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Original research

APPLICATION OF THE CNP 3D EASYDRESS SYSTEM IN THE MANAGEMENT OF COMPLEX SOFT TISSUE DEFECTS: A CASE SERIES REPORT

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ABSTRACT

Background: *Managing complex soft tissue defects remains a major challenge in orthopedic trauma and reconstructive surgery. Negative Pressure Wound Therapy (NPWT), or Vacuum-Assisted Closure (VAC), has significantly improved wound care by reducing edema, stimulating granulation tissue, and controlling infection. However, conventional NPWT systems have limitations in large tissue defects or when external fixation is required. The CNP Easy-dress system, a controlled 3D negative pressure dressing, was developed to overcome these shortcomings. Thi study evaluates the clinical efficacy, safety, and applicability of the CNP 3D Easy-dress system in managing complex soft tissue defects.*

Methods: *This case series includes four patients with extensive soft tissue defects, three of whom required external fixation. All patients were treated with NPWT using the CNP 3D Easy-dress system at the Center for Orthopedic Trauma and Plastic Surgery, Hue Central Hospital, starting from September 2024.*

Results: *All patients showed rapid improvement of soft tissue and robust granulation tissue formation after an average of 2 - 4 dressing changes. Subsequent wound coverage was successfully achieved with skin grafts or free flaps, with no complications such as infection or flap failure.*

Conclusion: *The application of the CNP 3D Easy-dress system enhances the effectiveness of NPWT in the management of complex soft tissue defects, particularly in cases requiring external fixation. This method shortens treatment duration, minimizes complications, and improves postoperative functional recovery.*

Keywords: *Controlled Negative Pressure (CNP); Easy-dress; Complex Soft Tissue Defects; NPWT; External Fixation; Free Flap; Skin Graft.*

I. INTRODUCTION

Complex soft tissue defects present a major challenge in the clinical practice of orthopedic trauma and reconstructive surgery. These injuries are commonly associated with chronic ulcers, high-energy trauma, or postoperative complications. The treatment of these defects requires significant time and resources and can severely impact patients' physical health, psychological well-being, and overall quality of life.

Negative Pressure Wound Therapy (NPWT) has been shown to be effective in managing complex wounds by reducing exudate, decreasing edema, increasing tissue perfusion, stimulating granulation tissue formation, and reducing the wound area. However, the application of NPWT in cases of extensive soft tissue defects or those involving external fixation is often difficult, particularly in maintaining an airtight system. These challenges may lead to failure in maintaining continuous negative pressure, increasing the risk of infection and prolonging treatment time [1].

The CNP 3D Easy-dress system, a Controlled Negative Pressure 3D dressing, was designed to overcome the limitations of conventional NPWT systems. This product features a transparent,

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airtight film that prevents bacterial invasion while not adhering to healthy tissue. Notably, CNP 3D Easy-dress allows for easy monitoring of wound progress and does not restrict movement in patients with external fixation. Its quick and simple application has been documented to significantly reduce surgical setup time and overall treatment costs while enhancing therapeutic effectiveness [2].

This study presents a case series utilizing the CNP 3D Easy-dress system in the management of complex soft tissue defects at the Center for Orthopedic Trauma and Plastic Surgery, Hue Central Hospital, from September 2024, aiming to evaluate the clinical efficacy and feasibility of this method.

II. CASE PRESENTATIONS

2.1. Case 1

A 19-year-old male was admitted following a traffic accident with an anterior tibial artery injury, complex fractures of the distal femur, and a type IIIB open fracture of both tibia and fibula in the left leg (Figure 1). The patient underwent debridement, removal of devitalized bone, external fixation of the femur and tibia, and placement of bone cement in the tibia. After three applications of NPWT using the CNP 3D Easy-dress system (Figure 2), robust granulation tissue was observed, and the wound was successfully covered with a cross-leg flap and skin graft (Figure 3A). After 22 months of follow-up, both the general condition and the local status at the proximal third of the left lower leg are completely stable (Figure 3B).

Figure 1: Complex wound with devitalized bone fragments

Figure 2: Debridement and NPWT with CNP 3D Easy-dress system

(A)  (B) 

Figure 3: (A) Partial skin graft and cross-leg flap coverage; (B) Patient outcome after 22 months.

2.2. Case 2

A 30-year-old male sustained a type IIIC open fracture of both tibia and fibula in the right leg, with posterior tibial artery injury and extensive soft tissue damage around the knee, following a high-energy traffic accident. Emergency surgery was performed, including external fixation and vascular repair. Postoperatively, the patient developed progressive necrosis of the lower leg compartments (Figure 4). After four NPWT sessions with CNP 3D Easy-dress, significant granulation tissue formation and reduced exudate were noted (Figures 5 and 6). The patient subsequently underwent fibular transposition and free latissimus dorsi muscle flap coverage (Figure 8). Postoperative recovery was stable, and rehabilitation was initiated (Figures 9 and 10).

