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Australia and New Zealand Horizon Scanning Network

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TERRITORY GOVERNMENTS OF AUSTRALIA
AND THE GOVERNMENT OF NEW ZEALAND

Horizon Scanning Technology Prioritising Summary

Shock wave therapy for wound healing

February 2009



ASERNIP/S

**Australian
Safety
and Efficacy
Register
of New
Interventional
Procedures -
Surgical**



**Royal Australasian
College of Surgeons**

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PRIORITISING SUMMARY

REGISTER ID S000095

NAME OF TECHNOLOGY DERMAGOLD™ SHOCK WAVE THERAPY

PURPOSE AND TARGET GROUP TO TREAT PATIENTS WITH SOFT TISSUE WOUNDS

STAGE OF DEVELOPMENT (IN AUSTRALIA)

- | | |
|---|---|
| <input checked="" type="checkbox"/> Yet to emerge | <input type="checkbox"/> Established |
| <input type="checkbox"/> Experimental | <input type="checkbox"/> Established <i>but</i> changed indication or modification of technique |
| <input type="checkbox"/> Investigational | <input type="checkbox"/> Should be taken out of use |
| <input type="checkbox"/> Nearly established | |

AUSTRALIAN THERAPEUTIC GOODS ADMINISTRATION APPROVAL

- Yes
- No
- Not applicable

INTERNATIONAL UTILISATION

COUNTRY	LEVEL OF USE		
	Trials Underway or Completed	Limited Use	Widely Diffused
Austria	✓		
USA	✓		

IMPACT SUMMARY

Shock wave therapy has been used for more than two decades to break down renal calculi and treat various musculoskeletal conditions. Shock wave therapy may also be useful for treating wounds by stimulating tissue regeneration and wound healing, and Dermagold™ shock wave therapy (Tissue Regeneration Technologies, Woodstock, GA) has been developed specifically to treat dermatologic indications. This technology is yet to emerge in Australia.

BACKGROUND

Wound healing disorders may have associated burdens including increased morbidity, prolonged hospital stay, increased treatment costs and lower patient satisfaction (Dumfarth 2008). The type and aetiology of a wound determines its treatment, with wounds broadly classified as either acute or chronic (Werdin 2008). Acute wounds are those in which the normal healing process is expected to take place, whereas chronic wounds are those which have not achieved anatomic and functional integrity after 3

months (Knox et al 2007; Werdin 2008). Common chronic wounds include venous and arterial ulcers, diabetic ulcers, and pressure sores (Werdin 2008).

Depending on the aetiology and severity of wound, treatments may include:

- Antibiotics
- Vacuum assisted closure: removal of excess wound fluid, allowing improved oxygenation and peripheral blood flow (Enoch et al 2006)
- Hyperbaric oxygen: an adjunctive therapy where the atmospheric pressure is increased (Enoch et al 2006)
- Pharmacology: improved circulation, controlled inflammatory response, and promotion of angiogenesis, collagen synthesis and epithelialisation (Enoch et al 2006)
- Antimicrobials: used for infected wounds, may include iodine or silver based preparations (Enoch et al 2006)
- Debridement: removal of devascularised tissue and necrotic material, without damaging healthy tissue
- Dressings:
 - Hydrogels for the debridement stage
 - Foam for the granulation stage
 - Hydrocolloids and low-adherence dressings for the epithelialisation stage (Werdin 2008)

DermaGold™ has been introduced as an alternative method of encouraging wound healing. DermaGold™ uses low-energy shock waves composed of heat, electromagnetic, acoustic and light energies to encourage tissue regeneration (Speed 2004; DermaGold™ website). The action of shock waves on wound healing is unknown, but thought to include neovascularisation, disintegration of calcium, neural effects, nitrous oxide and growth factor promotion, stem cell migration, and antibacterial effects (Speed 2004, DermaGold™ website). However, shock waves may also have adverse effects on soft tissues, as they may damage tissue during their passage which can result in localised bleeding.

