

SOFT TISSUE TUNNEL ACCESS INTO THE MANDIBULAR MUCOSA TO OPTIMIZE THE RESULT OF LATERAL MANDIBULAR BONE GRAFTS

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SUMMARY

Various diseases and conditions can cause bony defects in the maxillofacial region. Since microvascular bone graft transfers were introduced in 1970, new possibilities in reconstructive surgery have arisen. Various methods of treatment have been described for severely atrophic mandibles. These methods are: (1) the placement of four endosteal implants of short length, (2) the placement of a trans-mandibular implant (3) the placement of endosteal implants in combination with vertical distraction osteogenesis or (4) the placement of endosteal implants in combination with an onlay or interpositional bone graft.

The patient was operated on to harvest bone for dental implant insertion at the Galeazzi Institute (Milan, Italy) in August 2016. He presented high resorption of edentulous mandible. Bone from the anterior approach was harvested started with a saw, and then a chisel and mallet were used. After 6 months removal of the screws of synthesis (1 fractured is left in place). Insertion of endosseous implants After 3 months loading with mixed prosthesis (bar + overdenture) with locator. Several Authors have reported pain on walking, weakness of the abdominal wall, frank herniation, and disturbances of gait. A few other approaches have been suggested to reduce impairments at the donor site such as taking only the inner cortex, which will reduce the amount of bone available and its implantability. Others have suggested leaving the iliac crest and harvesting the underlying bone.

It is concluded that in treatment combining an onlay graft and simultaneous implant placement in the extremely resorbed mandible, considerable graft resorption must be anticipated.

Key words: implants, bone reconstruction, atrophic mandible, bone graft, iliac bone graft.



Introduction

Various diseases and conditions can cause bony defects in the maxillofacial region. Since microvascular bone graft transfers were introduced in 1970, new possibilities in reconstructive surgery have arisen (1). Various methods of treatment have been described for severely at-

rophic mandibles. These methods are: (1) the placement of four endosteal implants of short length, (2) the placement of a trans-mandibular implant (3) the placement of endosteal implants in combination with vertical distraction osteogenesis or (4) the placement of endosteal implants in combination with an onlay or interpositional bone graft. Applying the latter technique, implants are placed either simultaneously or during

a second procedure. The theoretical advantages of a one-stage procedure would be decreased treatment time, decreased surgical time, and decreased resorption of the bone grafts around the implant sites.

Microsurgical transfer of flaps has become the gold standard of surgical treatment after resection of tumours of the mandible. Depending on the site, dimension, and type of defect different reconstructive procedures are required (2, 3). Agreement exists that vascularised bone grafts should be used in the reconstruction of long bony defects in the load-bearing parts of the mandible, particularly if the recipient bed is poorly vascularised or has been irradiated (1-3). At present, two important donor regions, the fibula and the iliac bone, have major roles in mandibular reconstruction (4, 5). The iliac bone can optimally be used to reconstruct more than half of the mandible, as it offers sufficient bone with a similar shape (6). It provides adequate volume of bone for insertion of dental implants, to rehabilitate patients both functionally and aesthetically (7). Its gentle curve parallels that of the mandible, and the type of vascularisation permits contouring osteotomies from the lateral side to obtain the desired shape.

Although the causes of loss of the jawbone may change with time, the large continuity defects of the mandible remain a challenge for reconstructive surgeons, particularly if the reconstruction has to be undertaken in poorly vascularised recipient sites. The success and reliability of free bone grafts are curtailed by metabolic dependence on the recipient's facial bed. Currently, dental implants serving as a basis for removable and fixed prostheses are considered a significant tool to reduce problems related to lack of retention of a mandibular denture. Depending on clinical circumstances, endosseous implants can be inserted during the same session: as reconstruction of the resorbed mandible (simultaneous procedure), or after incorporation of the graft (8) (delayed procedure, commonly after 3-4 months). A major advantage of the simultaneous procedure is that the graft and the implant can be incorporated at the same time, thus eliminating the need for a second operation. An important

drawback of this approach is that the positioning and angulation of the implants is more complicated, making it less desirable from a prosthetic point of view (9). Another major drawback is the unpredictable resorption (10) of the perimplant bone in the grafted area. In addition correct prosthetization, healing process around implants oral hygiene and bacterial loading control are additional major determinants is long-term successfully clinical outcome (11-74).

Aim of this study was to describe a case of iliac crestal bone graft in an atrophic mandible creating a tunnel inside the mucosa of the vestibule of the mandible end inserting and fixing there the bone graft.

Poor revascularization, combined with the frequent porosity of the iliac spongios bone, is one of the causes of frequent severe reabsorption of the insertion grafts in the jaw and represents the reason why, where possible, the interposition or the most invasive graft must be preferred calvary grafting.

In the case report described the sampling on the cortical profile of the iliac wing provided a bone of excellent quality and in an amount adequate to the serious defect present (75).

The minimally invasive access technique was adopted to avoid the incision of the periosteum above the graft area and preserve the residual periosteal vascularization with respect to provide a faster and better revascularization of the graft, hypothesis verified by the almost absence of resorption at 18 months.

Material and methods

The patient was operated on to harvest bone for dental implant insertion at the Galeazzi Institute (Milan, Italy) in August 2016. He presented high resorption of edentulous mandible in asymmetric form, with paresthesia in the left hemimandible by outcrop of the intraosseous path of the left alveolar nerve.

