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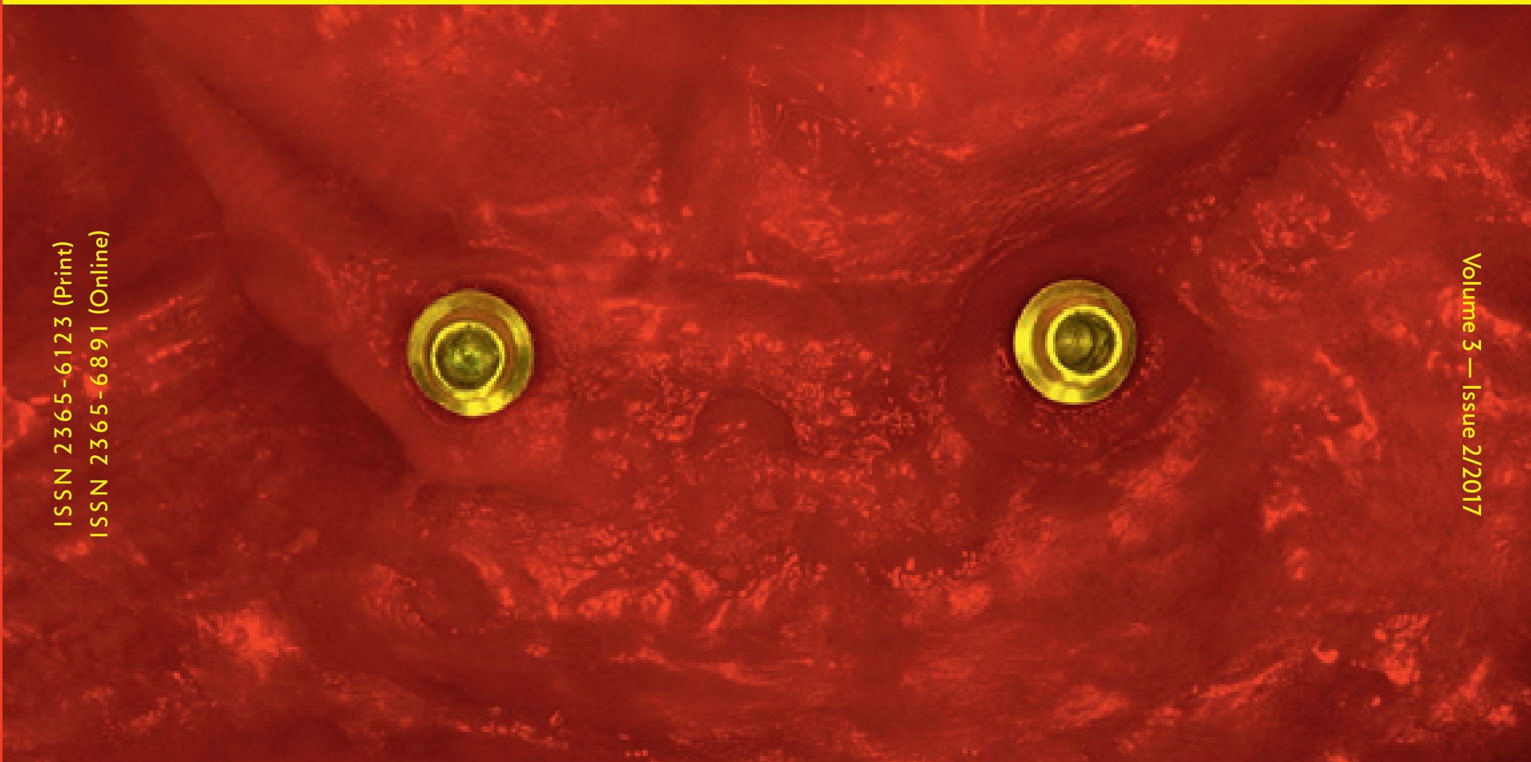

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Digital dentistry revolution: Should we ride the wave and where is it taking us?

