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Case Report

Efficacy of Diode Laser on Gingival Hyperplasia Lesions in the Aesthetic Area in Chinese Children with Orthodontics

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ABSTRACT

Background: Gingival hyperplasia in the aesthetic area of children during orthodontic treatment is a clinical challenge, which can affect aesthetics, chewing, and orthodontic correction. However, traditional surgical removal is often associated with bleeding and pain, making it difficult for children to accept. Therefore, exploring a safe and effective method is of great significance.

Methods: Two Chinese pediatric patients (aged 12 and 15) developed gingival hyperplasia in the aesthetic area before or during orthodontic treatment and were treated with diode laser, achieving satisfactory results.

Results: There was minimal bleeding during the procedure, the patients cooperated well, and the postoperative wound healing was good. Follow-up over 24 to 48 months showed stable results, with no recurrence and high patient satisfaction.

Conclusion: Diode laser is a simple and minimally invasive method that can replace traditional surgical methods for the treatment of gingival hyperplasia in the aesthetic area of anterior teeth in children during orthodontic treatment.

Keywords: Pediatric; Gingival hyperplasia; Orthodontics; Aesthetic area; Diode laser

1. Introduction

Gingival hyperplasia is a clinical challenge in children during orthodontic treatment, and effective treatment methods are still lacking. Misaligned teeth or the wearing of brackets and wires can affect children's oral hygiene, leading to inflammatory gingival hyperplasia, which in turn affects the completion of orthodontic treatment. The traditional method of treatment is to surgically remove the hyperplastic gum tissue under local anesthesia[1], but pediatric patients often have a fear of the bleeding and anesthesia involved in the surgery. Therefore, the

search for a non-invasive and safe treatment method has been ongoing. With the continuous development of laser technology, the application of lasers in the treatment of soft tissue lesions has been reported[2-5]. Some scholars have successfully treated hereditary gingival fibromatosis in a 6-year-old child using diode laser therapy[6]. A significant advantage of laser treatment is that it does not require suturing of wounds, which can reduce the number of patient visits and improve the cooperation between patients and doctors[7-8].

However, there are few reports on the use of diode laser treatment for gingival hyperplasia in the aesthetic area of children's orthodontics during treatment. Therefore, this study used diode laser therapy to treat two cases of gingival hyperplasia in children related to orthodontic treatment. The clinical research results are encouraging and are reported here.

2. Case Report

2.1. Case-1

A 15-year-old Chinese boy came to our orthodontic department for treatment due to misaligned teeth. After 3 months of orthodontic treatment, hyperplasia of the gingival papilla of the maxillary central incisor was observed, affecting the closure of the dental space. Therefore, the patient was referred to the periodontal department for gingivoplasty. Clinical examination revealed that the patient was wearing a fixed appliance. The hyperplasia of the gingival papilla of the maxillary central incisor was spherical, approximately 8 mm in diameter, covering the middle of the crown, with a space of about 2 mm between the maxillary central incisors. X-ray showed no significant absorption of alveolar bone **(Figure 1A)**. The patient had no history of systemic diseases or drug allergies. Due to the patient's fear of surgery, a painless treatment method was requested. Thus, we planned to use a diode laser for surgical excision, performed periodontal basic treatment on the patient one week before surgery. And written informed consent was obtained from the parents before laser surgery.

During the laser surgery, local anesthesia with 2% articaine was first administered, followed by the excision of the hyperplastic gingival tissue and gingivoplasty using a diode laser (Doctor Smile®, Italy) with an output power of 2.0 W and a wavelength of 810 nm in continuous mode **(Figure 1B)**. After the laser treatment, a thin layer of scab formed on the wound **(Figure 1C)**. Postoperative care included brushing with a soft-bristled toothbrush and rinsing with Xipayi Mouthwash (Xinjiang Xinqikang Pharmaceutical Co., Ltd., China) twice daily for at least 2 weeks.

On the 8th day after laser surgery, the wound area was slightly reddish **(Figure 1D)**. At 12 months postoperatively, the gingiva appeared essentially normal, and the space between the maxillary central incisors was completely closed **(Figure 1E)**. At 24 months postoperatively, the shape and color of the gums were improved, and the teeth were neatly arranged **(Figure 1F)**. The patient was very satisfied and had the fixed appliance removed.

