Marcelo Emir Requia Abreu, DDS, MsD[1]

Vinícius Nery Viegas, DDS, MsD[1]

Rogério Miranda Pagnoncelli, DDS, MsD, PhD[2]

Eduardo Martinelli Santayama de Lima, DDS, MsD, PhD[3]

Alessandro Marchiori Farret, DDS, MsD[4]

Fernando Zugno Kulczynski, DDS, MsD[5]

Marcel Marchiori Farret, DDS, MsD, PhD[4]

INFRARED LASER THERAPY AFTER SURGICALLY ASSISTED RAPID PALATAL EXPANSION TO DIMINISH PAIN AND ACCELERATE BONE HEALING

The aim of this study was to illustrate how gallium arsenite aluminum diode laser (824 nm) irradiation can reduce postsurgical edema and discomfort and accelerate sutural osseous regeneration after surgically assisted rapid palatal expansion (SARPE). An adult patient with an 8-mm transverse maxillary discrepancy was treated with SARPE. Infrared laser therapy was started on the 7th postoperative day, with a total of eight sessions at intervals of 48 hours. The laser probe spot had a size of 0.2827 cm^2 and was positioned in contact with the following (bilateral) points: infraorbital foramen, nasal alar, nasopalatine foramen, median palatal suture at the height of the molars, and transverse palatine suture distal to the second molars. The laser was run in continuous mode with a power of 100 mW and a fluency of 1.5 J/cm^2 for 20 seconds at each point. Subsequently, an absence of edema and pain was observed. Further, fast bone regeneration in the median palatal suture could be demonstrated by occlusal radiographs. These findings suggest that laser therapy can accelerate bone regeneration of the median palatal suture in patients who have undergone SARPE. World J Orthod 2010;11:273–277.

Key words: *low-level laser therapy, maxillary constriction, rapid palatal expansion, SARPE, bone regeneration*

[1]PhD student, Department of Oral and Maxillofacial Surgery, Pontifícia Universidade Católica do Rio Grande do Sul–PUCRS, Porto Alegre, Rio Grande do Sul, Brazil.
[2]Professor, Department of Oral and Maxillofacial Surgery, Pontifícia Universidade Católica do Rio Grande do Sul–PUCRS, Porto Alegre, Rio Grande do Sul, Brazil.
[3]Professor, Department of Orthodontics, Pontifícia Universidade Católica do Rio Grande do Sul–PUCRS, Porto Alegre, Rio Grande do Sul, Brazil.
[4]PhD student, Department of Orthodontics, Pontifícia Universidade Católica do Rio Grande do Sul–PUCRS, Porto Alegre, Rio Grande do Sul, Brazil; Private Practice, Santa Maria, RS, Brazil.
[5]MsD student, Department in Oral and Maxillofacial Surgery, Pontifícia Universidade Católica do Rio Grande do Sul–PUCRS, Porto Alegre, Rio Grande do Sul, Brazil; Private Practice, Porto Alegre, RS, Brazil.

CORRESPONDENCE
Dr Marcel Marchiori Farret
1000/113 Floriano Peixoto St.
Santa Maria, RS
Brazil 97015–370
Email: marcelfarret@yahoo.com.br

When maxillary transverse deficiencies are diagnosed early in children and adolescents, they may be adequately treated by rapid maxillary expansion. However, after skeletal maturation, the exclusive use of an expander can be unsuccessful and result in dentoalveolar expansion that is prone to relapse and accompanied by pain and gingival recessions. Therefore, in adults, osteotomies of the areas that limit or impede the transversal disjunction of the maxilla are indicated. This surgical procedure may be performed under general or local anesthesia. With or without surgical intervention, there will be edema and pain.

Lasers were developed in the 1960s, and since then, they have been utilized for multiple purposes. In medicine, two types of lasers are mainly employed: high- and low-intensity lasers. The former deposit high densities of energy in irradiated tissues and have the ability to cut, coagulate, and evaporate tissues by extremely elevating their temperature. Low-intensity lasers biomodulate irradiated tissues, and depending on the intensity, type, potential, and dose, they may accelerate or decelerate physiologic or pathologic processes.

