

# Postoperative Clinical Evolution of Edentulous Patients Treated by Guided Bone Regeneration Using Xenograft Bone Substitute and Collagen Membrane

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*This paper aims to assess the postoperative evolution of edentulous patients treated by guided bone regeneration technique using a xenograft bone substitute (Cerabone) and collagen membrane. A group of 40 patients, programmed for guided bone regeneration, randomly divided between laser-assisted technique and scalpel technique, were investigated to compare the postoperative evolution, healing time and prevalence of new bone formation, graft stability and inflammatory reactions. The guided bone regeneration technique associated with laser or scalpel technique offers reliable and predictable treatment results in the implant-prosthetic treatments. The accelerated healing time recommends the laser technique in the surgical procedures used for the alveolar augmentation.*

*Keywords: alveolar augmentation, guided bone regeneration, bone xenograft, collagen membrane*

The treatment of partially extensive edentulous requests the use of various artificial substitutes in order to restore both the continuity of dental alveolar arches and the functions of the stomatognathic system [1,2]. The implant dentistry and bone regenerative techniques have a major role in order to achieve these aims. The number of new biomaterials and biotechnologies with direct clinical applications in implant dentistry (sinus lift, horizontal and vertical augmentation, intraosseous defects, peri-implant defects) has increased in the last decade [3]. The implant mechanical stability is positively associated with successful implant integration and ensures the long-term successful clinical outcome [4]. However the reduced bone quantity and quality have been indicated as the major risk factors for implant failure as it may be associated with excessive bone resorption and impairment in the healing process compared with normal density bone [5]. In the light of these considerations, the new regenerative techniques using new bone substitute materials play a significant role in the oral rehabilitation of edentulous patients treated by dental-implant supported bridges. The xenograft materials are extensively used for various fields of oral surgery. The xenograft materials include natural hydroxyapatite and inorganic bone matrix materials (Cerabone, Bio-Oss) that serve as a scaffold for new bone formation, becoming integrated into the human bone and being slowly replaced by newly formed bone [6]. The manufacturers of bone graft and soft tissue biomaterials highlight the patient safety, ease of use, reliable and predictable treatment results. However the choice of the type of bone grafting material (autografts, allografts, xenografts, alloplastic) should be based on the patients' systemic healing capacity, the osteogenic potential of the recipient site, and the time available for graft maturation [7]. When a barrier membrane is placed in direct contact with the surrounding bone surface and bone defect, only cells from the neighbouring bone or bone marrow can migrate into this bone defect, without in-growth of competing soft tissue cells from the overlying mucosa (Bunyaratavej P 2001). The collagen bioresorbable membrane is an ideal choice due to

hemostasis, chemotaxis for periodontal ligament fibroblasts and gingival fibroblasts, low- risk immunogenicity, easy manipulation and adaption and direct effect on bone formation [7-9]. The laser-assisted surgical technique is also recommended in various fields of oral surgery, including alveolar augmentation [10].

This paper aims to assess the postoperative evolution of edentulous patients treated by guided bone regeneration technique using a xenograft bone substitute (Cerabone) and collagen membrane (Jason).

## Experimental part

Within a wide lot of patients, a group of 40 patients (24 women, 16 men; mean age 52.6 years) were selected. The patients were examined and treated between 2014 and 2016. All patients were diagnosed with various partially edentations and were affected by different complications (masticatory disfunction, improper esthetics, TMJ complications) in the absence of effective and complete therapy. The inclusion criteria were the absence of more than 3 teeth, the presence of the alveolar bone resorption with the indication of augmentation procedures to allow rehabilitation with dental implants, and the absence of systemic disease, local infection, or inflammation. The patients were randomly divided into two groups, based on whether they received guided bone regeneration (GBR) using laser-assisted technique (study group) or scalpel group (control). The laser-assisted technique was performed by using Er:YAG laser K.A.Y. (KaVO) (100mJ, 25Hz). For each group, the alveolar ridge reconstruction was performed by guided bone regeneration in the pre-implant phase, using the bone substitute material Cerabone (Botiss, Germany) and collagen membrane Jason (Botiss, Germany). The bone regeneration technique protocol included: (1) anaesthesia using 2% mepivacaine with epinephrine 1:100,000, (2) preparation of bone substitute material (Cerabone mixing with blood), (3) laser or scalpel incision, (4) full-thickness flap reflection, (5) laser or curette removal of pathologic tissues, (6) preparation of implant site (cortical perforations, using laser or 702 fissure bur, to increase the surface area and facilitate vascular

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ingrowth), (7) reconstruction of bone volume (bone substitute Cerabone + collagen membrane Jason), (8) suture. All patients received antibiotic therapy and anti-inflammatory therapy. The routine clinical and radiological 3 months follow-up were performed for all patients to assess the postoperative evolution. It were recorded VAS indices (Visual Analog Scale) related to postoperative pain intensity and patients' discomfort prevalence in the first 24 h following surgical procedures (T0), at day 1 (T1), day 3 (T2), and day 7 (T3); the mean healing time (days) for each group was recorded. The success of bone grafting procedure was assessed by a 3 months clinical and radiographic follow-up recording the prevalence of the new bone formation, graft stability and inflammatory reactions. Statistical tests Wilcoxon and Mann-Whitney were performed to compare the laser-assisted group versus scalpel group.

