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Negative Pressure Wound Therapy for Complex Oral, Head and Neck Wound in Multiply Operated Patient

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INTRODUCTION

Negative pressure wound therapy (NPWT) has provided a nonsurgical form of treatment for many types of complex wounds. This therapy utilizes the vacuum-assisted closure device (VAC), characterized in 1997 by Argenta and Morykwas [1]. The device consists of a semi occlusive dressing overlying a polyurethane foam sponge, which is placed into the wound. This sealed wound is attached to a tube connected to a pump, which supplies a suction force, typically of 125 mmHg, to the wound [2].

The mechanism of wound healing via the VAC has been studied. Scherer et al. describe the VACs ability to decrease air pressure and remove fluid that accumulates within the wound. This in turn decreases dead space and its associated fluid collection, which represents a nidus for infection. In addition, they report that the VAC decreases tissue edema and aids to facilitate macroscopic and microscopic changes that promote healing [2].
In their publication they further detail the study of VAC induced wound healing using an animal model. This study compared the efficacy of three groups: one with the VAC sponge alone, one with negative pressure alone, and then one with both components combined, as is standard. Though not surprising, this corroborated the fact that it is the combination of these two components of the device that improve healing. They further detailed the mechanistic findings of each component. First, the polyurethane foam induces angiogenesis, thus increasing the delivery of blood, oxygen and nutrients that are critical to healing. Secondly, the induction of negative pressure leads to stimulation of cell proliferation and growth factors, promoting new tissue growth. In addition, the negative pressure aids in approximating the wound edges Scherer et al, 2008). In the absence of such a device, loose connective tissue that often exists in these compartments leads to increased edema in the tissue, which predisposes the wound to abscess formation. It is hypothesized that the withdrawal of this tissue edema combined with the promotion of new, vascularized tissue growth helps to reverse the hypoxia of these fluid rich dead spaces, leading to more rapid and definitive healing.

NPWT's ascendance to superiority in complex wound care is evident in its use across surgical specialties. More recently, its use in head and neck wounds and infections has become more common. For example, studies have

documented NPWT treatment of necrotizing fasciitis, open facial fracture wounds, management of fistulas following osteoradionecrosis and reconstruction, and others [3-5].

Despite the increased use of NPWT in the head and neck region, there is substantially less data available on the management of transoral vacuum-assisted wound closure. Complex oral wounds may develop after traumatic injuries, as sequalae of oncologic treatment, as well as reconstruction failure. Management of such wounds is often quite arduous, as reconstructive options may be exhausted, or the patient may no longer be a candidate for surgical treatment. We present a case of the use of negative pressure wound therapy (NWPT) for the successful treatment of a complex, full-thickness oral wound and promote its consideration of use for similar difficult-to-treat oral wounds.

CASE REPORT

The patient was a 73-year-old female diagnosed with squamous cell carcinoma of the left buccal mucosa with mandibular invasion. She underwent primary resection, which included mandibulectomy and reconstruction with a parascapular free flap. Initially she did well both oncologically and functionally. However, she developed osteoradionecrosis with pathologic fracture and an associated orocutaneous fistula at the treated site approximately 10 years following her original treatment. The patient then underwent a segmental resection and reconstruction with an osteocutaneous fibula free flap in that same site.

Following this surgery, she was discharged on post op day 6 after an uneventful post-operative course. At the one week follow up, the native oral mucosa overlying the fibula flap had broken down, and a significant orocutaneous fistula and resultant salivary leak developed (Figures 1 and 2). There was concern of anastomotic compromise due to the proximity of the salivary collection to the pedicle, and potential for resultant flap loss. Extensive remobilization of the existing inset or elevation of a soft tissue flap would be necessary for surgical salvage. After much deliberation of options, the decision was made to undertake a novel, non-surgical treatment option: transoral NPWT.