Studies have suggested that laser therapy, as an auxiliary to orthodontic therapy, can reduce pain and accelerate

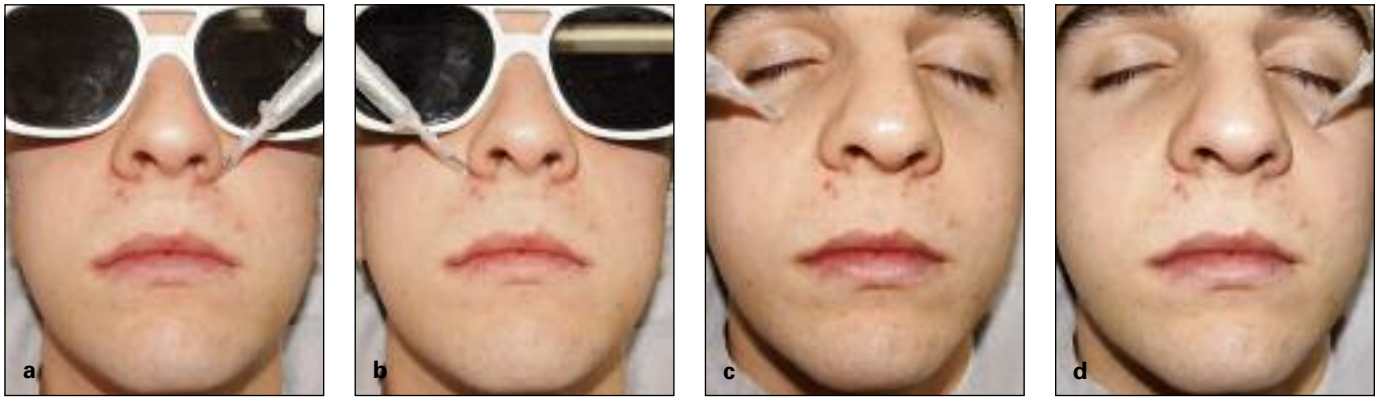

Fig 1 Facial points of laser application. **(a and b)** Bilateral nasal alar, **(c and d)** bilateral infraorbital foramen.

tooth movements and alveolar remodeling.[1–4] Maxillary osteotomies rarely heal completely, and the formation of new bone after surgically assisted rapid palatal expansion (SARPE) occurs slowly (4 to 6 months).[5–7] One reason for relapse after maxillary expansion is insufficient osseous regeneration of the median palatine suture.[7] Thus, acceleration of the bone remodeling of the median palatine suture after expansion would be helpful to prevent relapse and shorten the retention period.[8] According to the relevant literature, low-intensity lasers are beneficial during and after SARPE to reduce discomfort, pain, and tissue necrosis and accelerate bone deposition in the sutural region.[8–14]

This article presents an adult patient who underwent SARPE and infrared (824 nm) laser therapy with the intent to diminish postoperative edema and pain and accelerate bone healing of the osteotomy areas.

PATIENT REPORT

The patient was a 20-year-old man with good general health, no cavities, and no periodontal affections. His facial analysis revealed a normal sagittal skeletal relationship, straight profile, and normodivergent configuration. The clinical examination showed a Class II, division 1 occlusion, a marked overjet, no overbite, and mild crowding in both arches (arch length deficiency 4 mm in the maxilla and 3 mm in the mandible). The maxilla demonstrated a skeletal transverse deficiency of 8 mm with a bilateral crossbite. A dental compensation was contraindicated because of possible periodontal damages (gingival recession and root exposure).

Because the patient was an adult, conventional rapid maxillary expansion was not a good option. Therefore, SARPE was chosen. A Hyrax appliance was inserted with a 13-mm screw soldered to the bands of both first molars and first premolars. The surgery was performed under general anesthesia. The osteotomy included the lateral wall of the maxilla from the piriform opening to the pterygoid process, which freed the nasal septum. Complete separation was confirmed intrasurgically via the absence of any impediment to expansion. The extended osteotomy has the disadvantages of causing increased edema and discomfort.