### Results and discussions

The figures 1a-f present the clinical aspects of a patient treated by laser-assisted technique for the dehiscence of a previous bone graft.



Fig.1.a. Initial clinical aspect

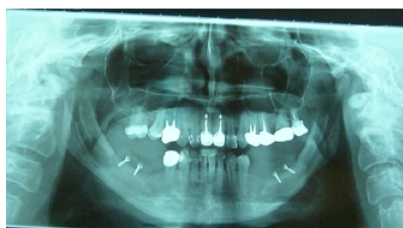


Fig.1.b. Initial radiographic aspect



Fig.1.c. Laser preparation



Fig.1.d. Cerabone preparation



Fig.1.e. Alveolar augmentation with Cerabone

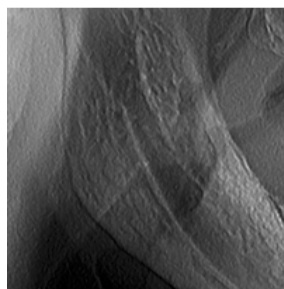


Fig.1.f. Radiographic follow up

VAS indices (postoperative pain intensity) decreased in the laser-assisted group from 9.6 at T0, to 9.0 at T1, 7.0 at T2 and 2.2 at T3. For the scalpel group, VAS indices decreased from 9.0 at T0, to 8.6 at T1, 6.6 at T2 and 2.0 at T3 (fig. 2.a). The prevalence rates of patients' postoperative

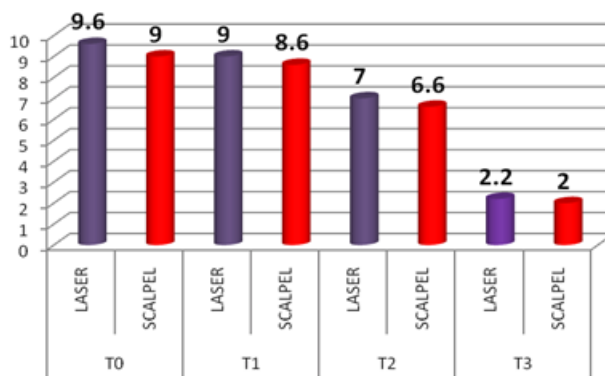


Fig. 2.a. VAS indices (pain intensity)

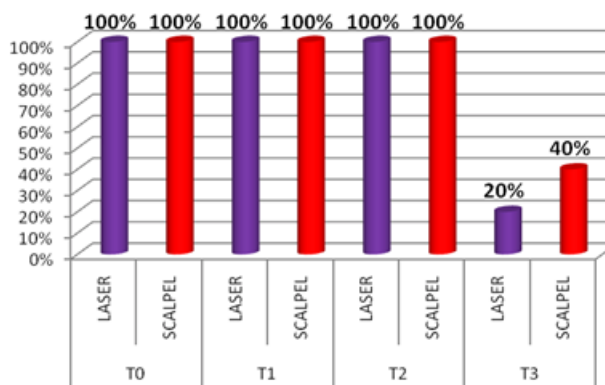


Fig. 2.b. Patients' discomfort rate

discomfort in the laser-assisted group were 100% at T0, 100% at T1, 100% at T2 and 20% at T3. In the scalpel group the prevalence rates of patients' postoperative discomfort in the laser-assisted group were 100% at T0, 100% at T1, 100% at T2 and 40% at T3 (fig. 2.b). The mean healing time varied between 15.5 days for the laser-assisted group and 19.6 days for the scalpel group (fig. 2.c). The clinical and radiographic 3 months follow-up showed the new bone formation and graft stability for 95% of the patients in both groups (fig. 2.d).