Standard orthopantomography (Figure 1) and CT scan were taken: pre-operatively, immediately postoperatively, and at last follow-up. Surgery

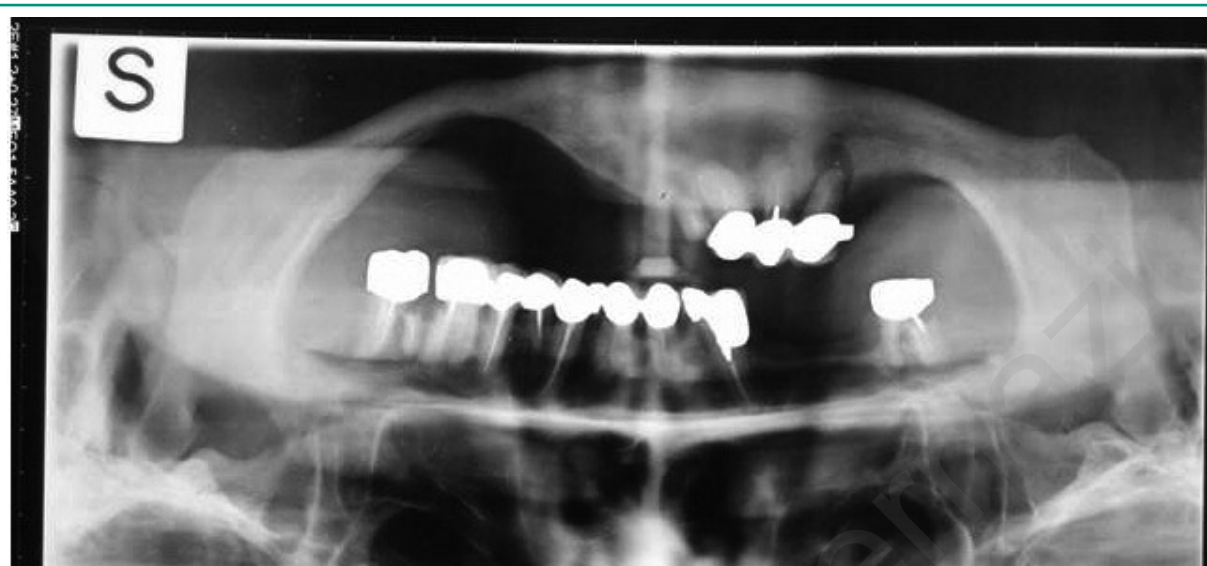


Figure 1
Preoperative. Rx OPT: important resorption of mandible bone.

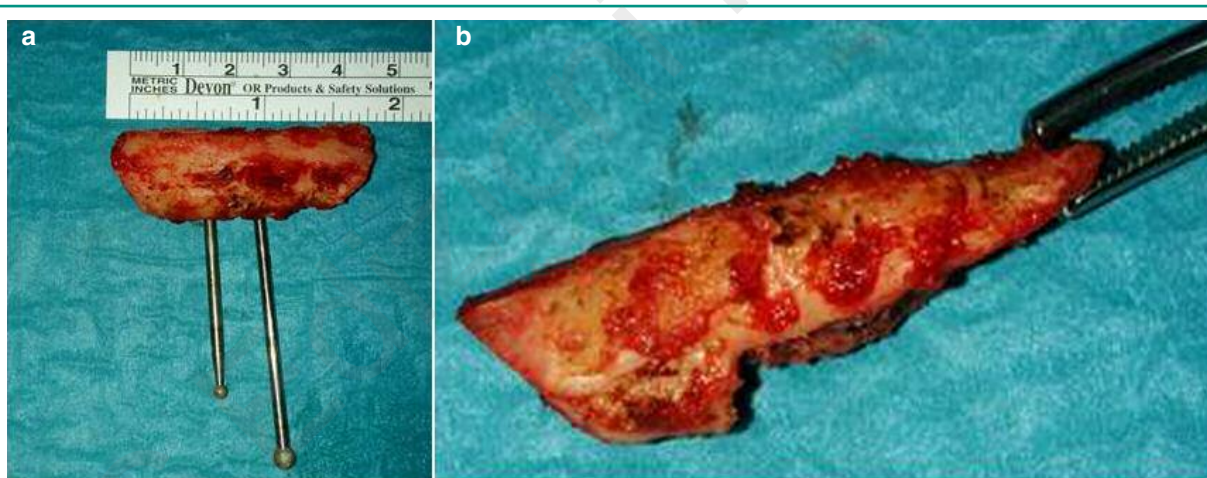
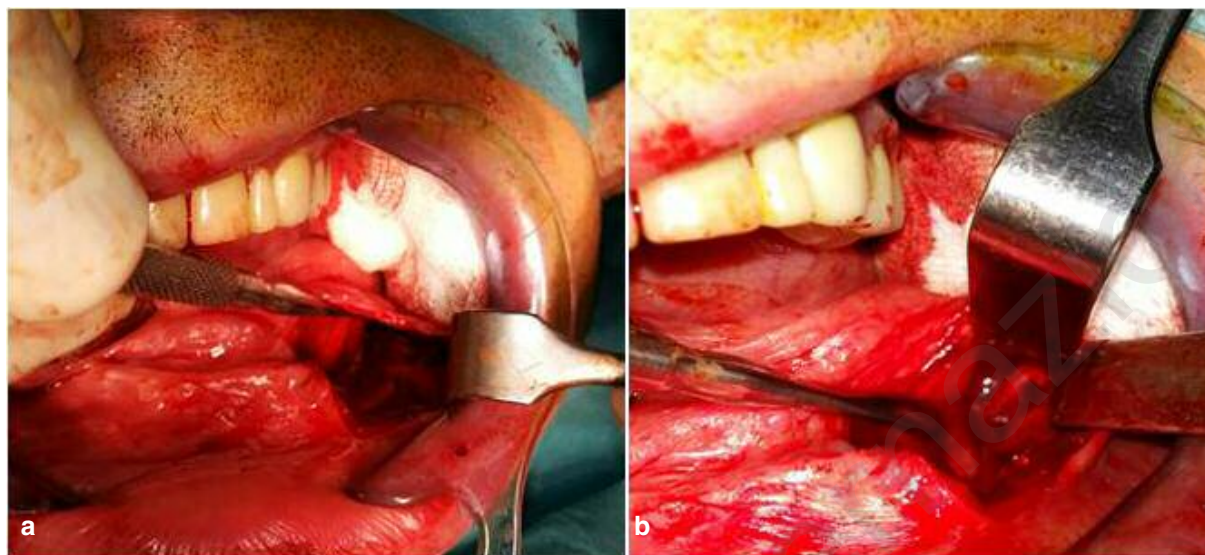