Seven days postoperatively, the Hyrax appliance was activated and laser therapy initiated. The expansion per day amounted to 0.5 mm and continued for 16 days. In total, eight sessions of irradiation with infrared (824 nm) Thera-Laser

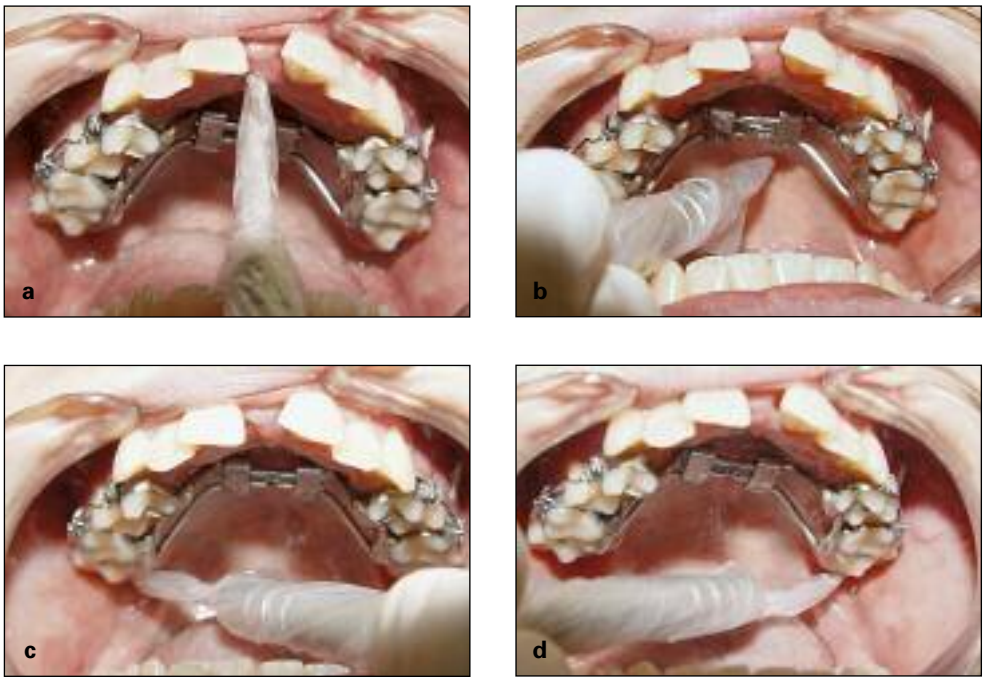

Fig 2 Intraoral points of laser application. **(a)** Nasopalatine foramen, **(b)** median palatine suture between the first molars, and **(c and d)** transverse palatine suture bilaterally distal to the second molars.

(DMC) were applied at 48-hour intervals. The tip of the device was 0.2827 cm^2 and brought into direct contact with the affected regions. The laser worked in direct mode with a fluency of 1.5 J/cm^2 and an automatic dosage calculation for 20 seconds per point. These points were the left and right infraorbital foramen, left and right nasal alar, nasopalatine foramen, median palatine suture at the height of the first molars, and transverse palatine suture distally to the second molars (Figs 1 and 2).

No edema developed, and after 23 days, excellent bone healing was observed. During activation of the Hyrax appliance, the patient did not experience any pain. Any discomfort was relieved after application of the laser.

The radiographic examinations revealed an advanced formation of new bone in the median palatine suture. At days 25 and 45, the existing radiopacity had diminished. At day 90, complete osseous healing of the suture was observed (Fig 3).

DISCUSSION

SARPE is the treatment of choice for correction of posterior crossbites after the median suture of the maxilla is ossified and transverse maxillary deficiency is greater than 5 mm.[6,10,15–23] Both conditions were present in the studied patient. Conventional rapid maxillary expansion in adults can cause discomfort, buccal cortical fenestration, and long-term instability. SARPE surpasses these problems and is performed even more frequently in adults with good long-term stability.[16,19,20]

The use of low-intensity lasers as favorable modulators of biological phenomena has been reported in the literature for quite some time.[19,20] In this patient, the laser was directed at the affected areas as described in the literature.[2–5] The patient felt less pain after each laser application. At the end of expansion, no gingival inflammation was observed, which corroborates the literature findings.[1,2,11,12,22,23] According to Malmström and Gurgel,[7] who analyzed