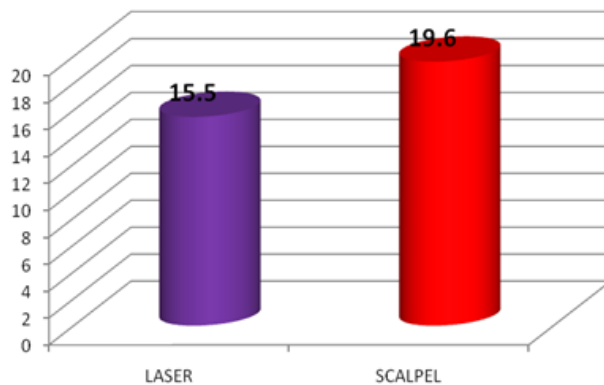


Fig. 2.c. Healing time (days)

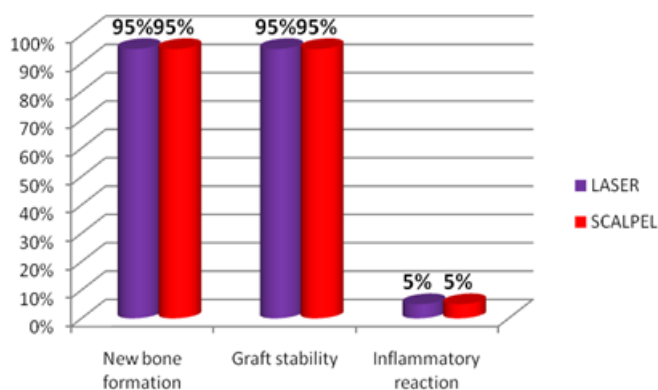


Fig.2.d. The results of 3 months clinical and radiographic follow-up

Test Statistics <sup>b</sup>				
	VAST0	VAST1	VAST2	VAST3
Mann-Whitney U	92.000	128.000	148.000	168.000
Wilcoxon W	302.000	338.000	358.000	368.000
Z	-3.393	-2.239	-1.504	-.989
Asymp. Sig. (2-tailed)	.001	.025	.132	.322
Exact Sig. [2*(1-tailed Sig.)]	.003 <sup>a</sup>	.052 <sup>a</sup>	.165 <sup>a</sup>	.398 <sup>a</sup>

a. Not corrected for ties.

b. Grouping Variable: therapy

**Table 1**  
STATISTICAL TESTS RESULTS. VAS INDICES  
(LASER-ASSISTED GROUP vs SCALPEL  
GROUP)

**Table 2**  
STATISTICAL TESTS RESULTS. HEALING TIME  
(LASER-ASSISTED GROUP vs SCALPEL GROUP)

Test Statistics <sup>a</sup>	
	HEALING TIME
Mann-Whitney U	.000
Wilcoxon W	210.000
Z	-5.507
Asymp. Sig. (2-tailed)	.000
Exact Sig. [2*(1-tailed Sig.)]	.000 <sup>b</sup>

a. Grouping Variable: LOT

b. Not corrected for ties.

The statistical tests for comparison between the laser-assisted group and scalpel group regarding the postoperative evolution of VAS indices, revealed significant statistical differences for T0, T1 (day 1) ( $p < 0.05$ ). No significant statistical differences between groups were found at T2 (day 3) and T3 (day 7) (table 1).

The statistical tests for healing time revealed significant statistical differences between laser-assisted technique and scalpel technique ( $p < 0.05$ ) (table 2).

Our study proved good results related to the placement of a collagen membrane and Cerabone as a bone substitute. The new bone formation and bone graft stability were encountered for all patients both in laser technique and scalpel technique. Also, the infection and inflammatory reactions were absent after 3 months follow-up. The guided bone regeneration technique was associated with the positive postoperative evolution of clinical parameters. The use of the laser technique was associated with less intraoperative bleeding, less postoperative pain, patients' discomfort and shorter healing time in comparison with control group. The results of our study proved the benefits of the association between laser technique and oral bone regenerative procedures due to minimal inflammatory response in soft tissues, reduced postoperative oedema, and low rate of infections in the surgical site [11]. The literature data showed that despite the fact that implants placed into grafted extraction sockets exhibited a clinical performance similar to implants placed into non-grafted sites in terms of implant survival and marginal bone loss, the grafted sites allowed placement of larger implants and required fewer augmentation procedures at implant placement when compared to naturally healed sites [12]. The importance of bone regenerative techniques in the

pre-implant stage is highlighted by literature data revealing high failure rates of dental implants due to the poor bone quality [13]. Literature data proved the efficiency of xenograft bone substitute (hydroxyapatite) associated with collagen membrane to increase the bone quality and implant success [14]. Caution is requested especially when the severe bone atrophy is localized in posterior maxillary area, due to the risk of sinus membrane exposure and infection [15]. New researches are requested regarding bone substitute materials as they require accurate reproduction of the chemical parameters and morphological features of the natural bone and its correlation with biological behaviours and concepts [16]. The new bone substitute materials must be validated by in vivo studies and request both the analysis of clinical outcomes on long-term and the determination of potential peri-implantitis rate [17].

## Conclusions

The guided bone regeneration technique using the natural bovine bone grafting material Cerabone and collagen membrane Jason offers reliable and predictable treatment results in the implant-prosthetic treatments. The accelerated healing time recommends the association of guided bone regeneration procedures with laser technique for the alveolar augmentation in the pre-implant stage.

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