Figure 2
a, b) Iliac crest bone graft.

was performed with the patient under general anaesthesia. The mandible was prepared for surgery by submucosal injection of lidocaine with epinephrine (1:80,000) extending from the midline to the retromolar area on the buccal as well as the lingual side facilitating hemostasis. Bone from crestal approach was harvested with a saw, and then a chisel and mallet were used.

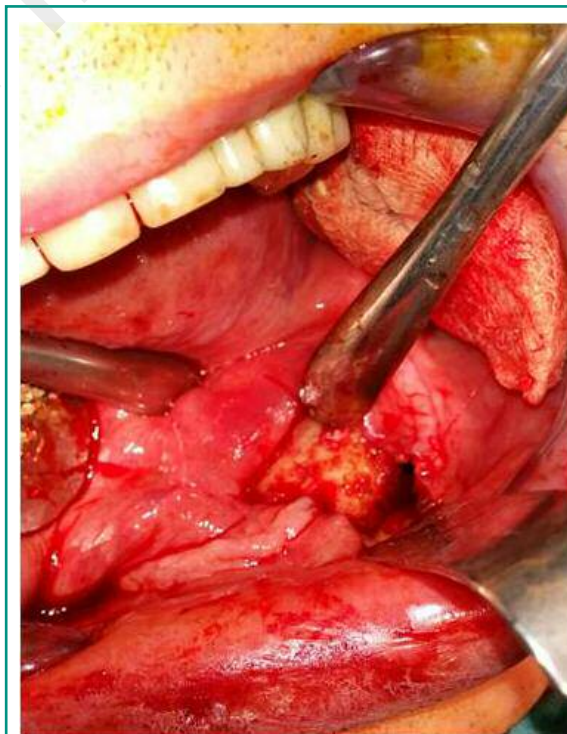
The bone fragment taken anterior laterally to the right crestal profile between the iliac antero-superior spine and the postero-superior measured 7 cm by 3 for 2 of height (Figure 2 a, b). This kind of withdrawal technique differs from the classic bone graft sec. Tessier technique and allows to create a better bone graft to insert into the lateral mandible.

**Figure 3**

a, b) Creation of the tunnel inside soft tissue of the mucosa of mandible.

The amount of bone was determined by putting the bone into a measuring cylinder partially filled with saline solution. To reduce postoperative pain, for the first 5 days, ibuprofen (600 mg 3 times daily) was prescribed. In addition, the patients received amoxicillin (1 g 3 times daily) for 5 days or, in the case of penicillin allergy, clindamycin (300 mg by mouth 3 times daily).

The surgical procedure was as follows. Transverse incision in the left hemimandibular crestal mucosa. Isolation of the inferior alveolar nerve to the emergency and lateralization of the same (outcropping on the surface) for about 3 cm. New emergency of the nerve packaging. Drilling of the cortical cretion of a soft tissue tunnel (Figure 3 a, b). Fixation of the bone graft with osteosynthesis screws (19 mm diameter 2 mm) (Figures 4, 5) suture. After 6 months removal of the screws of synthesis (1 fractured is left in place). (Insertion of endosseous implants (diameter 3.75 mm, in place 44 length 13 mm, 34, 32 and 42 length 16 mm) (Figure 6). After 3 months loading with mixed prosthesis (bar + overdenture) with locator (Figure 7).

**Figure 4**

Insertion and fixation inside the tunnel of iliac crest bone graft.



Figure 5
Control Rx OPT after bone graft harvesting.