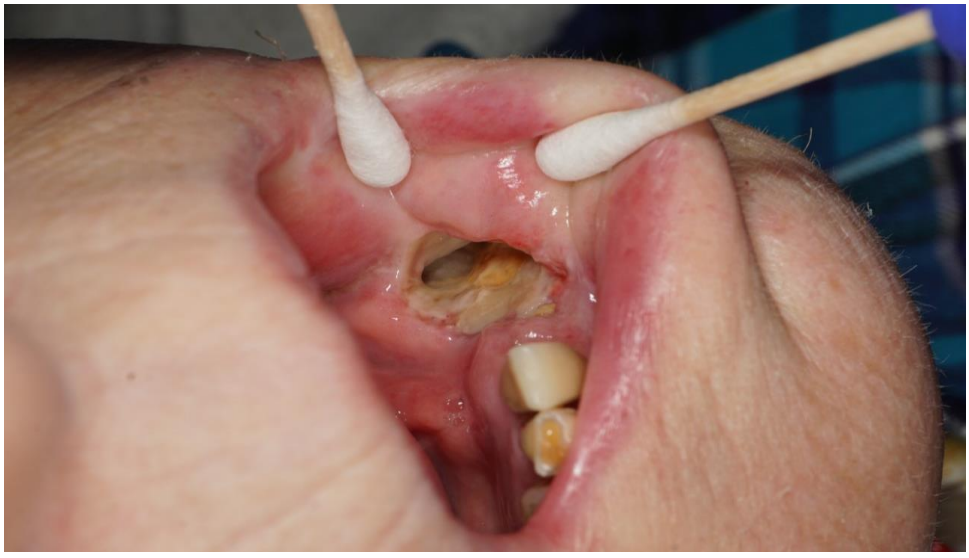

Figure 1: Photograph showing the full thickness intra-oral component of the orocutanous fistula with exposed fibula bone.

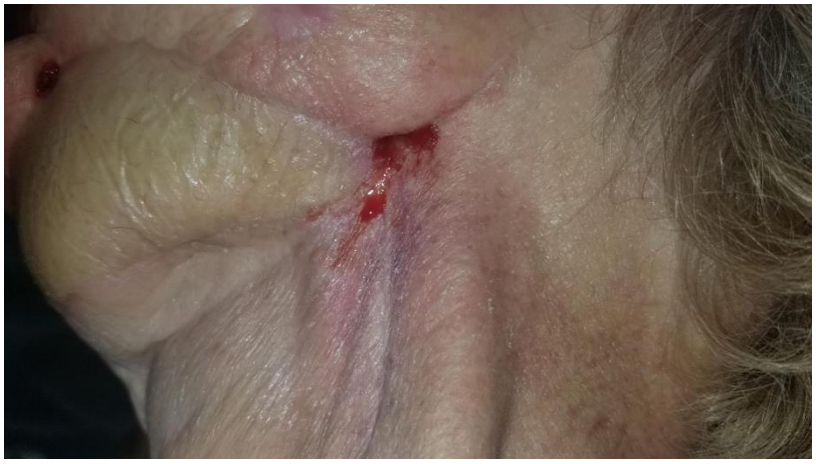

Figure 2: Photograph showing the cutaneous component of the orocutanous fistula. Also note significant scar contracture and evidence of radiation fibrosis of the skin.

In order to fabricate a custom oral VAC device, dental impressions were obtained from the patient, and a stone model was poured to create a template on which to fashion a custom tray (Figure 3). The custom tray was fabricated and verified using the stone model (Figure 4). This tray was then relined in the mouth with polyvinyl siloxane impression material to ensure adequate seal against the mucosa and this impression was then used to fabricate the acrylic splint to overly the defect. This splint was then perforated and connected to a VAC device and inserted into the oral cavity overlying a standard polyurethane foam which was inserted into the wound (Figure 5).

Initially, the device would not maintain suction due to an air leak from the corresponding cutaneous portion of the fistula. Therefore, a polyurethane foam VAC sponge was adapted to the cutaneous area and a Y-connector was placed to apply negative pressure to both sites simultaneously.

Figure 3: Stone model for the intraoral device with full thickness defect noted.

Figure 4: Custom tray overlying stone model prior to re-lining with dental impression material.

