Surface chemistry cells can’t resist.

Introducing Xeal and TiUltra – two new breakthrough surfaces derived from our decades of applied anodization expertise. From abutment to implant apex, we have reimagined surface chemistry and topography to optimize tissue integration at every level. We’ve now entered the Mucointegration™ era.

The new Xeal surface is now available for the On1™ Base and the Multi-unit Abutment. TiUltra is available on our best selling NobelActive® and NobelParallel™ CC implants.
IT'S SIMPLE TO BE A WINNER

The biological stability and predictable esthetics of the SEVEN, combined with the extensive research and development process have given the SEVEN a potential advantage in soft tissue preservation and growth as well as an array of restorative benefits. Learn more about the SEVEN implant system and MIS at www.mis-implants.com

PROVEN SUCCESS MEETS ENHANCED STABILITY. MAKE IT SIMPLE

MIS GLOBAL CONFERENCE

May 14 - 17, 2020

Marrakech, Morocco
In the world, there are 500 million of completely edentulous people. Edentulism has a significant impact on quality of life: esthetic concerns due to alteration of the vertical dimension and facial profile, decreased masticatory efficiency, temporomandibular joint dysfunction and problems associated with the use of removable complete prostheses, such as stomatitis, angular cheilitis, oral candidiasis, ulcers and hyperplasia.\textsuperscript{1,2} Edentulism has repercussions in social life and day-to-day activities. Edentulous patients may feel embarrassed when talking, smiling or eating in front of other people, and this can lead to social isolation and subsequent loneliness.\textsuperscript{3}

The best solution for patients with complete edentulism is rehabilitation with prostheses supported on implants. Improved oral health and quality of life can be seen in edentulous patients with atrophied maxillae after implant treatment with an immediate loading protocol.\textsuperscript{4} It is frequent that edentulous patients present severe bone atrophy. In these cases we should ask ourselves whether we need to regenerate before placing the implants or if can use the residual pristine bone. Therefore, we must establish whether it is better to place an implant with or without bone grafting.

A problem of regenerative procedures is bone graft resorption. Volumetric measurements of the grafts evidence progressive and unavoidable bone resorption of almost all the grafted bone in the maxilla and mandible. In a study with a number of years of follow-up, after vertical and horizontal alveolar ridge augmentation of atrophic maxillae and mandibles with autogenous crest block bone grafts, very high percentages of bone graft resorption were found.\textsuperscript{5} The use of anatomical buttresses is an alternative that overcomes the higher morbidity and higher treatment fees of regenerative procedures, as well as the longer postoperative periods for delivery of the definitive restorations. Flying buttresses are external discharge elements used in Gothic architecture in the form of a half arch. Buttresses collect the pressure at the start of the vault and transmit it to another buttress attached to the wall of a lateral nave. They were first used in 1180 in the construction of the central nave of the Notre Dame of Paris to reinforce its vault. In orofacial structures, buttresses are areas of dense bone that form a protective frame and dissipate forces around the craniofacial cavities: fronto-maxillary buttress, pterygomaxillary buttress, zygomatic buttress, palatal cortical bone and nasopalatine duct (an additional area of residual bone).\textsuperscript{6–8}

A study that compared conventional dental implants placed in augmented atrophic maxillae and the placement of implants in buttresses found a greater loss of implants in the augmentation group.\textsuperscript{9} It also found that the mean period for functional restoration was 1 week in the buttresses group and more than 1 year in the augmented patients.\textsuperscript{9}

Prof. Miguel Peñarrocha Diago
Editor-in-Chief
Contents

3 Editorial
Prof. Miguel Peñarrocha Diago

6 About the Journal of Oral Science & Rehabilitation

8 Marino Sánchez-Siles et al.
Evaluation of primary stability and early healing of 2 implant macrodesigns placed in the posterior maxilla: A split-mouth prospective randomized controlled clinical study

16 Guillermo Cabanes Gumbau et al.
All-on-4 with tapered neck implants and a hybrid prosthesis with a fiberglass-reinforced structure (TriLor Arch)

24 Lim Min Jim
An unusual case of sublingual ranula with submandibular gland involvement

28 Igor da Silva Brum et al.
Immediate dentoalveolar restoration

36 Guidelines for authors

38 Imprint — About the publisher
Welcome to MasterClass.Dental

Online classes taught by the world’s best doctors
directly from their practice

OBSERVE
DISCUSS
YOUR CASE
ON DEMAND
ALL DEVICES
GUARANTEED

www.MasterClass.Dental

Tribune Group GmbH designates this activity for 1 continuing education credits.