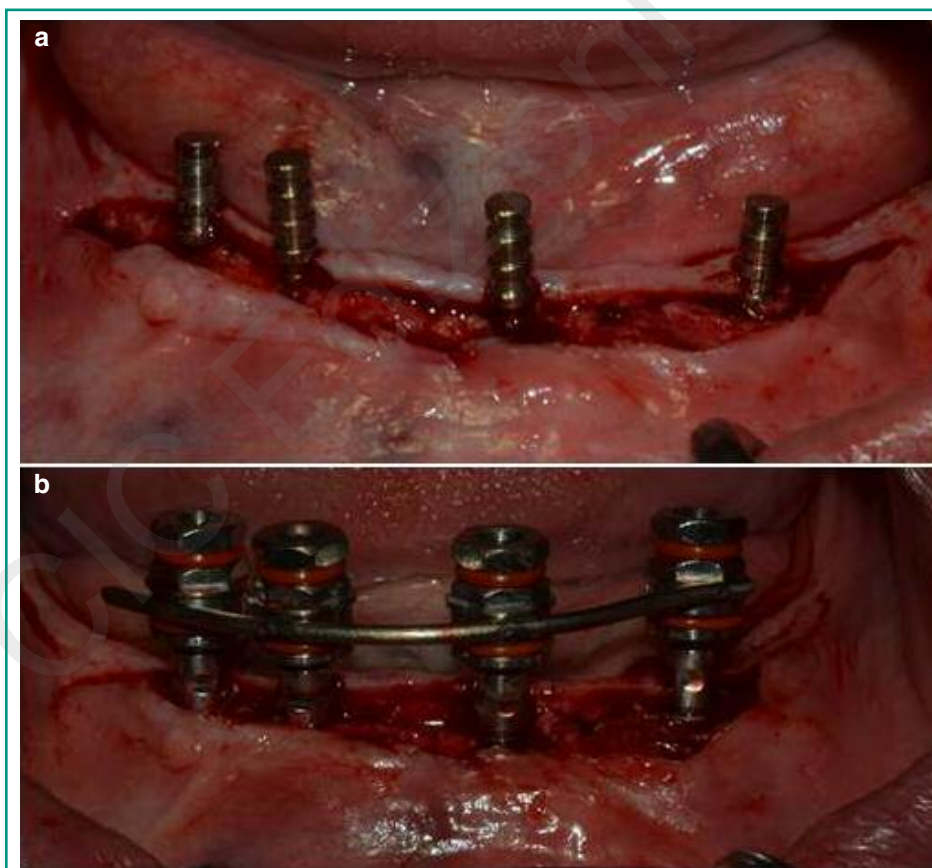


Figure 6
a, b) Insertion of mandibular implants.



Figure 7
Rx OPT in follow-up.

Discussion

Several Authors have reported pain on walking, weakness of the abdominal wall, frank herniation, and disturbances of gait (76, 77). A few other approaches have been suggested to reduce impairments at the donor site such as taking only the inner cortex, which will reduce the amount of bone available and its implantability (78, 79). Others have suggested leaving the iliac crest and harvesting the underlying bone. However, this manoeuvre can jeopardise the nutrient vessels, which usually run close to the iliac crest. Other investigators have suggested leaving the ASIS for better muscular reattachment and stability (80), which may also make the iliac region more prone to fracture. This segment can also be used optimally for reconstruction of the mandibular angle. We know of no comparable studies with standard ratings of postoperative complications. Numerous comparative studies have been published about the surgical and anatomical advantages and disadvantages. The donor side morbidity, the quality of life (81), and the applicability of each bone graft depending on the size and type of the defect after resection of

tumours (79). In terms of biomechanics, however, we know of few if any experimental studies that have directly compared the biomechanical properties of the reconstructed mandible. There is also a lack of studies that investigate the primary stability after reconstruction. For iliac crest harvesting, several complications have been described: chronic pain, sensory loss, wound breakdown, contour defect, hernia through the donor site, instability of the sacroiliac joint, gait disturbance, pathologic fracture, adynamic ileus, urethral injury, seroma, hematoma, and haemorrhage (80). Different trials with varying results have been carried out to compare anterior and posterior approaches for iliac bone grafting (80-83). A low incidence of donor-site morbidity is reported for anterior cancellous iliac crest bone in secondary bone grafting of the cleft alveolus (84, 85). Studies have reported that the anterior approach to the ilium causes considerably more problems than the posterior approach (85, 86). On the other hand, the potential morbidity of bone harvest from the posterior ilium is said to be greater than that from the anterior iliac crest, because of the proximity to the sacroiliac joint and the sciatic nerve. In reality, damage to these areas is rare (83). Be-

cause these operations are elective, how the patient rates them is most important. The iliac crest offers many advantages as a donor site, including easy accessibility and the possibility to harvest large amounts of bone and to close the wound primarily, whereas the posterior approach leads to increased operation time because of the need to rotate the patient during surgery.

Conclusions

It is concluded that in treatment combining an onlay graft and simultaneous implant placement in the extremely resorbed mandible, considerable graft resorption must be anticipated. This may require additional surgical intervention in some cases. Patients should be made aware of this and informed pre-operatively. We should inform patient that two surgical times should be more sure for good results. In order to avoid mental nerve damage one should be taken extra care to protect the mental nerves by placing the posterior tunnel in all cases slightly to the lingual surface of the mandible.

In order to use the described technique a single large bone fragment is required, perfectly implanted on the receiving site. The ideal site for sampling is the iliac crest, even the profile, especially in very thin individual could present a little dimorphism after the withdrawal. The anterior transverse incision, actually if on one hand, preserves the periosteal vascularization, on the other, limits the vision of the operative field and prevents posterior osteosynthesis positioning. The advantages of the procedure are evidenced by the almost complete preservation of the grafted bone available for implant rehabilitation.