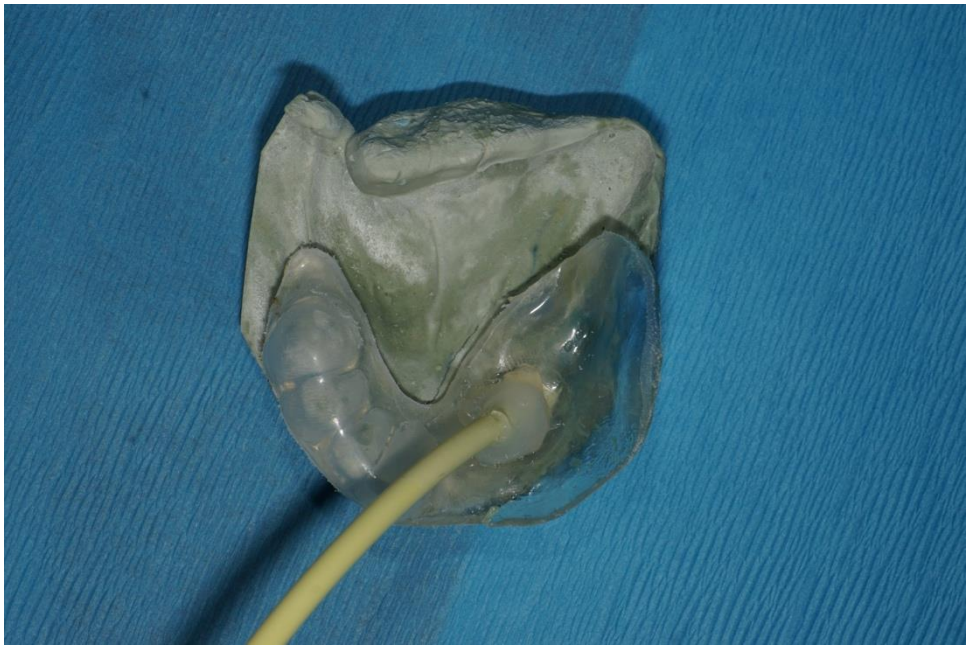

Figure 5: Acrylic splint with perforated area attached to tubing to attach to VAC system overlying the stone cast as it would then eventually sit within the oral cavity.

The device was well tolerated and worn continuously for at least 18 hours a day, with short periods allowed to disconnect; it maintained successful, continuous suction. Every third day, the VAC dressing and sponge were changed, inserting a smaller and smaller sized sponge. The patient was fed via a Dobhoff tube during this time. Two weeks later, the patient showed granulation tissue formation in her intraoral wound with almost complete closure (Figure 6).

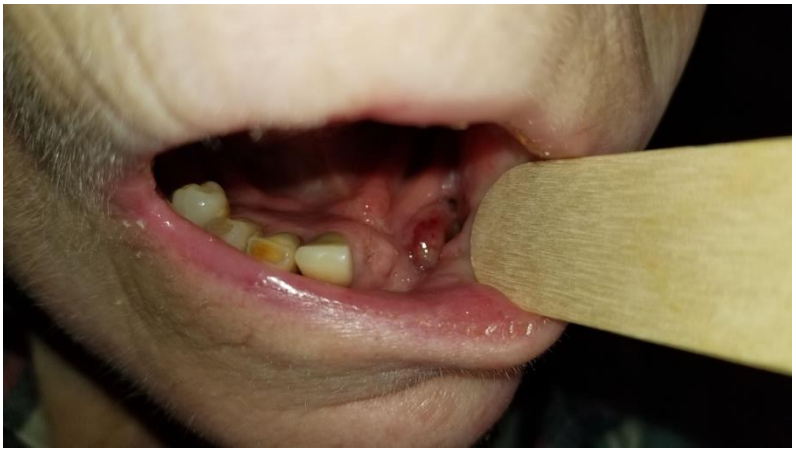

Figure 6: There is near complete mucosalization of the oral defect 2 weeks post initiation of combined transoral and transcervical NPWT.

At this point, the intraoral device was discontinued, while the VAC dressing on the neck was maintained for two additional weeks until the intraoral component of the fistula had mucosalized completely and was no longer able to be probed (Figure 7).