Today, the digital revolution is changing the world, and dentistry is no exception. Clinicians have to rapidly assimilate these new technologies into their daily routine to keep up with these changes. However, many clinicians find themselves struggling to make the transition to a digital workflow.

In recent years, many technologies have been introduced on the market that allow the dental team to use new materials and devices in the production of dental restorations, in order to make dental care easier and faster and improve communication with patients and their dental team.

There are many areas of digital dentistry from which a general practitioner can benefit, and many more are being researched and constantly introduced. Among these, CAD/CAM technologies, intraoral imaging, guided surgery (including design and fabrication of surgical guides), digital radiography, occlusal and temporomandibular joint analysis, and photography are only a few examples.

Today, CAD/CAM technologies have become part of our daily practice, allowing the dental team to effect prosthetic rehabilitation with an accuracy and precision previously difficult to obtain using well-established conventional protocols. Similarly, guided surgery has become increasingly popular owing to its ability to render improved diagnosis and facilitate planning, followed by higher transfer accuracy of the virtual plan to the patient's mouth. Hence, it has undoubtedly been a major achievement to provide optimal 3-D implant positioning and higher patient satisfaction. CAD/CAM technologies and guided surgery allow full integration with other digital devices, such as intraoral scanners, to provide for accurate and faster patient-centered solutions. Digital impression taking is one of the most exciting new areas in dentistry for a wide range of procedures in prosthodontics, restorative dentistry and orthodontics.

Although there is no doubt about the potential and accuracy of established digital solutions, there is still a lack of evidence that recent digital technologies available on the market are superior to conventional protocols. Certainly, the evidence, by itself, does not determine the decision, but it can help support the patient care process. Evidence-based medicine has always required integration of three key components: research-based evidence, clinical expertise, and the patient's values and preferences. The Journal of Oral Science & Rehabilitation publishes original research in the field of digital dental science, and the recommendation for further research is to conduct unbiased long-term randomized controlled trials aimed at making a fair comparison between a new treatment and the existing treatment to see which works best. Moreover, in spite of increasing demand for easier and faster dental treatments, and growing penetration of digital marketing in dentistry, the clinician's experience, training and reasoning skills are needed in each field of new dentistry to accelerate the accumulation of the requisite knowledge and skills.

In conclusion, the digital dentistry revolution is changing the workflow and consequently changing operating procedures. Hence, clinicians should reason in this way, but not blindly ride the wave.

Dr. Marco Tallarico
Statistical Adviser

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The *Journal of Oral Science & Rehabilitation* publishes original and high-quality research and clinical papers in the fields of periodontology, implant dentistry, prosthodontics and maxillofacial surgery. Priority is given to papers focusing on clinical techniques and with a direct impact on clinical decision-making and outcomes in the above-mentioned fields. Furthermore, book reviews, summaries and abstracts of scientific meetings are published in the journal.

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Use of argon plasma to enhance soft-tissue integration of prosthetic components: a randomized, controlled animal study

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Abstract

Objective

This paper aimed to assess histologically the soft- and hard-tissue changes after insertion of cleaned and activated titanium implant abutments.

Methods

Three months after tooth extractions, four implants were inserted in one side of the mandible. Before connecting the abutments to the implants, two of them were detoxified (test group), while two were left untreated (control group). The abutments were randomly placed on the two distally or on the two mesially located implants. After one month, the same procedure was repeated on the other side of the mandible. The animals were euthanized one month after the last surgery. Histological analysis was performed to identify the shoulder of the implant, the most coronal bone-to-implant contact, the top of the adjacent bony crest, the top of the periimplant mucosa (PM) and the apical termination of the junctional epithelium (AJE).

Results

All of the animals remained in good health during the experimental period. No statistically significant differences were found between the test and control sites ($p > 0.05$). Between the first and the second time points, no statistically significant differences between the groups were found, except for PM–AJE of the test group, with higher values observed two months after implant placement. However, a trend of better marginal bone levels was found in the test group, compared with the control group, at the second time point.