References

1. Shpitzer T, Neligan PC, Gullane PJ, Boyd BJ, Gur E, Rotstein LE, et al. The free iliac crest and fibula flaps in vascularized oromandibular reconstruction: comparison and long-term evaluation. *Head Neck*. 1999;21(7):639-47.
2. Hidalgo DA. Fibula free flap: a new method of mandible reconstruction. *Plastic and reconstructive surgery*. 1989;84(1):71-9.
3. Hidalgo DA, Rekow A. A review of 60 consecutive fibula free flap mandible reconstructions. *Plastic and reconstructive surgery*. 1995;96(3):585-96; discussion 97-602.
4. Moscoso JF, Keller J, Genden E, Weinberg H, Biller HF, Buchbinder D, et al. Vascularized bone flaps in oromandibular reconstruction. A comparative anatomic study of bone stock from various donor sites to assess suitability for enosseous dental implants. *Archives of otolaryngology-head & neck surgery*. 1994;120(1): 36-43.
5. Chen YB, Chen HC, Hahn LH. Major mandibular reconstruction with vascularized bone grafts: indications and selection of donor tissue. *Microsurgery*. 1994;15(4):227-37.
6. Riediger D. The importance of micro surgically transplanted iliac crest and the osteomyocutaneous flap for the restoration of form and function of the mandible: Springer; 1985.
7. Frodel JL Jr, Funk GF, Capper DT, Fridrich KL, Blumer JR, Haller JR, et al. Osseointegrated implants: a comparative study of bone thickness in four vascularized bone flaps. *Plastic and reconstructive surgery*. 1993;92(3):449-55; discussion 56-8.
8. Stellingsma C, Raghoobar GM, Meijer HJ, Batenburg RH. Reconstruction of the extremely resorbed mandible with interposed bone grafts and placement of endosseous implants. A preliminary report on outcome of treatment and patients' satisfaction. *Br J Oral Maxillofac Surg*. 1998;36(4):290-5.
9. Bell RB, Blakey GH, White RP, Hillebrand DG, Molina A. Staged reconstruction of the severely atrophic mandible with autogenous bone graft and endosteal implants. *J Oral Maxillofac Surg*. 2002;60(10): 1135-41.
10. Scapoli L, Girardi A, Palmieri A, Testori T, Zuffetti F, Monguzzi R, et al. Microflora and periodontal disease. *Dental Research Journal*. 2012;9(8 Suppl. 2):S202-S6.
11. Scapoli L, Girardi A, Palmieri A, Testori T, Zuffetti F, Monguzzi R, et al. Microflora and periodontal disease. *Dent Res J (Isfahan)*. 2012;9(Suppl 2):S202-6.
12. Scapoli L, Girardi A, Palmieri A, Carinci F, Testori T, Zuffetti F, et al. IL6 and IL10 are genetic susceptibility factors of periodontal disease. *Dent Res J (Isfahan)*. 2012;9(Suppl 2):S197-201.
13. Carinci F SL, Girardi A, Cura F, Lauritano D, Nardi GM, Palmieri A. Oral microflora and periodontal disease: new technology for diagnosis in dentistry. *Annals of Stomatology*. 2013;4(2):170-3.
14. Scapoli L, Girardi A, Palmieri A, Martinelli M, Cura F, Lauritano D, et al. Interleukin-6 Gene Polymorphism Modulates the Risk of Periodontal Diseases. *J Biol Regul Homeost Agents*. 2015;29(3 Suppl 1):111-6.
15. Scapoli L, Girardi A, Palmieri A, Martinelli M, Cura F,

- Lauritano D, et al. Quantitative Analysis of Periodontal Pathogens in Periodontitis and Gingivitis. *J Biol Regul Homeost Agents*. 2015;29(3 Suppl 1):101-10.
16. Lauritano D, Scapoli L, Mucchi D, Cura F, Muzio LLO, Carinci F. Infectogenomics: Lack of association between vdr, il6, il10 polymorphisms and "red Complex" bacterial load in a group of Italian adults with chronic periodontal disease. *Journal of Biological Regulators and Homeostatic Agents*. 2016;30(2):155-60.
17. Lauritano D, Martinelli M, Mucchi D, Palmieri A, Muzio LL, Carinci F. Bacterial load of periodontal pathogens among Italian patients with chronic periodontitis: A comparative study of three different areas. *Journal of Biological Regulators and Homeostatic Agents*. 2016;30(2):149-54.
18. Lauritano D, Muzio LLO, Gaudio RM, Russo LLO, Mucchi D, Nardi GM, et al. The ecological catastrophe of oral diseases: A possible link between periodontitis and protozoa. *Journal of Biological Regulators and Homeostatic Agents*. 2016;30(2):143-7.
19. Lauritano D, Cura F, Candotto V, Gaudio RM, Mucchi D, Carinci F. Periodontal Pockets as a Reservoir of *Helicobacter Pylori* Causing Relapse of Gastric Ulcer: A Review of the Literature. *J Biol Regul Homeost Agents*. 2015;29(3 Suppl 1):123-6.