DermaGold™ may be used prophylactically for surgical wounds or to actively treat acute and chronic wounds. It is a non-invasive therapy which requires no anaesthesia and may be performed as an outpatient procedure. The number of shock wave treatments needed varies, depending on the indication and the wound surface (DermaGold™ website)

CLINICAL NEED AND BURDEN OF DISEASE

The burden of disease is difficult to quantify as there is a wide range of acute and chronic wounds. In the identified studies shock wave therapy was used to treat surgical wounds, wounds with disturbed healing, post traumatic necrosis, venous stasis ulcer, decubitus ulcer, plaster cast pressure ulcer, arterial insufficiency ulcer, and burn wounds.

DIFFUSION

Shock wave therapy has been used since the mid-1980's for many different indications including kidney stones, treatment of un-united fractures, plantar fasciitis, calcifying tendonitis of the rotator cuff and humeral epicondylitis. Although shock wave therapy is not a new technology, its use in the treatment of wounds is novel. The Dermagold™ system has been developed specifically for dermatological treatment. At the time of writing Dermagold™ was an investigational device only, and not listed on the US Food and Drug Administration (FDA) or the Australian Therapeutic Goods Administration (TGA). Several clinical trials of the Dermagold™ technology for wound healing are currently underway in the United States.

COMPARATORS

Dermagold™ may be used as an adjunctive to wound closure treatments such as vacuum assisted closure (VAC), debridement, skin grafting or flap coverage, or dressings. It may also be used prophylactically, and comparators include other methods to promote epithelialisation such as hyperbaric oxygen therapy.

SAFETY AND EFFECTIVENESS ISSUES

Study description

Randomised controlled trial

This prospective randomised study enrolled 100 consecutive patients undergoing elective coronary artery bypass graft (CABG) surgery at one hospital department. Patients were randomly allocated to the treatment and control groups, although the method of randomisation was not reported. Excluded patients were emergency cases as well as those patients who tested positive for hepatitis C and HIV. The groups appeared to be well matched for age, gender, body mass index, risk factors for wound healing disorders, and history of impaired wound healing. Vein grafts were harvested from both groups and wound closure was performed using absorbable cutaneous sutures and staples. All patients received intraoperative antibiotic treatment. The treatment group received low-energy shock wave therapy (Dermagold) after wound closure. A total of 25 impulses (0.1 mJ/mm²; 5Hz) per centimetre of wound length were applied to the wounds. Patients in the control group did not receive shock wave therapy. The follow up was seven days. In this study, shock wave therapy was studied as a prophylactic treatment (Dumfarth et al 2006).

Case series

This study prospectively enrolled 208 patients between August 2004 and June 2006. Eligible patients had either "...acute or chronic complicated, non-healing wounds of various aetiologies including trauma, failure of primary closure following operation, venous or arterial insufficiency, pressure necrosis, or burn in the absence of extension to underlying bone or associated bone disruption." The most common wounds were surgical wounds which had failed to heal and wounds resulting from direct trauma associated with necrosis of the epidermis. Excluded patients were those who were pregnant, had stage I and stage IV decubitus ulcers, superficial first- and second-degree or circumferential

burns, compartment syndrome, necrotising fasciitis, or lymphoedema. Further exclusions were patients participating in another clinical study, those with physical or mental disability, or those who were not located close to the study and may not have been available to follow up. All patients received shock wave therapy (Dermagold) in conjunction with wound debridement and dressing. According to the wound size, patients received 100 to 1000 pulses at 0.1mJ/mm (100 pulses/cm²). Although no patients were removed from the study due to wound progression or deterioration, 32 patients (15.4%) dropped out of the study and were analysed in the incomplete healing group. The mean follow-up was 6.3 weeks (Schaden et al 2007).

Safety

Randomised controlled trial

A total of three patients died (3%, 3/100): two in the control and one in the treatment group. The causes of death included multiorgan failure, haemorrhagic stroke, and pulmonary embolism. There were no severe wound infections during the seven day follow up. No haematoma formations, skin lacerations or postoperative pain were observed after low-energy shock wave therapy (Dumfarth et al 2006).

Case series

There were no reported cardiac, neurological, dermal, thermal or allergic reactions or adverse events. Further, no clinically evident wound infections developed, and no wounds deteriorated in this study. During follow-up there was no treatment-related toxicity, no infection, and no deterioration of shock wave therapy-treated wounds (Schaden et al 2007).