This continuing education activity has been planned and implemented in accordance with the standards of the ADA Continuing Education Recognition Program (ADA CERP) through joint efforts between Tribune Group GmbH and Dental Tribune Int. GmbH.
About

The aim of the *Journal of Oral Science & Rehabilitation* is to promote rapid communication of scientific information between academia, industry and dental practitioners, thereby influencing the decision-making in clinical practice on an international level.

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.

Papers submitted to the *Journal of Oral Science & Rehabilitation* are subject to rigorous double-blind peer review. Papers are initially screened for relevance to the scope of the journal, as well as for scientific content and quality. Once accepted, the manuscript is sent to the relevant associate editors and reviewers of the journal for peer review. It is then returned to the author for revision and thereafter submitted for copy editing. The decision of the Editor-in-Chief is made after the review process and is considered final.

About Dental Tribune Science

Dental Tribune Science (DT Science) is an online open-access publishing platform ([www.dtscience.com](http://www.dtscience.com)) on which the *Journal of Oral Science & Rehabilitation* is hosted and published.

DT Science is a project of the Dental Tribune International Publishing Group (DTI). DTI is composed of the leading dental trade publishers around the world.

For more, visit → [www.dental-tribune.com](http://www.dental-tribune.com)
Benefits of publishing in the journal for authors

There are numerous advantages of publishing in the *Journal of Oral Science & Rehabilitation*:

- Accepted papers are published as e-papers on [www.dtscience.com](http://www.dtscience.com); abstracts are published on [www.dental-tribune.com](http://www.dental-tribune.com).

- Authors’ work is granted exposure to a wide readership, ensuring increased impact of their research through open-access publishing on [www.dtscience.com](http://www.dtscience.com).

- Authors have the opportunity to present and promote their research by way of interviews and articles published on both [www.dtscience.com](http://www.dtscience.com) and [www.dental-tribune.com](http://www.dental-tribune.com).

- Authors can also post videos relating to their research, present a webinar and blog on [www.dtscience.com](http://www.dtscience.com).

Information

The journal is published quarterly. Each issue is published as an e-paper on [www.dtscience.com](http://www.dtscience.com).

Copyright © Dental Tribune International GmbH. Published by Dental Tribune International GmbH. All rights reserved. No part of this publication may be reproduced, stored or transmitted in any form or by any means without prior permission in writing from the copyright holder.
Evaluation of primary stability and early healing of 2 implant macrodesigns placed in the posterior maxilla: A split-mouth prospective randomized controlled clinical study

Marino Sánchez-Siles,* Joao Baptista Ilha,b Juan Alberto Fernández Ruizc & Fabio Camacho Alonso d

a Private practice, Murcia, Spain 
b Department of Oral Practice, State University of Maringá, Maringá, Brazil
c Private practice, Ibiza, Spain 
d Department of Oral Surgery, University of Murcia, Murcia, Spain

Corresponding author:
Dr. Fabio Camacho Alonso
Clinica Odontológica Universitaria
Unidad Docente de Cirugía Bucal
Hospital Morales Meseguer (2 planta)
Avda. Marqués de los Vélez s/n
30008 Murcia
Spain
fcamacho@um.es


Materials and methods
In this split-mouth prospective randomized controlled clinical study, 60 Avinent dental implants (Avinent Implant System) were placed in the posterior maxillae of 30 patients. Each patient received 1 tapered implant with a wide thread (OCEAN) and 1 cylindrical implant with a narrow thread (CORAL). Primary stability was evaluated at baseline by measuring the insertion torque applied and registering the implant stability quotient (ISQ). Periimplant crestal bone loss was evaluated from intraoral radiographs taken at 1 and 4 months after implant placement. Lastly, ISQ was registered after 4 months.