Conclusion

Although differences between the test and control groups failed to reach significance, a trend of better marginal bone levels was found at the test sites compared with the control sites.

Keywords

Argon plasma, soft-tissue adhesion, animal study, titanium abutment.

Introduction

Periimplant soft- and hard-tissue stability is critical for the success of an implant-supported restoration, from a functional and esthetic point of view.[1] It has been described that the relationship between the implant–abutment connection and surrounding hard and soft tissue plays an important role in establishing such mechanical and biological stability.[2, 3] In fact, the literature has demonstrated that, when an implant is exposed to the oral environment after the connection of a prosthetic component, periimplant hard-tissue level changes may occur[4] and that the amount of bone remodeling, characterized by circumferential (horizontal and vertical) bone loss, should remain stable after one year.[5] Several factors and, in particular, disruptions occurring after prosthetic connections may affect periimplant resorption,[6] since the bacterial contamination of the implant–abutment junction from the oral cavity has been shown to trigger a hard-tissue response.[7]

Many strategies have been advocated to minimize the effect of this contamination clinically: mechanical improvement of the implant–abutment connection stability,[8] implant–abutment microgap shifting from the vital bone,[9–12] and reducing the number of abutment dis- and reconnections.[6] Nevertheless, minimal bone resorption (0.5 mm) has been observed in longitudinal analysis.[13]

Bone resorption might be related to the contaminants (bacteria, wear microparticles and pollution from laboratory procedures) present on the abutment at the time of implant–abutment connection. In fact, the presence of contaminants on the abutment surface can still be observed after the steam cleaning protocol after technical laboratory procedures.[14] Since the abutment comes into contact with both bone and connective tissue, abutment cleanliness appears to be important. In fact, the presence of contaminants at the platform–abutment level has been suggested to cause associated tissue-damaging inflammation.[14] Titanium wear microparticles have been demonstrated to activate osteoclastogenesis.[15] Additionally, it has been shown how interactions between cellular components and implant–abutment materials influence the healing process around implants and how these interactions are regulated by the state of the surface.[16]

In order to protect abutments against such pollutants, plasma cleaning of customized abutments has recently been advocated.[17] Plasma cleaning has been demonstrated *in vitro* to have a triple effect on titanium: cleaning, corrosion protection and increased surface energy.[18, 19] However, there is a lack of evidence in the literature regarding the clinical relevance of a plasma cleaning procedure performed on dental implant abutments.

Although there are certain differences in the inflammatory response and in the bacterial population, the beagle dog model has been extensively used in experimental study because of its size and its extremely cooperative nature. Although some major differences exist between dogs and humans, all periodontal tissues and the size of the teeth are quite similar to those observed in humans. Furthermore, they are a very inbred type of animal with very limited anatomical differences between the various dogs.

The aim of this animal study was to assess histologically soft- and hard-tissue adaptation after insertion of cleaned and activated titanium implant abutments. The null hypothesis was that argon plasma cleaning treatment of abutments does not have any positive or detrimental effect on periimplant bone remodeling and soft-tissue adhesion.

Materials and methods

Subjects

This study followed the ARRIVE guidelines.[20] The research protocol was approved by the local ethics committee for animal research at the University of São Paulo, Ribeirão Preto, Brazil.

Eight beagle dogs were used for the experiment. The animals were pre-anesthetized for all surgical procedures with Acepran 0.2% (0.05 mg/kg; Univet-vetnil, São Paulo, Brazil) and sedated with Zoletil (10 mg/kg; Virbac, St. Louis, Mo. U.S.), and the maintenance of the anesthesia was performed with inhalation of Forane (Baxter Hospitalar, São Paulo, Brazil).

All mandibular premolars and the first molars were extracted bilaterally and after three months, a crestal incision was performed in the premolar–molar region of one randomly selected side of the mandible. Full-thickness mucoperiosteal flaps were elevated, and four experimental sites were selected in the edentulous alveolar ridges of the mandible, two in the anterior and two in the distal regions. The surgical preparation of the sites was performed accord-