Treatment of Oral Cavity Venous Malformations with the Nd:YAG Laser Using the Underwater Technique

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Abstract
Mucosal involvement of venous malformations can cause bleeding, pain, and functional impairment. Treatment options include surgery, sclerotherapy, or laser therapy. Neodymium:yttrium aluminum garnet (Nd:YAG) laser therapy has been used to treat mucosal disease, but few studies have focused purely on the oral cavity. We present a retrospective review of 4 patients (5 subsites) with oral cavity venous malformations treated with the Nd:YAG laser using an underwater technique. Photographs of the venous malformations before and after treatment were evaluated by 2 blinded physicians. A visual analog scale was used to rate the treatment. The medical record was reviewed to assess change in symptoms and to note complications. Four sites were rated as having "significant improvement" and 1 site as "some improvement." Our study demonstrates that the Nd:YAG laser can be a feasible option in the treatment of venous malformations of the oral cavity.

Keywords
venous malformation, Nd:YAG laser, oral cavity, vascular malformation

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Venous malformations are congenital vascular malformations composed of ectatic veins and can be found anywhere in the body.1 When the head and neck region is affected, there appears to be a preference for these lesions to occur in the oral cavity.2 Mucosal involvement can cause bleeding, pain, swelling, functional impairment, and cosmetic deformities.3

Many treatment options have been developed, including sclerotherapy, surgery, embolization, and laser treatment. One of the most promising laser treatments consists of using neodymium:yttrium aluminum garnet (Nd:YAG) laser. The Nd:YAG laser has a wavelength of 1064 nm and is absorbed preferentially by oxyhemoglobin, with a 4- to 7-mm surface penetration, making it an effective option for treatment of mucosal vascular lesions. Berlien and colleagues2 have described using ice water to assist with skin and mucosal surface cooling to improve the effectiveness of this laser.

Few studies have been published evaluating or describing treatment of venous malformations of the oral cavity using the Nd:YAG laser.4 We describe our technique of treating these malformations using an underwater technique with the Nd:YAG laser. We also evaluate the safety and outcomes of this technique.

Methods
Approval for this study was obtained by the institutional review board at the University of Utah. A retrospective review of 4 patients (5 subsites) with oral cavity venous malformations who underwent Nd:YAG laser treatment was undertaken. Patient charts were reviewed to assess change in symptoms and to identify postprocedure complications. Photographs of the venous malformation before and after Nd:YAG laser treatment were taken by the treating physician as part of routine treatment documentation.

The photographic documentation was arranged into a digital presentation by the study team. Two blinded board-certified otolaryngologists, unfamiliar with the patients, formally evaluated the presentation of each patient and subsite. Treatment response was graded using a common visual analog scale used in previous studies of vascular anomalies.5 The venous malformations were numerically rated by 0 = growth of the venous malformation, 1 = stable (no growth or improvement), 2 = some improvement, 3 = significant improvement, 4 = resolution.

Surgical Technique
An underwater technique is used on subsites located within the oral cavity (palatal, buccal mucosa, and lingual subsites).

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The underwater technique consists of filling the oral cavity with ice water to minimize thermal trauma, decrease hemorrhage, and improve efficacy of the laser. A 0° telescope is used to allow for visualization of the venous malformation underwater and to improve accuracy of the laser.

All patients are orally intubated and undergo general anesthesia. Moistened pads are used to protect the eyes, and moistened towels are used to protect the surrounding skin. A mouth gag is used to expose the intraoral lesions. Afterward, the oral cavity is filled with ice water. The Nd:YAG laser is set between 15 and 20 W with a pulse duration between 0.5 and 1 second. The laser fiber is secured to a 0° telescope with an adhesive tape. This allows the operator to have an improved underwater view of the effects of the laser on the venous malformation. Immediate contraction of the malformation can be visualized with assistance of the scope. The treatments are spaced 2 to 4 mm apart (Figure 1). After the treatment, the patient is taken to the recovery room and monitored for any respiratory difficulties.

Results

Four patients, ages 2 to 41 years, underwent 1 to 3 ND:YAG treatments to the oral cavity during September 2010 to September 2011 at Primary Children’s Medical Center or at the University of Utah Hospital in Salt Lake City, Utah. Photographs were taken of the subsites at an average of 2 months after treatment (Figures 2 and 3). Upon retrospective review of the medical charts, subjective improvement was documented in all patients. Only 1 patient described prolonged pain after the procedure. Another patient noted some swelling after the treatment. This same patient was subsequently admitted to the hospital with dehydration. No other complications were identified.

After evaluation by the blinded physicians, 2 sites were rated as having “significant improvement” by both examiners. One site was rated as having complete “resolution” by 1 examiner and “significant improvement” by the other. The other 2 sites were split, with 1 examiner noting “some improvement” and the other grading the site as having “significant improvement.” No site was rated as having “growth” or remaining “stable.” The average rating, based on the visual analog scale, was 2.9 ± 0.6 (Table 1).

Discussion

Bleeding, pain, oral functional impairment, and cosmetic deformity can occur when venous malformations involve the oral mucosa. Effectively treating these lesions without causing significant morbidity can be difficult. Our study indicates that using an underwater technique with the Nd:YAG laser can be a viable option in treating these malformations.

All of the patients evaluated in this study were found to have improvement, with most obtaining significant improvement. The underwater technique described may be helpful and appears to be safe. Few side effects and complications were described after treatment. According to the documented medical record, the treatment is generally well tolerated, and patients appear to be satisfied with the results.

This study is a small introductory investigation of the use of the Nd:YAG laser in the treatment of oral cavity venous malformations using an underwater technique. Prospective studies with larger numbers of patients will aid in defining the full extent of the effectiveness of this treatment.

Figure 1. Intraoperative 0° endoscopic photographs immediately before and during treatment of a lingual venous malformation.

Figure 2. An example of before and after photographic documentation. Photographic documentation of venous malformation No. 3 used by the 2 blinded examiners.

Figure 3. An example of before and after photographic documentation. Photographic documentation of venous malformation No. 4 used by the 2 blinded examiners.

Table 1
Conclusion

This study demonstrates that using an underwater technique with the Nd:YAG laser is a feasible option in the treatment of venous malformations of the oral cavity. The technique described was found to be well tolerated, and there were few side effects noted in this sample of patients.

Author Contributions

David J. Crockett, design of the project, analysis and interpretation of the data, drafting the manuscript, and final approval of the manuscript; Jeremy D. Meier, acquisition of the data, editing and revising the manuscript, and final approval of the manuscript; Kevin F. Wilson, acquisition of the data, editing and revising the manuscript, and final approval of the manuscript; J. Fredrik Grimmer, conception and design of the project, acquisition of data, revising and editing manuscript, and final approval of the manuscript.

Disclosures

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References


Table 1. Average rating based on the visual analog scale for each venous malformation (VM) evaluated by the 2 blinded examiners.

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<tr>
<th>VM Sites Evaluated</th>
<th>Average Score by Blinded Examiners</th>
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