Results
At baseline, both insertion torque and ISQ values were significantly higher for tapered implants (P = 0.008). There was less periimplant crestal bone loss at 1 and 4 months with tapered implants with a wide thread (0.43 ± 0.27 mm and 0.59 ± 0.31 mm, respectively) than with cylindrical implants with a narrow thread (0.73 ± 0.28 mm and 0.95 ± 0.43 mm, respectively), and the differences at both evaluation times were significant (P < 0.001 and P = 0.001, respectively). The ISQ values at 4 months were higher for tapered implants with a wide thread, and the difference was significant (P = 0.014).

Conclusion
Although both implant macrodesigns can be placed in low-density bone, tapered implants with a wide thread appear to produce better results in terms of insertion torque, ISQ and crestal bone loss 4 months after placement.

Keywords: Dental implant macrodesign; tapered implant; cylindrical implant; low-density bone; thread.
Introduction

Bone density and especially cortical thickness are important factors in achieving adequate primary stability and a successful clinical outcome when placing dental implants. Primary stability is defined as the absence of movement after the intraosseous insertion of the implant. Different types of bone in the jaws have been clinically classified in various ways according to structural characteristics related to the proportion of cortical to trabecular bone. The most commonly used classification is that of Lekholm and Zarb, according to which type I is the most densely compacted bone type, and type IV the most trabeculated, with lower density and thinner cortical bone, which is generally considered less suitable for supporting dental implants. Nevertheless, none of the classification systems take the bone’s biological capacity into account.

In recent years, various quantitative methods for assessing primary stability have been introduced. These can be used to monitor implant stability repeatedly over time. Resonance frequency analysis (RFA) consists of applying a bending load that imitates clinical implant loading and its direction. This provides information about the rigidity of the bone-to-implant union, and the result is registered as a parameter known as the implant stability quotient (ISQ). ISQ values range from 1 (low stability) to 100 (maximum stability). Alternatively, insertion torque is a direct measure of the bone’s cutting resistance during implant insertion surgery. But insertion torque is a mechanical parameter that can be influenced by the surgical procedure, implant design and bone quality.

The success of an implant depends largely on its primary stability, as mechanical stability provides a basis for osseointegration. Bone density and quality, surgical technique, primary stability and, of course, the implant’s geometry are all important factors in achieving implant osseointegration.

Implant design and shape have undergone various modifications over the years, aimed at increasing the contact between implant surface and bone, and increasing primary and secondary stability. An adequate macrodesign must balance compression and traction forces and minimize shear forces, to maintain micromovement at a level below 50–150 µm during the healing period. A tapered shape provides the implant with a good basis for primary stability, as it allows the gradual expansion of the bone and minimizes stress at its interface with the surrounding bone. It has been shown clinically that implants with a tapered design present better stability in areas with lower bone density. The pitch and shape of the thread also influence primary stability, stress and initial bone-to-implant contact. According to some studies, a reduced pitch improves surface contact with bone, reduces the distribution of stress and improves primary stability in low-density bone.

Thus, the aim of this split-mouth prospective randomized controlled study was to evaluate the clinical behavior of 2 implants of different macrodesigns at the moment of insertion in the low-density bone of the posterior upper jaw and during bone healing.

Methods and materials

Recruitment and patient characteristics

The study protocol was approved by the University of Murcia’s ethics committee (Spain) (1933/2018) and was carried out between June 2018 and December 2018 at the university’s dental clinic. Subjects were treated according to guidelines established by the Declaration of Helsinki for medical research involving human subjects. All the subjects provided their informed consent to participate. The entire protocol (clinical, surgical and radiographic) was carried out by a single clinician.