Effectiveness

Randomised controlled trial

The primary outcome, wound healing, was measured using the ASEPSIS (Additional treatment, presence of Serous discharge, Erythema, Purulent exudate, Separation of the deep tissue, Isolation of bacteria, and duration of patient Stay) score. Wounds were assessed from postoperative days 3 to 7 by a blinded investigator. The ASEPSIS score was significantly lower in the treatment group than in the control group from postoperative day 3 to day 7 ($p < 0.05$ for each day). ASEPSIS scores were then analysed in five classes (satisfactory healing, disturbance of healing, minor wound infection, moderate wound infection, and severe wound infection). When analysed in this manner, there was more satisfactory healing in the treatment group ($p < 0.05$). There were significantly higher disturbances of healing, and minor and moderate wound infection in the control group ($p < 0.05$ for each). The secondary outcomes included the need for surgical revisions of the wound; and the need for new antibiotic treatment for wound healing disturbances of the vein graft harvesting site. The control group required more surgical revisions than the treatment group (control: 10% vs. treatment: 2%, $p = 0.092$) but this was not statistically significant. However, the control group required significantly more antibiotics than the treatment group (4 vs. 22; $p = 0.015$) (Dumfarth et al 2006).

Case series

The majority (75%, 156/208) of patients enrolled in the trial achieved 100% wound epithelialisation. Of the 176 patients who completed the trial, 88.6% (156/176) showed complete healing. No wound deteriorated with shock wave therapy. Complete wound epithelialisation was significantly associated with wound size (81.0% for wounds ≤ 10 cm² surface area vs. 61.8% for versus ≥ 10 cm² surface area, $p=0.05$) and duration (83.0% for wound ≤ 1 month old vs. 57.1% for wound ≥ 1 month old, $p<0.001$). Acute wounds were found to be significantly more likely to heal than chronic wounds (81.0% acute versus 56.3% chronic; $p=0.001$), and complete epithelialisation was significantly less likely and healing time prolonged in patients with large (>10 cm²) chronic (>1 month) wounds ($p<0.005$). Wound healing was significantly better in younger than in older patients (complete epithelialisation 57.7 ± 1.5 years vs. less than complete epithelialisation 69.1 ± 2.6 years, $p<0.001$). The wounds which demonstrated the worst overall healing rates were venous stasis ulcers (36.0% vs. 66.0% for all other wounds; $p=0.001$) (Schaden et al 2007).

COST IMPACT

At the time of writing, the cost for DermaGold™ was not available, as the device was still under clinical investigation. Shock wave therapy is proposed to reduce length of hospital stay and associated costs through several mechanisms including reducing the need for operative debridement of wounds; provision of treatment in an outpatient setting; and promotion of wound healing.

ETHICAL, CULTURAL OR RELIGIOUS CONSIDERATIONS

No other issues were identified from the retrieved studies.

OTHER ISSUES

Two authors of the randomised trial, Dr. Grimm and Dr. Schaden, disclosed a financial relationship with the manufacturer of Dermagold™ (Tissue Regeneration Technologies, Woodstock, GA). Dr. Schaden was also an author on the case series study and it is likely that this financial relationship was applicable, although no disclosure was made.

SUMMARY OF FINDINGS

Both studies applied shock wave therapy at 0.1 mJ/mm² with the case series applying 100 pulses per cm² and the RCT applying 25 pulses per centimetre of wound length. One patient receiving shock wave therapy died, as did two control patients. No other serious side effects were reported. Both studies reported that shock wave therapy was effective in treating various wounds including surgical, post-traumatic, venous stasis ulcer, decubitus ulcer, plaster cast pressure sores, arterial insufficiency ulcers, burns, and wounds with disturbed healing. However, further comparative trials are required and it is unclear whether the technology will be effective or safe in treating other types of wounds.

HEALTHPACT ACTION

The evidence available on shock wave therapy for wound healing is limited. Furthermore, the comparator utilised within the randomised trial was a control rather than an active

comparator such as hyperbaric oxygen therapy. There was no cost information available; however, it may be assumed that a shorter length of hospital stay due to complete wound healing may represent economic benefits. Based on the available evidence, shock wave therapy for wound healing will be monitored for 12 months.

NUMBER OF STUDIES INCLUDED

Total number of studies: 2

Level II and IV intervention evidence

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SOURCES OF FURTHER INFORMATION

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SEARCH CRITERIA TO BE USED

Shock wave therapy AND (tissue OR wound)