The excised gingival mass, after HE staining, revealed a large number of lymphocytes and plasma cells infiltrating the lamina propria, an increase in fibroblasts, and obvious dilation, congestion, and proliferation of small blood vessels **(Figure 2A, Figure 2B)**. Immunohistochemical (IHC) staining revealed positive expression of CD31 in the vascular endothelial cells of the lamina propria **(Figure 2C, Figure 2D)**, while CD34 showed strong positive expression **(Figure 2E, Figure 2F)**. Based on the clinical and microscopic appearance, a histological diagnosis of granulomatous epulis was established.

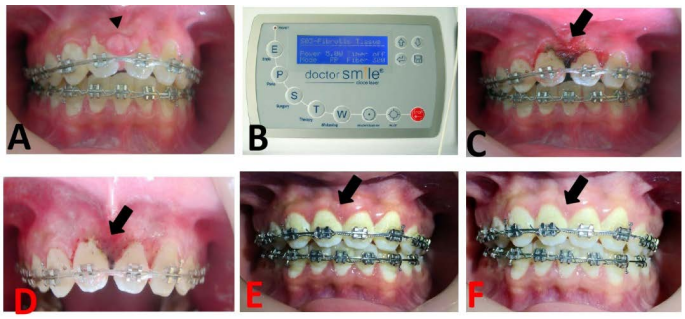

Figure 1: Clinical observation of diode laser on granulomatous epulis. (A) Initial aspect of granulomatous epulis. (B) Diode laser therapeutic apparatus. (C) Wound area after laser treatment. (D) Wound healed at 8 days after laser treatment. (E) 12 months after laser surgery. (F) 24 months after laser surgery.

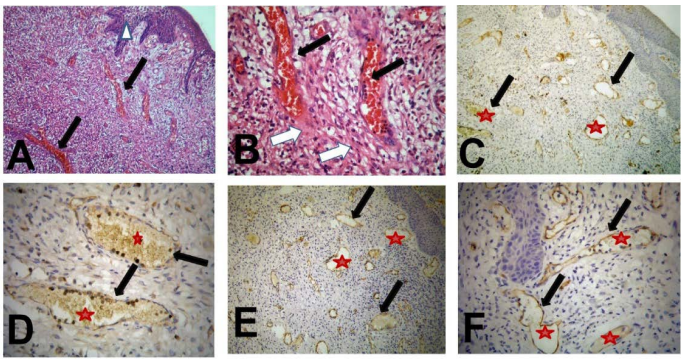

Figure 2: Histological observation of diode laser on granulomatous epulis. (A) HE staining of granulomatous epulis (x200). (B) Magnification observation of Fig A (x400). (C) Positive expression of CD31 in cells by IHC staining (x200). (D) Magnification observation of Fig C (x400). (E) Strong positive of CD34 in cells by IHC staining(x200). (F) Magnification observation of Fig E (x400). blood vessel, strong positive, collagen fiber (7), epithelial spikes(A). IHC, Immunohistochemistry.

2.2. Case-2

A 12-year-old male child patient came to our orthodontic department for treatment due to misalignment of teeth. The doctor found obvious gingival hyperplasia of the patient after preliminary examination, so he referred the patient to the department of periodontics for gingivoplasty. The oral examination found that the significant gingival hyperplasia of lower anterior teeth and covering the middle of the crown, misalignment of teeth and crowding, counter bite of Teeth 11 and Teeth 21 affects appearance and chewing function **(Figure 3A)**. The X-ray shows that the alveolar bone is not absorbed obviously **(Figure 3B)**. The patient has no history of systemic disease or drug allergy. After oral health education and basic periodontal treatment for patients, gingival redness and swelling were significantly improved **(Figure 3C)**. And written informed consent was obtained before laser surgery.

Under the local anesthesia of 2% articaine, the gingivoplasty was performed with the diode laser therapeutic apparatus in reference case 1, with continuous mode wave during the laser surgery, and the output power was set at 2.0 W and the wavelength at 810 nm. There was no obvious bleeding in the wound area during the operation **(Figure 3D)**. Postoperative

measures are the same as case 1, and there was no obvious discomfort after laser therapy.