The inclusion criteria were as follows: aged over 18 years; total edentulism in the maxilla necessitating bilateral implant insertion in the posterior third in type III bone within a range of 350–830 Hounsfield units (HU), according to Norton and Gamble’s classification; absence of medical contraindications to oral surgical procedures (ASA I/II); and willingness to provide informed consent to take part. The exclusion criteria were as follows: presence of a disease or condition or use of medication that could compromise healing or osseointegration (diabetes mellitus, severe osteoporosis or bisphosphonate administration); pregnancy or lactation; and radiotherapy of...
the head and neck during the previous 18 months; and refusal to provide informed consent to take part.

Thirty patients fulfilled the inclusion criteria and were invited to take part in the trial. Before surgery, the patients' sociodemographic data were registered, as well as their status regarding smoking and alcohol consumption, and their complete medical histories.

Bone mineral density measurements
To measure bone mineral density (BMD) in the maxillary posterior third in cone beam computed tomography (CBCT) images, a 3D circular region of interest was determined in each and it was between 10 and 20 mm² in area. BMD was calculated in HU. The CBCT images were taken using a Kodak CS 8100 CBCT unit (Kodak) with the following specifications: 18 × 21 cm field of view, 90 kVp, 10 mA, exposure time of 15 s, and spatial resolution of 10 lp/cm and 0.2 mm voxel size. This CBCT unit was calibrated every 6 months in accordance with the Spanish Royal Decree of Dec. 23, 1976/1999. Images were constructed with Carestream 3D imaging software (Carestream Health).

Dental implant surgery and randomization
All the surgical interventions were performed under local anesthesia (1:100,000 articaine) by a single clinician at the same drilling speed of 50 rpm with irrigation. Each patient received 2 Avinent dental implants (Avinent Implant System), 1 tapered implant with a wide thread (OCEAN) and 1 cylindrical implant with a narrow thread (CORAL). The insertion of one or the other design in each posterior region was determined using an online randomization service (www.randomization.com). The characteristics of the tapered implant with a wide thread were as follows: internal hex connection, wide thread pitch (1.5 mm), square-shaped thread and thread depth of 0.5 mm. The characteristics of the cylindrical implant with a narrow thread were as follows: narrow thread pitch (0.5 mm), V-shaped thread and thread depth of 0.36 mm (Figs. 1 & 2). The insertion torque of the 60 implants was registered with an Implantmed SI-1023 surgical micromotor (W&H), first establishing an initial insertion torque of 20 N cm and then increasing torque by 5 N cm increments as necessary until the required insertion torque was reached. All the implants were submerged. No healing abutments or provisionalization crowns were placed during the 4-month healing period. In all the cases, the postoperative medication prescribed was amoxicillin (500 mg) every 8 h for 7 days (in case of penicillin allergy, clindamycin [300 mg] every 8 h was prescribed) and ibuprofen (600 mg) every 8 h for 3 days.

Resonance frequency analysis
RFA was performed at baseline and 30 days after implant insertion using the Osstell Mentor (Integration Diagnostics). Each measurement was performed twice, 1 from each 90° angle, parallel to the crestal line; the highest ISQ value was taken as the reference value.

Radiographic parameters
For evaluation of radiographic bone loss (1 and 4 months after implant placement), a digital radiographic system (RVG 5100, Kodak) was used with...
### Patient sample characteristics

