervous tissue. The skin is thus the weakest and most vulnerable tissue in case of edema. The Jones dressing cast provides a layer of higher tensile strength that helps to protect the skin [20].

There are many further advantages that are not reported in the data:

The cast facilitates mobility though as the cast can become uncomfortable and the leg painful whenever the patient spends too much time standing, the patient will elevate the limb to find relief.

A reduced hospitalisation time is possible because the cast protects the wound from the environment. No further medical care is required until the sutures are removed.

The condition of the cast indicates the patient's compliance with the physician's instructions. The cast serves as a buffer: weight bearing with the cast leads to its damage before damage can occur to the surgical reconstruction. This was the reason for considering the complications like screw dislocation and non-unions in the statistical analysis of this study.

7. Conclusion

The Jones dressing cast is a useful tool that can help minimize postoperative complication rates. Wearing the cast for two weeks is preferable. Our study suggests its effectiveness in reducing soft tissue complications and facilitating independent mobility.

Conflict of interest

The authors confirm no conflicts of interest.

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