At 2 weeks after laser surgery, the wound area is healed without obvious swelling **(Figure 3E)**. Orthodontic treatment was initiated due to misalignment of teeth. After 24 months of orthodontic treatment, the teeth arranged neatly, but the gingival papilla was slightly swollen **(Figure 3F)**. Gingival papilla swelling improved at one week after scaling **(Figure 3G)**. Due to the neat arrangement of teeth, the fixed appliance was removed. Follow up for 48 months showed good tooth alignment, slight swelling of the gingival papilla, no recurrence of hyperplastic gingivitis, and no significant absorption of alveolar bone **(Figure 3H, Figure 3I)**. Gingival papillitis disappeared after periodontal scaling, and the patient was satisfied with the results.

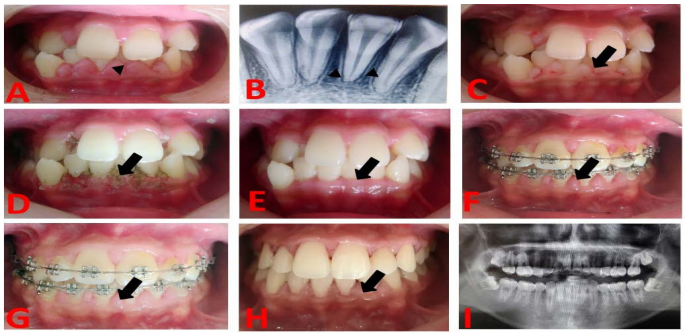

Figure 3: Clinical observation of diode laser on hyperplastic gingivitis. (A) Initial aspect of gingival hyperplasia. (B) X-ray photograph of lesion area Pre-operation. (C) 1 week after scaling. (D) Wound area after laser treatment. (E) 2 weeks after laser surgery. (F) 24 months after laser surgery. (G) 1 week after scaling. (H) 48 months after laser surgery. (1) X-ray photograph at 48 months.

The excised gingival tissue, after HE staining, showed elongation of the epithelial rete ridges, increased blood vessels nearby, thickening of collagen fibers, infiltration of lymphocytes and plasma cells in the lamina propria, and congestion and edema of collagen fibers in the capillaries **(Figure 4A, Figure 4B)**. Immunohistochemical (IHC) staining revealed positive expression of CD31 in vascular endothelial cells **(Figure 4C, Figure 4D)**, and strong positive expression of CD34 **(Figure 4E, Figure 4F)**. Based on the clinical and microscopic findings, a diagnosis of hyperplastic gingivitis was confirmed.

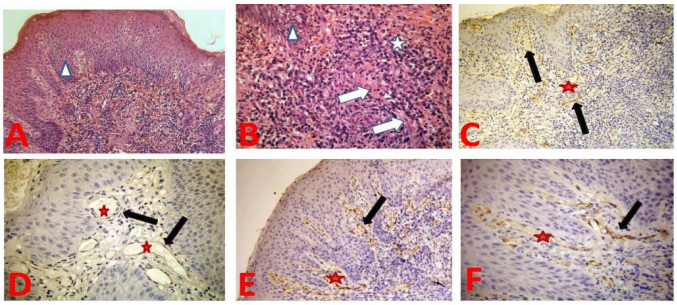

Figure 4: Histological observation of diode laser on hyperplastic gingivitis. (A) HE staining of on hyperplastic gingivitis (x200). (B) Magnification observation of Fig A (x400). (C) Positive expression of CD31 in cells by IHC staining (x200). (D) Magnification observation of Fig C (x400). (E) Strong positive of CD34 in cells by IHC staining(x200). (F) Magnification observation of Fig E (x400). blood vessel, strong positive, collagen fiber, plasma cell, epithelial spikes. IHC, Immunohistochemistry.

3. Discussion

The choice of treatment methods for gingival hyperplasia in children during orthodontic treatment has always been a difficult problem for doctors, and it often affect orthodontic treatment. Due to the high incidence of gingival hyperplasia-related diseases in children, concerns about pain and bleeding, and fear of general anesthesia, they are unwilling to accept conventional surgical treatment. Therefore, the exploration of simple, painless, and safe methods has always been a concern. In 2011, Martens LC reported that lasers have certain application value in children's dental diseases[9]. Based on this, our research group has been exploring the role of diode laser in the treatment of gingival hyperplasia since 2018 and has found that it has significant efficacy in the treatment of gingival hyperplasia in Chinese children before and after orthodontic treatment, which is now reported.