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Patients:</strong> n</td>
<td>30</td>
</tr>
<tr>
<td><strong>Age (years): mean ± SD(^\dagger)</strong></td>
<td>64.07 ± 9.02</td>
</tr>
<tr>
<td><strong>Sex: n (%)</strong></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>9 (30.00)</td>
</tr>
<tr>
<td>Female</td>
<td>21 (70.00)</td>
</tr>
<tr>
<td><strong>Smoking status: n (%)</strong></td>
<td></td>
</tr>
<tr>
<td>Nonsmoker</td>
<td>22 (73.34)</td>
</tr>
<tr>
<td>≤ 10 cigarettes</td>
<td>4 (13.33)</td>
</tr>
<tr>
<td>11–20 cigarettes</td>
<td>4 (13.33)</td>
</tr>
<tr>
<td><strong>Alcohol consumption: n (%)</strong></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>25 (83.33)</td>
</tr>
<tr>
<td>Daily</td>
<td>2 (6.67)</td>
</tr>
<tr>
<td>Weekend drinker</td>
<td>3 (10.00)</td>
</tr>
<tr>
<td><strong>Diseases: n (%)</strong></td>
<td></td>
</tr>
<tr>
<td>Arterial hypertension</td>
<td>9 (30.00)</td>
</tr>
<tr>
<td>Auricular fibrillation</td>
<td>1 (3.33)</td>
</tr>
<tr>
<td>Acute myocardial infarction</td>
<td>1 (3.33)</td>
</tr>
<tr>
<td>Hypercholesterolemia</td>
<td>3 (10.00)</td>
</tr>
<tr>
<td>Fibromyalgia</td>
<td>1 (3.33)</td>
</tr>
<tr>
<td>Anxiety</td>
<td>3 (10.00)</td>
</tr>
<tr>
<td>Depression</td>
<td>2 (6.67)</td>
</tr>
<tr>
<td>Diabetes mellitus type II</td>
<td>2 (6.67)</td>
</tr>
<tr>
<td>Thyroid hypofunction</td>
<td>2 (6.67)</td>
</tr>
<tr>
<td>Chronic obstructive bronchitis</td>
<td>1 (3.33)</td>
</tr>
</tbody>
</table>

\(^\dagger\) SD = standard deviation.

**Table 1:** Study population characteristics.
Primary stability of 2 implant macrodesigns

Rinn XCP support (DENTSPLY RINN). All the radiographs were captured at 70 kV, 8 mA and a focal distance of 30 cm. Mesial, distal and total crestal bone loss (mesial + distal/2; vertical distance from the implant shoulder to the first bone-to-implant contact) were measured using ImageJ digital image analysis software (Version 1.46, National Institutes of Health).

Statistical analysis
Data were analyzed using the SPSS statistical package (Version 20.0, IBM Corp.). A descriptive study of each variable was performed. The Student t test for 2 independent samples was used in application to quantitative variables, in each case determining whether variances were homogeneous. Statistical significance was established at P ≤ 0.05.

Results
This study recruited 30 patients (9 men and 21 women), with an average age of 64.07 ± 9.02 years. Most did not smoke (73.34%) or drink alcohol (83.33%; Table 1). At baseline, both insertion torque and ISQ values were higher for tapered implants with a wide thread (29.14 ± 3.85 and 53.66 ± 2.04, respectively) than for cylindrical implants with a narrow thread (26.25 ± 3.94 and 49.48 ± 7.66, respectively), and the differences in insertion torque were statistically significant (P = 0.008; Table 2). There was less periimplant crestal bone loss at 1 and 4 months with tapered implants (0.43 ± 0.27 mm and 0.59 ± 0.31 mm, respectively) than with cylindrical implants (0.73 ± 0.28 mm and 0.95 ± 0.43 mm, respectively), and the differences at both evaluation times were significant (P < 0.001).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Tapered implants with wide thread (n = 30)</th>
<th>Cylindrical implants with narrow thread (n = 30)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insertion torque value (N cm; mean ± SD†)</td>
<td>29.14 ± 3.85</td>
<td>26.25 ± 3.94</td>
<td>0.008</td>
</tr>
<tr>
<td>ISQ value (mean ± SD)</td>
<td>53.66 ± 12.04</td>
<td>49.48 ± 7.66</td>
<td>0.118</td>
</tr>
</tbody>
</table>

† SD = standard deviation. Table 2: Comparison of primary stability (at baseline) between study groups (Student t test).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Tapered implants with wide thread (n = 30)</th>
<th>Cylindrical implants with narrow thread (n = 29)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-month M + D/2† radiographic bone loss (mm; mean ± SD‡)</td>
<td>0.43 ± 0.27</td>
<td>0.73 ± 0.28</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>4-month M + D/2† radiographic bone loss (mm; mean ± SD)</td>
<td>0.59 ± 0.31</td>
<td>0.95 ± 0.43</td>
<td>0.001</td>
</tr>
<tr>
<td>4-month M + D/2 ISQ value (mean ± SD)</td>
<td>54.21 ± 7.67</td>
<td>49.25 ± 7.24</td>
<td>0.014</td>
</tr>
</tbody>
</table>