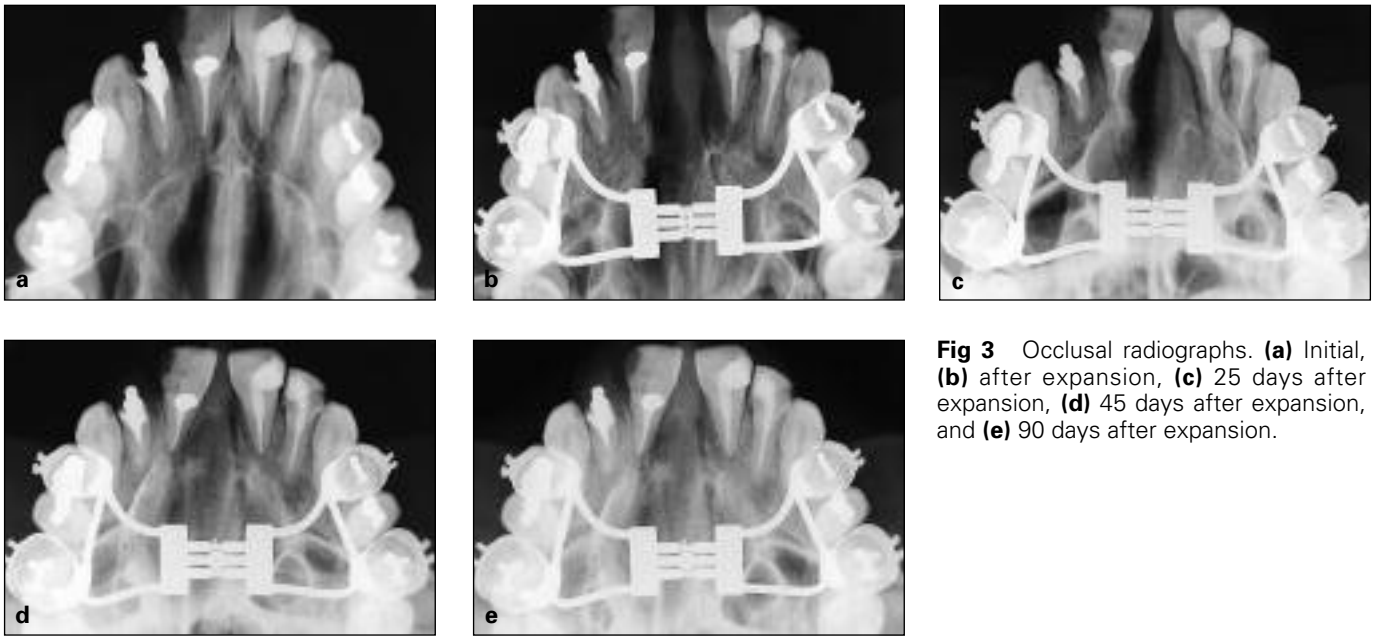

Fig 3 Occlusal radiographs. **(a)** Initial, **(b)** after expansion, **(c)** 25 days after expansion, **(d)** 45 days after expansion, and **(e)** 90 days after expansion.

occlusal radiographs after SARPE, the amount of bone regeneration without laser after 120 days is insufficient. Only 45 days after SARPE, this patient showed advanced osseous regeneration of the median palatine suture.[8,9–12] Due to this superior bone formation, an increased stability can be expected.[5,18,24]

CONCLUSION

Laser application can be effective in promoting acceleration of bone formation and reducing pain, tissue irritation, and hemorrhage during surgically assisted rapid maxillary expansion.

REFERENCES

1. Honmura A, Ishii A, Yanase M, Obata J, Haruki E. Analgesic effect of Ga-Al-As diode laser irradiation on hyperalgesia in carrageenin-induced inflammation. Lasers Surg Med 1993;13:463–469.
2. Lim HM, Lew KK, Tay DK. A clinical investigation of the efficacy of low level laser therapy in reducing orthodontic postadjustment pain. Am J Orthod Dentofacial Orthop 1995;108:614–622.
3. Harazaki M, Takahashy H, Ito A, Isshiki Y. Soft laser irradiation induced pain reduction in orthodontic treatment. Bull Tokyo Dent Coll 1998;39:95–101.
4. Kawasaky K, Shimizu N. Effects of low-energy laser irradiation on bone remodeling during experimental tooth movement in rats. Lasers Surg Med 2000;26:282–291.
5. Souza JEP, Pinheiro FHSL, Andrade Júnior P, Janson GRP, Freitas MR, Henriques JFC. Surgically assisted rapid palatal expansion: A case report. Rev Dent Press Ortod Ortop Facial 2002;7:81–86.