We know that diode laser is a non-invasive treatment method, characterized by rapid hemostasis, which is easily accepted by children; it can also reduce pain during surgery, shorten surgery time, and decrease the use of postoperative antibiotics[10-11]. Case 1 in this paper is a child patient who developed a granulomatous epulis during orthodontic treatment, and the proliferative gum affected the closure of the dental space, leading to a referral to our hospital's periodontology department. Case 2 is a child patient with gingival hyperplasia before orthodontic treatment. Both patients were treated with diode laser resection, and the outcome was good after a follow-up of 24-48 months. Due to the hemostatic properties of the laser, it has been attempted to treat patients on anticoagulants. Campos FHO and others found in animal experiments that when using a diode laser (810nm/1.5W) to remove the lingual frenulum of rats on anticoagulants, there was no significant bleeding during surgery, and hemostasis after surgery was rapid[12].

Although Fornani C reported that diode lasers can remove soft tissue without anesthesia[13], the child patients in this study required treatment in a completely painless condition. Therefore, both patients underwent laser resection under local anesthesia with a small amount of articaine, and there was no obvious pain during and after the surgery, and the surgery time was reduced compared with conventional treatment.

Cxayan T and others reported that when using laser treatment to remove inflammatory fibrous hyperplasia, the total number of bacteria on the first day after surgery was significantly less than that of the traditional surgery group[14], confirming the antibacterial properties of lasers[15]. The antibacterial effect of lasers makes them promising for use in surgical procedures for diabetic patients. Al-Mohaya MA used a 940nm diode laser to remove a purulent granuloma of the gum in a 51-year-old diabetic patient, and it was found that there was little bleeding during the surgery, the wound healed well, and there was no wound infection[16]. In this paper, the two pediatric patients did not use antibiotics after laser surgery, and there was no postoperative infection. To reduce the recurrence after surgery, the surgical resection range was appropriately expanded in case 1, a patient with granulomatous epulis, to ensure the stability of the therapeutic effect.

Despite the advantages of lasers such as hemostasis and antibacterial effects, Camposa L[17] and Chen TL[18] have shown that the removal of hyperplastic gingival lesions using lasers with a wavelength of 808-810 nm and a power of 1.5-2.0 W is

safe. However, due to the potential for lasers to cause local tissue overheating and necrosis, the issue of thermal damage must be considered during surgery, and protective measures should be taken. In vitro experiments found that when using a 445 nm diode laser for biopsy, the thermal damage to the epithelial tissue around the incision was 650.93 micrometers, and the connective tissue was 468.07 micrometers[19]. It was also found that the thermal damage of the 810 nm laser group was less than that of the 1470 nm laser group, and the thermal damage of the 0.5 W laser group was less than that of the 2.0 W laser group[20]. In this paper, two pediatric patients with granulomatous epulis and hyperplastic gingivitis underwent diode laser excision surgery at 810 nm/2.0 W, with no significant thermal damage observed.

4. Conclusions

During orthodontic treatment in children, gingival hyperplasia is a clinical challenge that often hinders the orthodontic treatment. The choice of treatment methods for gingival hyperplasia has a significant impact on the therapeutic effects. The limited data in this paper confirm that diode laser has antibacterial, bleeding reduction, and pain relief characteristics, making it a non-invasive, safe, and effective method for the treatment of hyperplastic gingival lesions in the anterior aesthetic area of children, with broad application prospects. Further large-sample and long-term clinical observation is needed to verify its long-term value.

5. Acknowledgments

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6. Conflict of Interest

None.

7. Ethical Approval

All procedure involving participants were in compliance with the ethical standards of the institutional and national research committees, as well as the ethical standards of the 1964 Helsinki Declaration and its later amendments.

8. Author Contributions

TC contributed to conception, treatment, original draft preparation, and manuscript review; WC contributed to the treatment; YW and ZG contributed to manuscript editing; CJ contributed to the interpretation of data; AY and XY contributed to the treatment; ZQ-contributed to manuscript review.