† M + D/2 = average mesial and distal surface values; ‡ SD = standard deviation. Table 3: Comparison of implant osseointegration between study groups (Student t test).
and \( P = 0.001 \), respectively; Table 3). Lastly, the ISQ values at 4 months after implant insertion were higher for tapered implants (54.21 ± 7.67) than for cylindrical implants (49.25 ± 7.24), and the difference was statistically significant (\( P = 0.014 \); Table 3).

**Discussion**

This study included 30 patients who received a total of 60 dental implants in the posterior third of the maxilla (with low type III BMD), 30 with a tapered design with a wide thread and 30 with a cylindrical design with a narrow thread. Insertion torque, ISQ and crestal bone loss were measured during the first 4 months of healing.

Insertion torque was found to be higher for tapered implants than for cylindrical implants. This finding coincides with the results obtained in most other investigations of this topic. Menicucci et al. compared insertion torque achieved for tapered and cylindrical implants and also obtained significantly higher torque values for tapered implants (31.5 N cm) than for cylindrical implants (25.5 N cm). In 2000, O’Sullivan et al. also obtained similar results in an ex vivo study, and in 2006, Akça et al. concluded that tapered implants achieve higher insertion torque than cylindrical implants do. They also argued that insertion torque values are more sensitive than ISQ values in terms of revealing biomechanical conditions at the bone-to-implant interface.

As for ISQ, tapered implants obtained higher values both at baseline and after 4 months of osseointegration (although without a statistically significant difference at baseline). Other studies have also registered ISQ obtaining higher values for tapered implants than for cylindrical implants. This finding could be due to tapered implants exerting higher lateral compression force against the crestal and middle bone walls, leading to small differences in ISQ values between implant types, despite significant differences in insertion torque. Similar results were obtained by Sakoh et al., who found no differences in ISQ values between tapered and cylindrical implants in an in vitro study. Other authors have also reported that, although insertion torque was higher for tapered implants, ISQ values were similar for the 2 types of implant.

Thread geometry can be considered an important factor of implant stability and osseointegration. In a study by Steigenga et al., 72 implants with differing thread geometries were placed (V-shaped vs. square-shaped thread) in 12 New Zealand rabbit tibias. After 12 weeks, the outcomes were analyzed by radiography and histomorphometric analysis, registering the bone-to-implant contact area and reverse torque. It was concluded that the square thread shape obtained better results in all the analyses performed.

Few studies have been published on the influence of implant shape on implant stability, osseointegration and survival when the implant is placed in low-density bone (such as the posterior third of the maxilla), as shown by the systematic review by Alshehri and Alshehri of clinical studies in humans of tapered and/or cylindrical implants in the posterior maxilla. For this reason, further prospective clinical trials are needed to confirm that tapered implants could be a better option for maximizing primary stability and bone healing in critical areas with low bone density.

**Conclusion**

In conclusion, although both the implant designs tested (tapered and cylindrical) may be inserted in low-density bone (such as the posterior third of the maxilla), tapered implants with a wide thread would appear to offer better results in terms of insertion torque, ISQ and crestal bone loss at 4 months after insertion.

**Competing interests**

The authors declare that they have no competing interests.

**Figure legends**

Fig. 1 – Tapered implant with wide thread (A = 3.5 mm, B = 11.5 mm, F = 1.5 mm, G = 0.5 mm, H = 4.1 mm).