20. Silvestre FJ, Lauritano D, Carinci F, Silvestre-Rangil J, Martinez-Herrera M, Del Olmo A. Neuroinflammation, Alzheimers disease and periodontal disease: is there an association between the two processes? *J Biol Regul Homeost Agents*. 2017;31(2 Suppl 1):189-96.
21. Lauritano D, Sbordone L, Nardone M, Iapichino A, Scapoli L, Carinci F. Focus on periodontal disease and colorectal carcinoma. *ORAL and Implantology*. 2017;10(3):229-33.
22. Carinci F, Martinelli M, Contaldo M, Santoro R, Pezzetti F, Lauritano D, et al. Focus on periodontal disease and development of endocarditis. *J Biol Regul Homeost Agents*. 2018;32(2 Suppl. 1):143-7.
23. Lauritano D, Petrucci M, Nardi GM, Carinci F, Minervini G, Di Stasio D, et al. Single Application of a Dessicating Agent in the Treatment of Recurrent Aphthous Stomatitis. *J Biol Regul Homeost Agents*. 2015;29(3 Suppl 1):59-66.
24. Lauritano D, Cura F, Gaudio RM, Pezzetti F, Andreasi Bassi M, Carinci F. Polymerase Chain Reaction to Evaluate the Efficacy of Silica Dioxide Colloidal Solutions in the Treatment of Chronic Periodontitis: A Case Control Study. *J Biol Regul Homeost Agents*. 2015;29(3 Suppl 1):131-5.
25. Lauritano D, Cura F, Candotto V, Gaudio RM, Mucchi D, Carinci F. Evaluation of the Efficacy of Titanium Dioxide with Monovalent Silver Ions Covalently Linked (Tiab) as an Adjunct to Scaling and Root Planing in the Management of Chronic Periodontitis Using Pcr Analysis: A Microbiological Study. *J Biol Regul Homeost Agents*. 2015;29(3 Suppl 1):127-30.
26. Avantiaggiato A, Palmieri A, Carinci F, Trapella G, Sollazzo V, Lauritano D. Effects of glucosamine and nucleotide association on fibroblast: extracellular matrix gene expression. *International journal of immunopathology and pharmacology*. 2014;27(4):689-93.
27. Lauritano D, Palmieri A, Vinci R, Azzi L, Taglabue A, Carinci F. Adipose derived stem cells: basic science fundamentals and clinical application. An update. *Minerva Stomatol*. 2014;63(7-8):273-81.
28. Roncati M, Lauritano D, Cura F, Carinci F. Evaluation of light-emitting diode (led-835 nm) application over human gingival fibroblast: An in vitro study. *Journal of Biological Regulators and Homeostatic Agents*. 2016;30(2):161-7.
29. Lauritano D, Bignozzi CA, Pazzi D, Palmieri A, Gaudio RM, Di Muzio M, et al. Evaluation of the efficacy of a new oral gel as an adjunct to home oral hygiene in the management of chronic periodontitis. A microbiological study using PCR analysis. *Journal of Biological Regulators and Homeostatic Agents*. 2016;30(2):123-8.
30. Lauritano D, Candotto V, Bignozzi CA, Pazzi D, Carinci F, Cura F, et al. The role of zinc plus octenidine in the regulation of gene expression: an in vitro study. *J Biol Regul Homeost Agents*. 2018;32(2 Suppl. 1):237-44.
31. Lauritano D, Candotto V, Bignozzi CA, Pazzi D, Carinci F, Cura F, et al. Zinc plus octenidine: a new formulation for treating periodontal pathogens. A single blind study. *J Biol Regul Homeost Agents*. 2018;32(2 Suppl. 1):231-6.
32. Gaudio RM, Ottria L, Lauritano D, Palmieri A, Cura F, Tagliabue A, et al. Peri-implant test is a proposal of a new procedure to prevent peri-implantitis and forensic claims. *J Biol Regul Homeost Agents*. 2018;32(2 Suppl. 1):43-50.
33. Cieslik-Wegemund M, Candotto V, Wierucka-Mlynarczyk B, Tanasiewicz M, Gilowski L, Duda M, et al. Coverage of multiple recessions using the tunnel technique and a collagen matrix in the maxilla or mandible: a 6-month study. *J Biol Regul Homeost Agents*. 2018;32(2 Suppl. 1):1-10.
34. Lopez MA, Manzulli N, D'Angelo A, Lauritano D, Papalia R, Candotto V. The use of hyaluronic acid as an adjuvant in the management of peri-implantitis. *J Biol Regul Homeost Agents*. 2017;31(4 Suppl 2):123-7.
35. Lopez MA, Manzulli N, D'Angelo A, Candotto V, Casale M, Lauritano D. The use of hyaluronic acid as an adjuvant in the management of mucositis. *J Biol Regul Homeost Agents*. 2017;31(4 Suppl 2):115-8.
36. Lopez MA, Manzulli N, D'Angelo A, Candotto V, Casale M, Lauritano D. The use of hyaluronic acid as an adjuvant in the management of gingivitis. *J Biol Regul Homeost Agents*. 2017;31(4 Suppl 2):111-8.
37. Baj A, Beltramini GA, Romano M, Lauritano D, Palmieri A, Cura F, et al. Cone-morse implant connection system significantly reduces bacterial leakage be-