Figure 4: Progressive necrosis primary debridement surgery

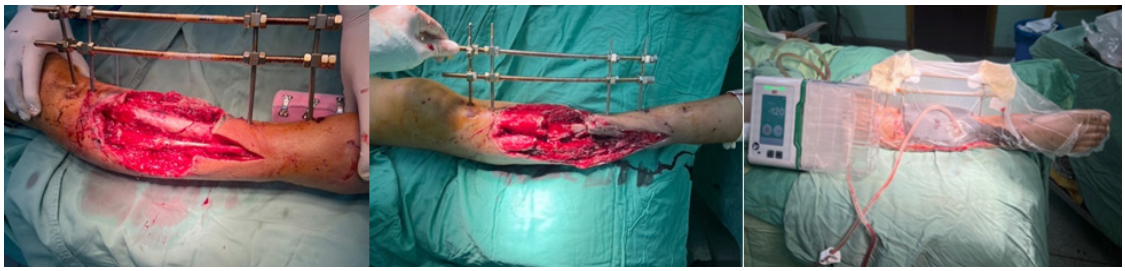

Figure 5: Debridement and NPWT with CNP 3D Easy dress system

Figure 6: Soft tissue condition improved after four surgical procedures

Figure 7: Fibular vascularized and free latissimus dorsi muscle flap coverage

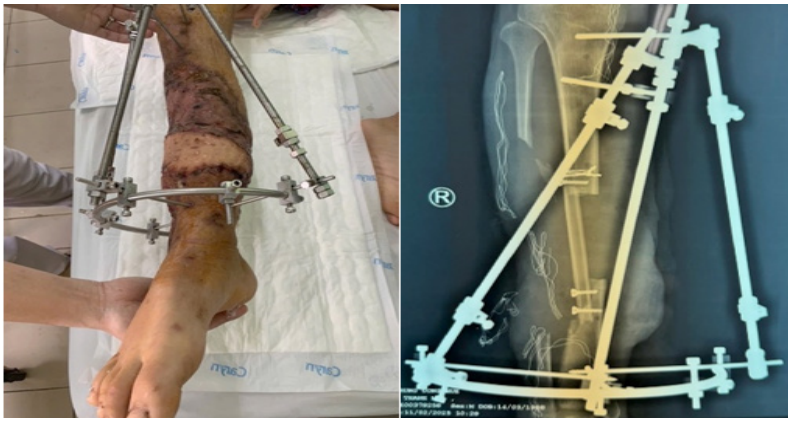

Figure 8: Radiographs Pos-op

Figure 9: Rehabilitation progress after three months

2.3. Case 3

A 16-year-old male presented with bilateral complex injuries of the lower legs and feet from a traffic accident, including extensive skin avulsion of the right leg, closed fracture of the left femur, and type IIIB open fracture of the left tibia and fibula. Following initial surgery and external fixation, the patient developed progressive necrosis in both lower limbs. Bilateral debridement and two applications of NPWT with CNP 3D Easy-dress were performed (Figures 10 and 11). Subsequent full-thickness skin grafting and realignment of the left tibia were conducted (Figures 12). Osteotomy of tibia and external fixation had been done after 7 months (Figures 13).

Figure 10: Bilateral debridement and NPWT with CNP 3D Easydress

Figure 11: Robust granulation after each application

Figure 12: Full-thickness skin graft coverage

Figure 13: Osteotomy with external fixation after 7 months

2.4. Case 4

A 26-year-old female sustained closed fractures of the left tibia and fibula, and a type IIIC open fracture of the right leg with delayed compartment syndrome due to a traffic accident. After fasciotomy, external fixation, and intramedullary nailing, progressive necrosis was observed. Debridement and removal of devitalized bone were followed by one application of NPWT with CNP 3D Easy-dress (Figures 15 and 16). The patient underwent additional skin grafting and further osteosynthesis. Full recovery was achieved after two months, and the patient began rehabilitation (Figures 17, 18, and 19).