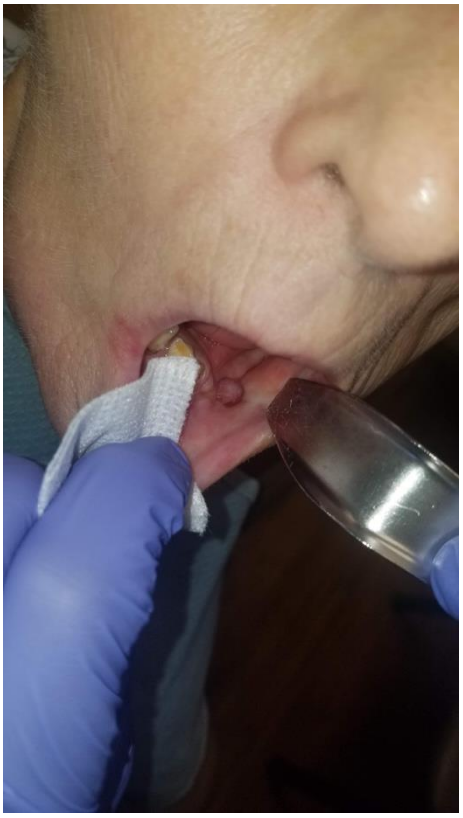

Figure 7: There is mucosalization of the oral defect and diminshed erythema and edema of the healing wound as compared to Figure 6, 2 weeks prior.

DISCUSSION

In this report, we aimed to examine the efficacy and feasibility of a novel treatment for a complex oral wound in a multiply operated patient. We found that the custom tray faciliated transoral wound NPWT, afforded significant formation of healing granulation tissue over the two weeks following the initiation of treatment, and helped avoid additional surgery in a multiply operated patient. This wound closure in our patient occurred in the setting of having had two previous free flaps, as well as previous adjuvant radiation and the development of osteoradionecrosis. Had this not been successful, she would have potentially required additional free tissue transfer, if possible. We propose that transoral NPWT is a promising option for patients presenting with complex, difficult-to-manage oral wounds such as orocutaneous fistulas and post-surgical or traumatic defects resulting from a variety of etiologies.

Multiple studies have previously demonstrated the success of using vacuum assisted closure for orocutanous and pharyngocutaneous fistulas, using an external cutaneous approach. [6-8]. Yang et. Al. detail their treatment approach to thirteen patients with complex head and neck wounds, of which six of the thirteen had orocutaneous fistulas which were treated with VAC. Their approach included watertight suturing of the mucosal side of the wound, with VAC placement in the dead space of the cutaneous side. Only one of the six patients required free tissue transfer (using anterolateral thigh flap) and one required split thickness skin graft, as the remaining four of six healed via VAC assisted secondary intention [8].

Additional approaches included attempts to use a tissue sealant for the mucosal side of orocutaneous fistulas, with the VAC device placed on the cutaneous component. Items used in these efforts included dental paste and a stitched sterile glove as watertight mucosal sealers [9,10].

In the only study discoverable which used intraoral wound vac, three patients with medication-related osteonecrosis of the jaw were treated via a similar intraoral approach as in this report. They showed increased granulation tissue and pain relief while citing no serious negative effects of the oral VAC therapy. One difference in these patients from that which we describe is that they presented with oral wounds alone, without corresponding cutaneous fistulas, as was present in ours. Thus, they only required an intraoral suctioning device [11].

The case presented here is the first to use a dental impression tray to create a custom, acrylic splint to achieve a watertight oral seal. Once connected to the VAC suction tubing, this allowed for the generation of stable, continuous negative pressure, wound mucosalization, and obviated the need for further surgical intervention.

The limitations of this treatment modality include feasibility and tolerance of wearing a device intraorally. Due to the mucosal environment, difficulties persist to keep a water and air tight seal, leading to the sustained suction forces necessary for the VAC devices. Similarly, patients must be able to tolerate wearing the device and also be fed via a Dobhoff tube. Exceptional patient compliance is necessary for these reasons, as well as frequent follow up visits to manage the wound dressings. In this case, the sponges in the VAC device were scheduled to be changed every 3 days, and this was continued as an outpatient service. Further limitations specific to this report include its retrospective and single case report nature. Therefore, we advocate for further pooling and publication of institutional data that might further validate its use.

Overall, there are promising results for the use of NPWT as a treatment option for orocutaneous fistulas, particularly in the multiply operated patient with few remaining surgical treatment options. This modality warrants further and more extensive use to detail its efficacy as a standard, reproducible option for treatment of various etiologies of complex oral wounds.

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