6. Silverstein K, Quinn P. Surgically-assisted rapid palatal expansion for management of transverse maxillary deficiency. J Oral Maxillofac Surg 1997;55:725–727
7. Malmström MFV, Gurgel JA. Evaluation of new bone formation at the midpalatal suture by digitized radiography after surgically assisted maxillary expansion. Rev Dent Press Ortod Ortop Facial 2007;12:82–93.
8. Saito S, Shimizu N. Stimulatory effects of low–power laser irradiation on bone regeneration in midpalatal suture during expansion in the rat. Am J Orthod Dentofacial Orthop 1997; 111:525–532.
9. Brugnera AJ, Santos AECG, Bologna ED, Ladolardo TCGPC. Atlas de laserterapia aplicada à clínica odontológica. São Paulo: Santos, 2003.
10. Abreu MER, Viegas VNRM, Pagnoncelli RM. Biomodulation with low-laser (830 nm) in surgically assisted maxillary expansion. The 9th International Congress on Laser Dentistry: 2004, 21–24.
11. Pagnoncelli RM, Abreu MER, Viegas VN. Biomodulation with low-laser (830 nm) in surgically assisted maxillary expansion. Brazilian Dent J. 2004;15:122.
12. Abreu MER, Viegas VN, Pinto PR, Lima, EMS, Pagnoncelli RM. Lasers na Ortodontia. Ortodontia Gaúcha. 2005;9:135–141.
13. Suri L, Taneja P. Surgically assisted rapid palatal expansion: A literature review. Am J Orthod Dentofacial Orthop 2008;133:290–302.
14. Lanigan DT, Mintz SM. Complications of surgically assisted rapid palatal expansion: Review of the literature and report of a case. J Oral Maxillof Surg 2002;60:104–110.
15. Betts NJ, Vanarsdall RL, Barber HD, Higgins-Barber K, Fonseca RJ. Diagnosis and treatment of transverse maxillary deficiency. Int J Adult Orthodon Orthognath Surg 1995;10:75–96.
16. Progel MA, Kaban L. Surgical assisted rapid maxillary expansion in adults. Int J Adult Orthodon Orthognath Surg 1992;7:37–41.
17. Morgan TA, Fridrich KL. Effects of the multiple-piece maxillary osteotomy on the periodontium. Int J Adult Orthodon Orthognath Surg 2001;16: 255–265.
18. Tavares CAE, Scheffer MS. Surgically assisted rapid maxillary expansion (SARPE) prior to combinated Le Fort I and sagittal osteotomy: A case report. Int J Adult Orthodon Orthognath Surg 2001;16:200–206.
19. Gilon Y, Heymans O, Limme M, Brandt L, Raskin S. Indications and implications of surgical maxillary expansion in orthodontic surgery. Rev Stomatol Chir Maxillofac. 2000;101:252–258.
20. Clayman L, Kuo P. Lasers in Maxillofacial Surgery and Dentistry. New York: Thieme, 1997.
21. Brugnera AJ, Pinheiro A. Lasers na Odontologia Moderna. São Paulo: Pancast, 1998.
22. Mezawa S, Iwata K, Naito K, Kamogawa H. The possible analgesic effect of soft-laser irradiation on heat nociceptores in the cat tongue. Arch Oral Biol 1988;33:693–694.
23. Gurgel JA, Sant'ana E, Henriques JFC. Orthodontic-surgical treatment of transverse maxillary deficiency. Rev Dent Press Ortod Ortop Facial 2001;6:59–66.
24. Koustaal MJ, Poort LJ, Van der Wal KG, Wolvius EB, Prahl-Andersen B, Schulten AJ. Surgically Assisted Rapid Maxillary Expansion (SARME): a review of the literature. J Oral Maxillofacial Surg 2005;34:709–714.