Retrospective Evaluation of Microbicidal Polymer Dressing for Reduction of Infection Following Post Deformity Correction Surgery

Shital Pema DPM
Kettering, OH

ABSTRACT

Pin site infections are a very common complication of external fixation, and unfortunately, no standard of care exists to effectively minimize the risk of infection. Various pin site care regimens with different methods of cleaning and dressing orthopedic percutaneous pin sites can be found. Little evidence exists as to which pin site care regimen best reduces infection rates. This retrospective case series introduces the potential of a new organic polymer in solvent (DuraDerm®), which when applied to a pin site, eradicates any organisms, and forms a flexible occlusive bandage that reduces the risk of microbe migration into the pin track site.

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INTRODUCTION

K-wires and metal pins are commonly used for external fixation in patients requiring provisional or definitive fixation. These pins protrude through the skin and create an avenue for migration of organisms. Anytime there is a break in the integrity of the skin, the risk of infection is increased. Pin site infections are a very common complication of external fixation, and unfortunately, the literature is scant on how to optimally minimize the risk of infection.

An optimal dressing for pin track sites would have microbicidal properties in order to prevent infection but would also facilitate healing. DuraDerm® is a new product consisting of organic polymers. When applied, DuraDerm eradicates any organisms it comes in contact with and then rapidly evaporates leaving an elastomeric, transparent, biodegradable, and occlusive dressing. The product has already been used on hundreds of wounds secondary to trauma, shave biopsies, and Mohs micrographic surgery, including on flap and full-thickness skin graft repairs.[1,2] This is the first review evaluating its use for the reduction of infection post deformity correction and/or traumatic provisional surgery.

Depending on the reference, pin track infection rates have been reported to range from 0% to 100%. A systematic review of the incidence of pin track infections associated with external fixation published in 2016 revealed a cumulative pin track infection rate of 27%. This rate was defined as the inherent risk of any given research participant developing a pin track infection at a random pin or wire site during the course of treatment with external fixation.[3] A 2016 review describes pin track infection as the most commonly expected problem, or even an almost inevitable complication, when using external fixation.[4]

Common Risk Factors in Patients Associated With Deformity Correction and/or Traumatic Provisional Surgery

The traditional nonsurgical accommodative treatment for diabetes-associated Charcot foot arthropathy has been unsuccessful in improving the quality of life in affected individuals. This has led to the growing interest in surgical correction of the acquired deformity with either "super construct" internal fixation implants or fine-wire static circular external fixation. Pin site infection is common in this high-risk patient population.

Risk factors for pin track infection are multi-factorial. Patient specific factors may include increased age, comorbidities (diabetes, immune disorder, vascular diseases), immune status, medications (corticosteroids), and smoking. Pin and procedure related risk factors are also multifactorial. These may include, length of operative procedure, pin insertion technique, pin placement sites, and skin tension around pin site.[5]

Role of Duraderm

DuraDerm is a 510K FDA cleared medical device indicated for providing a covering over minor wounds and scrapes that are clean and dry. The microbicidal liquid solution consists of organic polymers. The unique formulation eradicates any organisms (bacteria, fungi, viruses) it comes in contact with. This is a result of the solvent's activity against an infinite number of organisms. After eradication is complete, the solvent then transitions into a clear, elastomeric, non-odorous film for covering disrupted tissue. The film protects the wound against entry of water, dirt, and germs. The film is elastomeric and protects in difficult regions where flexing, bending and creasing skin occurs. The clear film forms in less than a minute.[6] DuraDerm should not be used to the treat deep infected wounds. Dura-

TABLE 1.

Patient Demographics						
Gender	Age	Procedure	Number of Pins	Time of First Treatment	Length of Pin Placement	Risk Factors for Infection
M	68	Charcot foot	16	first post op visit	8 weeks	DM
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F	30	Ruptured Achilles tendon deformity correction procedure	6	first post op visit after second surgery	9 weeks	DM and HTN
F	37	Charcot foot	10	first post op visit	8 weeks	DM, non-healing foot ulcer with osteomyelitis
F	33	Traumatic provisional surgery	10	first post op visit after leaving hospital	6 weeks	former smoker, preexisting coagulopathies, obesity
M	42	Charcot foot	12	first post op visit	8 weeks	PVD, HTN, morbid obesity, ESRD, DM with DPN, non-healing foot ulcer
F	48	Charcot foot	12	first post op visit	8 weeks	DM, HTN, Hyperlipidemia, current smoker

DM- diabetes mellitus
HTN- hypertension
PVD- peripheral vascular disease
ESRD- end stage renal disease

Derm can be used to protect disrupted skin surface of wounds that are clean and dry.

OBJECTIVE

The objective of this case series was to investigate if the use of DuraDerm had an impact on the reduction of pin tract infection following lower limb reconstruction.

METHOD

A retrospective case series review of six patients (66 pins) who had procedures where pins were placed for Deformity Correction and/or Traumatic Provisional Surgery was completed. All patients were evaluated and treated by the primary surgeon (See Table 1 for patient demographics).