9. References

1. Ishida CE, Ramos-Silva M. Cryosurgery in oral lesions. Int J Dermatol, 1998;37: 283.
2. Boj JR, Poirier C, Hernandez M. Review: Laser soft tissue treatments for paediatric dental patients. Eur Arch Paediatr Dent, 2011;12: 100-105.
3. Boj JR, Hernández M, Espasa E. Erbium laser treatment of an impacted first mandibular premolar: case report. J Clin Pediatr Dent, 2008;33: 9-12.
4. Chen TL, Wang XM, Zhang XH, et al. Therapeutic effects of diode laser on vascular epulis in esthetic area. J Indian Soc Periodontol, 2021;25: 75-77.
5. Yassaei S, Aghili H, Tavakol Afshari J, et al. Effects of diode laser (980 nm) on orthodontic tooth movement and interleukin 6 levels in gingival crevicular fluid in female subjects. Lasers Med Sci, 2016;31: 1751-1759.
6. Aboujaoude S, Cassia A, Moukarzel C. Diode laser versus scalpel in the treatment of hereditary gingival fibromatosis in a 6-year-old boy. Clinics and Practice, 2016;6: 895.
7. Boj JR, Hernandez M, Espasa E. Laser treatment of an oral papilloma in the pediatric dental office: a case report. Quintessence Int, 2007;38: 307-312.
8. Jacobson B, Berger J, Kravitz R. Laser pediatric crowns performed without anesthesia: a contemporary technique. J Clin Pediatr Dent, 2003;28: 11-12.
9. Martens LC. Laser physics and a review of laser applications in dentistry for children. Eur Arch Paediatr Dent, 2011;12: 61-67.
10. Boj J, Galofre N, España A. Pain perception in pediatric patients undergoing laser treatment. J Oral Laser Appl, 2005;5: 85-89.
11. Khosraviani F, Ehsani S, Fathi M, et al. Therapeutic effect of laser on pediatric oral soft tissue problems: a systematic literature review. Lasers in Medical Science, 2019;34: 1735-1746.
12. Campos FHO, Ferreira LB, Romano MM, et al. Immediate laser-induced hemostasis in anticoagulated rats subjected to oral soft tissue surgery: a double-blind study. Braz Oral Res, 2018;32: e56.
13. Fornaini C, Rocca JP, Bertrand MF. Diode laser in the surgical management of soft tissues related to orthodontic treatment. Photomed Laser Surg, 2007;25: 381-392.
14. Cxayan T, Erbasxar GNH, Akca G, et al. Comparative evaluation of diode laser and scalpel surgery in the treatment of inflammatory fibrous hyperplasia: A split-mouth study. Photo biomodulation Photomedicine and Laser Surgery, 2019;37: 91-98.
15. Farista S, Kalakonda B, Koppolu P, et al. Comparing laser and scalpel for soft tissue crown lengthening: A clinical study. Global Journal of Health Science.2016; 8:73-80.
16. Al-Mohaya MA, Al-Malik AM. Excision of oral pyogenic granuloma in a diabetic patient with 940nm diode laser. Saudi Med J.2016;37:1395-1400.
17. Camposa L, Gallottinib M, Pallosc D, et al. High-power diode laser on management of drug-induced gingival overgrowth: Report of two cases and long-term follow-up. J Cosmetic Laser Therapy, 2018;20: 215-219.
18. Chen TL, Wang XM, Zhang XH, et al. Therapeutic effects of diode laser on vascular epulis in esthetic area. J Indian Soc Periodontol, 2021;25: 75-77.
19. Palaia G, Pergolini D, D'Alessandro L, et al. Histological effects of an innovative 445 nm blue laser during oral soft tissue biopsy. Int J Environ Res Public Health, 2020;17: 2651.
20. Gutiérrez-Corrales A, Rizcala-Orlando Y, Montero-Miralles P, et al. Comparison of diode laser - oral tissue interaction to different wavelengths. In vitro study of porcine periodontal pockets and oral mucosa. Med Oral Patol Oral Cir Bucal, 2020;25: 224-232.