Figure 14: Debridement following the initial emergency surgery

Figure 15: Granulation tissue formation after NPWT with CNP 3D Easy-dress

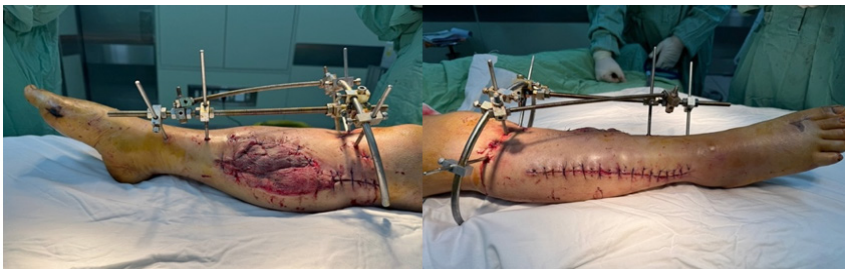

Figure 16: Skin graft coverage and wound reinforcement

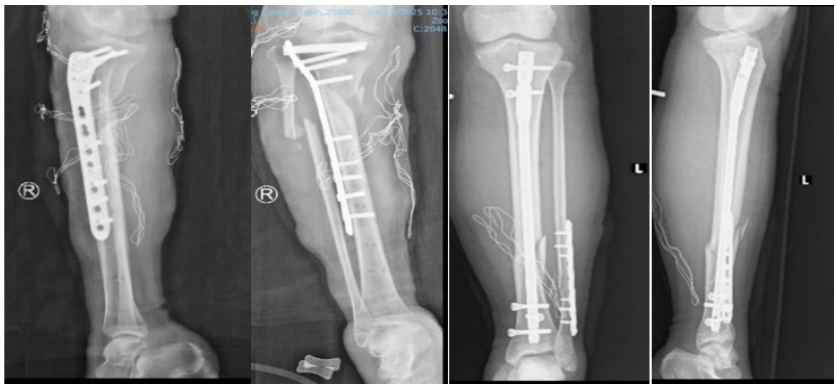

Figure 17: Osteosynthesis after wound stabilization at both side

Figure 18: Rehabilitation progress after five months

III. DISCUSSION

Complex soft tissue defects, especially in the lower extremities, remain a significant challenge in orthopedic trauma and reconstructive surgery. Optimizing the wound healing environment is essential for successful reconstruction. NPWT has been widely recognized for its ability to enhance wound healing by reducing exudate, decreasing edema, improving perfusion and stimulating granulation tissue formation [1, 2].

However, traditional NPWT systems, including foam-based (e.g., VAC Therapy™) and gauze-based (e.g., RENASYS™) systems, have limitations in managing extensive wounds, especially those involving external fixation. Major challenges include maintaining an airtight seal, preventing negative pressure leakage, complicated dressing changes and restrictions on patient mobility [3]. Studies report failure rates in sealing traditional NPWT systems ranging from 15 - 25%, leading to increased infection risk, prolonged treatment times, and higher healthcare costs [4].

The CNP 3D Easy-dress system addresses these issues. Its three-dimensional, transparent polyurethane dressing provides excellent elasticity and self-sealing capabilities. The advantages include:

- Maintain stable negative pressure and airtight sealing even in soft tissue injuries involving external fixation frames, thereby minimizing pressure leakage or system failure [5].

- Significantly reduced setup time, allowing for quicker and more streamlined application compared to traditional foam-based NPWT. According to the report by Stanek et al., the application time for NPWT dressing during surgery was reduced by approximately 50 - 90% [6].

- Flexible taping enables early rehabilitation without restricting movement or requiring complex fixation [7].

- Transparent film facilitates continuous wound assessment, minimizing unnecessary dressing changes and infection risk.

Additionally, CNP 3D Easy-dress contains no chemical adhesives, reducing trauma to healthy tissue during removal, thereby minimizing pain and enhancing patient comfort [8]. Regarding cost-effectiveness, traditional NPWT systems is often high due to the large amounts of consumables required (foam, adhesive dressings, suction devices), the time-consuming procedures for healthcare staff, and the increased risk of additional costs from complications resulting from inadequate airtight sealing. According to a study by Apelqvist et al. (2017), the average cost for one cycle of foam-based NPWT treatment ranges from 250 to 600 USD per week, depending on the extent of the wound [9]. In contrast, CNP 3D Easy-dress has been shown to significantly reduce the amounts of consumable materials, especially in large wounds or those involving external fixation frames. It also decreases the frequency of dressing changes and the need for additional surgical interventions, thereby shortening the average hospital stay by approximately 20–30% compared to other NPWT systems [6,10]. With the preliminary observations at our place, it indicates that the total treatment cost per patient using CNP 3D Easy-dress is approximately 20–25% lower than that of the conventional NPWT treatment protocol. Despite encouraging preliminary results, this study has limitations, including a small sample size and the lack of a control group. Further large-scale randomized controlled trials are needed to validate the clinical efficacy, safety, and cost-effectiveness of CNP 3D Easy-dress.

IV. CONCLUSION

The CNP 3D Easy-dress negative pressure dressing system has demonstrated significant effectiveness in the management of complex soft tissue defects, particularly in cases involving external fixation. This system offers stable negative pressure, promotes granulation tissue formation, reduces complication rates, and supports early patient mobilization. Compared to traditional NPWT systems, CNP 3D Easy-dress offers simplified application, effective sealing, reduced treatment duration, and lower healthcare costs. Preliminary results from the case series in this study indicate the potential for broad clinical application of this approach. However, further randomized controlled trials with larger sample sizes and long-term follow-up are needed to confirm the effectiveness, safety, and long-term cost-effectiveness of the CNP 3D Easy-dress system.

Declaration of conflicting interests

The authors declare no conflicts of interest with respect to the research, authorship, and/or publication of this article

Ethical approval

All details, medical records and figures were used with the written consent for publication from the patients.

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