Surgical Technique for Deformity Correction and/or Traumatic Provisional Surgery

All patients were placed supine on the operating table and underwent general anesthesia for each procedure. Prophylactic antibiotics were routinely administered 30 minutes prior to surgery. A percutaneous triple hemi-section Achilles tendon lengthening was performed prior to the initial application of the external fixator in each case. The two-stage technique consists of gradual deformity correction utilizing Seal Frame followed by rigid internal fixation.

PROCEDURES

The topical application of DuraDerm was implemented at the first post-operative visit in clinic approximately one week after

FIGURE 1. Photo of deformity correction procedure. *(Courtesy of Dr. Pema)*

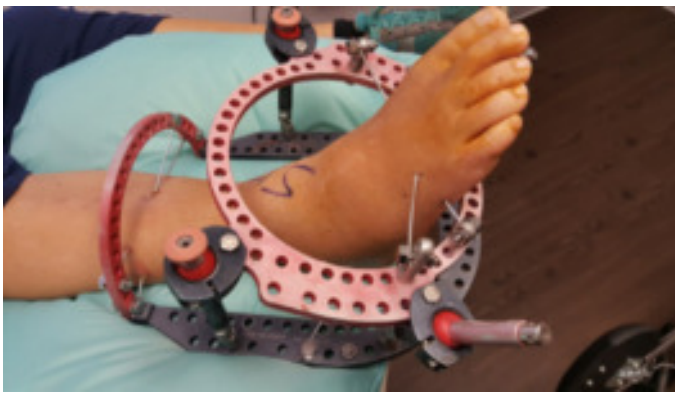

FIGURE 2. Photo of traumatic provisional surgery. *(Courtesy of Dr. Pema)*

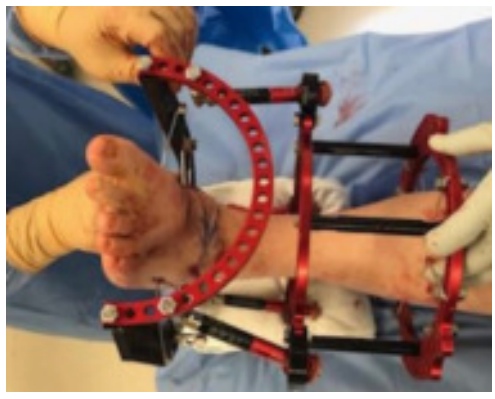

FIGURE 3. Classification of pin tract infection.[7]

Grade 1	Irritation of pin surrounding area by adhesions and restriction of movement
Grade 2	Infection of the pin surrounding area without secretion
Grade 3	As grade 2, but with definite pin-track secretion, without significant pin loosening

surgery. This pin care protocol was administrated by a home health nurse on average of three times a week for a period 5-8 weeks until pins were removed and then for an additional 14 days following pin and suture removal (see Figure 4 for protocol).

RESULTS

Of the 6 patients and 66 pins, no patient developed clinical signs of pin tract infection according to below classification of pin tract infection. This represents a significant reduction from the average incidence of pin site infections reported in the literature (<1% vs 27% on a per research participant basis).

CONCLUSION

Early research shows that DuraDerm is effective in the prevention of pin tract infection post deformity correction and/or traumatic provisional surgery.

DISCUSSION

These encouraging retrospective results warrant further investigation with prospective, randomized controlled IRB studies to better understand the clinical and economic implication of this novel approach to prevention of pin tract infection.

Momentary stinging may occur upon initial application. The film commonly remains intact for 1-3 days or longer depending on exposure to rubbing, flexing, or soap and water. This film is resistant to degradation by water alone but can be easily removed with the combination of soap and water or it can be gently peeled off starting at the outer edges. DuraDerm is for external use only and not intended for use on deep or infected wounds or puncture wounds, or for use near the eyes, mouth, or nose. Intentional inhaling of the contents may be harmful or fatal. The bottle should be tightly capped after each use to prevent evaporation of the solvent.[7]

FIGURE 4. Pin care protocol using DuraDerm.

Step 1:	Brush the pin sites with saline using an ordinary soft toothbrush or gauze with sterile gloves.
Step 2:	If following Step 1, debris remains, use forceps (tweezers) to gently remove debris.
Step 3:	Apply DuraDerm® with Q-tip on clean dry wound around (extending approximately one inch around pin site) and on the pin. *DuraDerm® will be applied at least three times a week post discharge.*

DuraDerm® should be reapplied at the end of each Pin Care Cleaning Regimen. This pin site routine will continue for 5 to 8 weeks while the pins are in place. Then for a period of 14 days after pin and suture removal, follow the standard post-op DuraDerm® protocol.

DISCLOSURE

Dr. Pema has no conflicts of interest.

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AUTHOR CORRESPONDENCE

Shital Pema DPM

E-mail:..... shitalpema@yahoo.com