- tween implant and abutment: an in vitro study. *Journal of Biological Regulators & Homeostatic Agents*. 2017;21(2 Suppl 1):203-8.
38. Sabatini S, Lauritano D, Candotto V, Silvestre FJ, Nardi GM. Oral probiotics in the management of gingivitis in diabetic patients: a double blinded randomized controlled study. *J Biol Regul Homeost Agents*. 2017;31(2 Suppl 1):197-202.
 39. Lauritano D, Pazzi D, Iapichino A, Gaudio RM, Di Muzio M, Lo Russo L, et al. Evaluation of the efficacy of a new oral gel containing carvacrol and thymol for home oral care in the management of chronic periodontitis using PCR analysis: a microbiological pilot study. *J Biol Regul Homeost Agents*. 2016;30(2 Suppl 1):129-34.
 40. Fogli V, Camerini M, Lauritano D, Carinci F. Success and high predictability of intraorally welded titanium bar in the immediate loading implants. *Case Rep Dent*. 2014;2014:215378.
 41. Danza M, Lauritano D, Carinci F. Successful rehabilitation of partial edentulous maxilla and mandible with new type of implants: molecular precision implants. *Case Rep Med*. 2014;2014:307364.
 42. El Haddad E, Lauritano D, Carinci F. Interradicular septum as guide for pilot drill in postextractive implantology: a technical note. *J Contemp Dent Pract*. 2015;16(1):81-4.
 43. Lopez MA, Bassi MA, Confalone L, Carinci F, Ormianer Z, Lauritano D. The use of resorbable cortical lamina and micronized collagenated bone in the regeneration of atrophic crestal ridges: A surgical technique. case series. *Journal of Biological Regulators and Homeostatic Agents*. 2016;30(2):81-5.
 44. Lauritano D, Bignozzi CA, Pazzi D, Cura F, Carinci F. Efficacy of a new coating of implantabutment connections in reducing bacterial loading: An in vitro study. *ORAL and Implantology*. 2017;10(1):1-10.
 45. Balan I, Di Girolamo M, Lauritano D, Carinci F. Treatment of severe atrophic maxilla with zygomatic implants: A case series. *ORAL and Implantology*. 2017;10(3):317-24.
 46. Balan I, Calcaterra R, Lauritano D, Grecchi E, Carinci F. A new spiral dental implant: A tool for oral rehabilitation of difficult cases. *ORAL and Implantology*. 2017;10(3):262-9.
 47. Carinci F, Lauritano D, Cura F, Lopez MA, Bassi MA, Confalone L, et al. Prevention of bacterial leakage at implant-Abutment connection level: An in vitro study of the efficacy of three different implant systems. *Journal of Biological Regulators and Homeostatic Agents*. 2016;30(2):69-73.
 48. Ottria L, Lauritano D, Andreasi Bassi M, Palmieri A, Candotto V, Tagliabue A, et al. Mechanical, chemical and biological aspects of titanium and titanium alloys in implant dentistry. *J Biol Regul Homeost Agents*. 2018;32(2 Suppl. 1):81-90.
 49. Pasqualini ME, Rossi F, Dal Carlo L, Colombo D, Nardone M, Shulman M, et al. Riabilitazioni a carico immediato di edentulie singole con impianti one piece stabilizzati con ago elettrosaldato – Single tooth rehabilitations with immediate loading of one-piece implants stabilized to a titanium pin with intraoral welding. *Doctor OS*. 2016;XXVII:372-8.
 50. Haddad EE, Calcaterra R, Haddad GE, Candotto V, Lauritano D. Treatment of maxillary retained canine with implants: new perspectives. *Oral Implantol (Rome)*. 2017;10(3):343-8.
 51. Busato A, Vismara V, Grecchi F, Grecchi E, Lauritano D. Surgiplanner: a new method for one step oral rehabilitation of severe atrophic maxilla. *Oral Implantol (Rome)*. 2017;10(3):325-34.
 52. Lico S, Andrisani C, Andreasi Bassi M, Candotto V, Silvestre FJ, Lauritano D. Computer-guided implant insertion in a patient with impacted maxillary canines: case report. *J Biol Regul Homeost Agents*. 2017;31(2 Suppl 1):247-51.
 53. Pedreira De Oliveira D, Ottria L, Gargari M, Candotto V, Silvestre FJ, Lauritano D. Surface modification of titanium alloys for biomedical application: from macro to nano scale. *J Biol Regul Homeost Agents*. 2017;31(2 Suppl 1):221-32.
 54. Baj A, Muzio LL, Lauritano D, Candotto V, Mancini GE, Gianni AB. Success of immediate versus standard loaded implants: A short literature review. *Journal of Biological Regulators and Homeostatic Agents*. 2016;30(2):183-8.
 55. Andreasi Bassi M, Andrisani C, Lopez MA, Gaudio RM, Lombardo L, Lauritano D. Guided bone regeneration in distal mandibular atrophy by means of a pre-formed titanium foil: a case series. *J Biol Regul Homeost Agents*. 2016;30(2 Suppl 1):61-8.
 56. Lopez MA, Andreasi Bassi M, Confalone L, Gaudio RM, Lombardo L, Lauritano D. Clinical outcome of 215 transmucosal implants with a conical connection: a retrospective study after 5-year follow-up. *J Biol Regul Homeost Agents*. 2016;30(2 Suppl 1):55-60.
 57. Lopez MA, Andreasi Bassi M, Confalone L, Gaudio RM, Lombardo L, Lauritano D. The influence of conical plus octagonal internal connection on implant survival and success rate: a retrospective study of 66 fixtures. *J Biol Regul Homeost Agents*. 2016;30(2 Suppl 1):49-54.
 58. Lopez MA, Andreasi Bassi M, Confalone L, Gaudio RM, Lombardo L, Lauritano D. Retrospective study on bone-level and soft-tissue-level cylindrical implants. *J Biol Regul Homeost Agents*. 2016;30(2 Suppl 1):43-8.
 59. Andreasi Bassi M, Andrisani C, Lopez MA, Gaudio RM, Lombardo L, Lauritano D. Modified connective tissue punch technique to increase the vestibular/buccal keratinized tissue on flapless implant surgery: a case series. *J Biol Regul Homeost Agents*. 2016;30(2 Suppl 1):29-34.
 60. Andreasi Bassi M, Andrisani C, Lopez MA, Gaudio RM, Lombardo L, Lauritano D. Endoscopically con-