Fig. 2 – Cylindrical implant with narrow thread (A = 4.1 mm, B = 11.5 mm, F = 0.5 mm, G = 0.36 mm, H = 4.1 mm).
Primary stability of 2 implant macrodesigns

References


All-on-4 with tapered neck implants and a hybrid prosthesis with a fiberglass-reinforced structure

Guillermo Cabanes Gumbau, Álvaro Canet López, Miguel Peñarrocha Diago & Maria Peñarrocha Diago

Oral Surgery Unit, Department of Stomatology, Faculty of Medicine and Dentistry, University of Valencia, Valencia, Spain

Corresponding author:

Dr. Álvaro Canet López
Universidad de Valencia
Facultad de Medicina y Odontología
Clínica Odontológica. Cirugía bucal
C/ Gascó Oliag, 1
46021 Valencia
Spain
falvarocanet@hotmail.com

How to cite this article: Cabanes Gumbau G, Canet López Á, Peñarrocha Diago M, Peñarrocha Diago M. All-on-4 with tapered neck implants and a hybrid prosthesis with a fiberglass-reinforced structure. J Oral Science Rehabilitation. 2019 Sep;5(3):16–23.

Abstract

Introduction
The All-on-4 treatment concept (Nobel Biocare) was developed to optimize the use of remaining bone in atrophic mandibles, allowing immediate rehabilitation and avoiding the need for other regenerative procedures that increase morbidity and cost. The treatment protocol involves the placement of 4 implants in the anterior maxillary segment or in the space between the mental foramina of the mandible. The 2 most anterior implants are positioned axially, while the 2 posterior implants are distalized and tilted in order to minimize the cantilever length and thus allow extension of the prosthesis to the area of the first molar, thereby improving masticatory efficiency. This treatment strategy affords promising results over the short and middle term and is highly successful in terms of implant survival rate, as described in the literature, provided adequate surgical and prosthetic protocols are used.

Clinical case
A 68-year-old woman presented with teeth in the anterior mandibular segment, numerous caries-affected teeth, missing teeth in the posterior segment, and mandibular bone atrophy. An All-on-4 procedure for immediate occlusal loading on 4 implants with a resin provisional fixed prosthesis was planned. Restoration with the definitive fixed prosthesis took place 6 months after surgery.

Conclusion
In atrophic mandibles, the use of tapered neck implants in conjunction with a novel nonmetallic fiberglass- and resin-reinforced structure (TriLor Arch) through an All-on-4 technique, provides adequate functional and aesthetic results after 2 years of follow-up.

Keywords: All-on-4; tilted implants; dental prostheses; immediate occlusal loading; fiberglass-reinforced composite structure.
Primary implant stability is an essential pre-requisite for immediate loading, it can be improved by adapting drilling protocols to enhance lateral compression of the bone and by using tapered implant designs. The prosthetic restoration should provide rigidity and not be flexible in order to avoid micro-movements, and should be strong enough to not fracture.

The original Brånemark surgical and prosthetic protocol advocated the placement of 4 implants for the restoration of a resorbed mandible and 6 implants in the case of mandibles with minimal or moderate resorption. Other guidelines were subsequently also developed. The present clinical case describes the results after 2 years of follow-up in a patient subjected to All-on-4 rehabilitation involving 2 novel elements that appear to offer interesting advantages over the conventional technique. From the surgical perspective, the dental implants used present a new tapered neck design, while from the prosthodontic perspective, the definitive prosthesis is manufactured with a novel nonmetallic fiberglass- and resin-reinforced structure (TriLor Arch, Harvest Dental Products).

Clinical case

A 68-year-old woman presented with teeth in the anterior mandibular segment, numerous caries-affected teeth, missing teeth in the posterior segment, and mandibular bone atrophy (Fig. 1). After extractions and preoperative examination, it was observed that the posterior segment was located close to the inferior alveolar nerve. An All-on-4 procedure was planned involving 4 Prama implants (Sweden & Martina, Padua, Italy), with immediate occlusal loading of the resin provisional fixed prosthesis. Restoration with the definitive fixed prosthesis with TriLor Arch internal reinforcement would take place 6 months after surgery.