- trolled hydraulic sinus lift in combination with rotary instruments: one-year follow-up of a case series. *J Biol Regul Homeost Agents*. 2016;30 (S2):21-8.
61. Andreasi Bassi M, Andrisani C, Lopez MA, Gaudio RM, Lombardo L, Lauritano D. Maxillary sinus bypass with tilted implants via tapered-screw bone expanders in low density bone: one year follow -up of a case series. *J Biol Regul Homeost Agents*. 2016;30 S (1):13-20.
 62. Andreasi Bassi M, Lopez MA, Confalone L, Gaudio RM, Lombardo L, Lauritano D. Clinical outcome of a two-piece implant system with an internal hexagonal connection: a prospective study. *J Biol Regul Homeost Agents*. 2016;30(2 Suppl 1):7-12.
 63. Andreasi Bassi M, Lopez MA, Confalone L, Gaudio RM, Lombardo L, Lauritano D. A prospective evaluation of outcomes of two tapered implant systems. *J Biol Regul Homeost Agents*. 2016;30(2 Suppl 1):1-6.
 64. Carinci F, Scapoli L, Contaldo M, Santoro R, Palmieri A, Pezzetti F, et al. Colonization of *Legionella* spp. In dental unit waterlines. *J Biol Regul Homeost Agents*. 2018;32(2 Suppl. 1):139-42.
 65. Lauritano D, Nardone M, Gaudio RM, Candotto V, Carinci F. Risk assessment of colonization of *Legionella* SPP. in dental unit waterlines. *ORAL and Implantology*. 2017;10(3):283-8.
 66. Ruggiero F, Carbone D, Mugavero R, Palmieri A, Lauritano D, Baggi L, et al. Human polyomavirus in tonsillar microbiota of an Afghan population group. *J Biol Regul Homeost Agents*. 2018;32(2 Suppl. 1):185-90.
 67. Ruggiero F, Carbone D, Mugavero R, Palmieri A, Lauritano D, Baggi L, et al. Detection of endocarditis bacteria in tonsillar mucosa of Afghan population. *J Biol Regul Homeost Agents*. 2018;32(2 Suppl. 1):179-83.
 68. Candotto V, Lauritano D, Nardone M, Baggi L, Arcuri C, Gatto R, et al. HPV infection in the oral cavity: Epidemiology, clinical manifestations and relationship with oral cancer. *ORAL and Implantology*. 2017;10 (3):209-20.
 69. Lauritano D, Lucchese A, Contaldo M, Serpico R, Lo Muzio L, Biolcati F, et al. Oral squamous cell carcinoma: diagnostic markers and prognostic indicators. *J Biol Regul Homeost Agents*. 2016;30(2 Suppl 1):169-76.
 70. Slutzky S, Cohen O, Lauritano D, Moses O, Ormianer Z, Tal H, et al. Temperature changes of one-piece implants during the setting of acrylic resin temporary crown. The effect of implant diameter. An in vitro study. *J Biol Regul Homeost Agents*. 2017;31(2 Suppl 1):53-60.
 71. Matalon S, Frydman G, Lauritano D, Slutzky H, Shlomo E, Levartovsky S, et al. The effect of enriching denture adhesives with chlorhexidine diacetate on the proliferation of *Candida albicans*: an in vitro analysis. *J Biol Regul Homeost Agents*. 2017;31(2 Suppl 1):45-52.
 72. Meirowitz A, Nowotny Klein R, Lauritano D, Harel N, Block J, Matalon S, et al. Survey results of currently used techniques and materials by dentists for fabrication of complete removable dental prostheses. *J Biol Regul Homeost Agents*. 2017;31(2 Suppl 1):27-36.
 73. Bassi MA, Bedini R, Pecci R, Ioppolo P, Lauritano D, Carinci F. Mechanical properties of resin glass fiber-reinforced abutment in comparison to titanium abutment. *Journal of Indian Society of Periodontology*. 2015; 19(3):273-8.
 74. Segal P, Candotto V, Ben-Amar A, Eger M, Matalon S, Lauritano D, et al. The effect of gingival wall location on the marginal seal of class ii restorations prepared with a flowable bulk-fill resin-based composite. *J Biol Regul Homeost Agents*. 2018;32(2 Suppl. 1):11-8.
 75. Kalk WW, Raghoobar GM, Jansma J, Boering G. Morbidity from iliac crest bone harvesting. *Journal of oral and maxillofacial surgery : official journal of the American Association of Oral and Maxillofacial Surgeons*. 1996;54(12):1424-9; discussion 30.
 76. Parr JM, Adams BM, Wagels M. Flow-through flap for salvage of fibula osseocutaneous vascular variations: a surgical approach and proposed modification of its classification. *Journal of oral and maxillofacial surgery: official journal of the American Association of Oral and Maxillofacial Surgeons*. 2014;72(6):1197-202.
 77. Holzle F, Kesting MR, Holzle G, Watola A, Loeffelbein DJ, Ervens J, et al. Clinical outcome and patient satisfaction after mandibular reconstruction with free fibula flaps. *Int J Oral Maxillofac Surg*. 2007;36(9):802-6.
 78. Sullivan MJ, Carroll WR, Baker SR, Crompton R, Smith-Wheelock M. The free scapular flap for head and neck reconstruction. *American journal of otolaryngology*. 1990;11(5):318-27.
 79. Maciejewski O, Smeets R, Gerhards F, Kolk A, Kloss F, Stein JM, et al. Gender specific quality of life in patients with oral squamous cell carcinomas. *Head & face medicine*. 2010;6:21.
 80. Meyer U, Meyer T, Wiesmann HP, Stratmann U, Kruse-Losler B, Maas H, et al. The effect of magnitude and frequency of interfragmentary strain on the tissue response to distraction osteogenesis. *Journal of oral and maxillofacial surgery : official journal of the American Association of Oral and Maxillofacial Surgeons*. 1999;57(11):1331-9; discussion 40-1.
 81. Nkenke E, Lehner B, Weinzierl K, Thams U, Neugebauer J, Steveling H, et al. Bone contact, growth, and density around immediately loaded implants in the mandible of mini pigs. *Clin Oral Implants Res*. 2003;14(3):312-21.
 82. Payne AG, Tawse-Smith A, Thomson WM, Duncan WD, Kumara R. One-stage surgery and early loading of three implants for maxillary overdentures: a 1-year report. *Clin Implant Dent Relat Res*. 2004;6(2):61-74.
 83. Marx RE, Morales MJ. Morbidity from bone harvest in major jaw reconstruction: a randomized trial comparing the lateral anterior and posterior approaches to the ilium. *Journal of oral and maxillofacial surgery: official*

- journal of the American Association of Oral and Maxillofacial Surgeons. 1988;46(3):196-203.
84. Beirne JC, Barry HJ, Brady FA, Morris VB. Donor site morbidity of the anterior iliac crest following cancellous bone harvest. International journal of oral and maxillofacial surgery. 1996;25(4):268-71.
85. Kessler P, Thorwarth M, Bloch-Birkholz A, Nkenke E, Neukam FW. Harvesting of bone from the iliac crest-comparison of the anterior and posterior sites. Br J Oral Maxillofac Surg. 2005;43(1):51-6.
86. Khoury F, Happe A. Soft tissue management in oral implantology: a review of surgical techniques for shaping

an esthetic and functional peri-implant soft tissue structure. Quintessence Int. 2000;31(7):483-99.

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