Surgical technique

A full-thickness mucoperiosteal flap was raised with central and distal releasing incisions, allowing us to visualize emergence of the mental nerves and access the anterior bone. A 2 × 10 mm central bone perforation was performed, the axis coinciding with the facial midline, in order to insert the stem of a standard metal surgical guide with vertical marks to help orientate dental implant placement tilted at 30°, while also keeping the tongue away from the surgical field.

Two tilted distal implants (3.8 × 13.0 mm) were placed with a minimum insertion torque of 35–40 N cm. Transmucosal abutments were placed on the 2 distal implants to correct tilting in the screw-retained prosthesis, applying a torque of 25 N cm, and 2 provisional straight titanium abutments were fitted over them. Then, the beds of the 2 mesial implants were...
prepared, seeking to maintain equidistance and parallelism between them and the 2 distal abutments. Two cylindrical implants (3.8 × 11.5 mm) were placed in these positions with undersized drilling using conical burs and a minimum insertion torque of 35–45 N cm. Two provisional straight titanium abutments (Sweden & Martina, Padua, Italy) without a hexagonal base were screwed over these 2 central implants, with no need for an intermediate abutment thanks to the large transmucosal portion specific to implants of this kind. Panoramic radiographs were obtained, thereby completing the surgical phase of the All-on-4 procedure (Fig. 2).
Immediate occlusal loading prosthodontic technique

A thin layer of soft warm wax on the tissue aspect of the provisional prosthesis allowed pressure marking of the healing abutments as a simple way to indicate the location of the implants for making 4 perforations in the prosthesis where photopolymerizing fluid composite was used to splint the provisional titanium abutments directly in the mouth (Fig. 3). These abutments were then definitively incorporated into the prosthesis in the laboratory, the lateral posterior wings of the prosthesis were trimmed, and 3 h after surgery, we were able to position the prosthesis in the mouth with correct passive and occlusal fit (Fig. 4).

Prosthodontic technique for the definitive prosthesis

A screw-retained hybrid prosthesis containing a fiberglass- and resin-reinforced structure (TriLor Arch) was manufactured. The definitive prosthetic phase started by unscrewing the provisional prosthesis, performing hygiene and fitting 4 transfer copings for impression taking using the open-tray technique with silicone of 2 consistencies. The impression thus obtained recorded the positioning of the implants and of the soft tissue (Fig. 5).

A mandibular baseplate was prepared in the laboratory for a maxillomandibular relationship record to determine the vertical dimension. The provisional prosthesis also served as reference, thanks to correct adaptation and patient comfort. The passive fit of the resin-splinted definitive abutments was checked, and the assembly was sent to the laboratory again (Fig. 6).

Separate testing was done of the teeth and TriLor Arch bar, which bore the orifices for fitting of the definitive abutments, and these were later cemented in the laboratory (fixed with dual-polymerizing composite cement [URC Bioloren]). The occlusion was checked, and the assembly was sent to the laboratory for integration of the TriLor Arch structure to the tooth (Fig. 7). The definitive prosthesis therefore contained the reinforcing structure integrated into the resin, which had
convex compressive fit on its tissue aspect, in the inter-implant zones, to facilitate hygiene and ensure less plaque retention (Fig. 8).

After 2 years of follow-up, correct periimplant soft tissue conditions were confirmed, as was integrity of the structure and good bone stability (Fig. 9). The mean marginal bone loss after 24 months was 0.5 ± 0.09 for tilted straight implants. A similar bone loss pattern between tilted and straight implants is observed. The bleeding on probing (BOP) according to Mombelli index was 0 in all implants. Hygiene was performed every 6 months, and the patient received instructions on how to maintain good implant conditions and health.
Discussion

The present 2-year follow-up study has provided a detailed description of the All-on-4 technique and shown it to be a reliable, immediate, simple, safe and cost-effective solution for the implant-based rehabilitation of patients involving immediate occlusal loading with a screw-retained prosthesis followed by the fitting of a hybrid prosthesis with a novel fiberglass- and resin-reinforced structure (TriLor Arch). Moreover, the use of tissue level implants with a tapered design at the transmucosal portion appears to offer a number of additional advantages thanks to the large transepithelial machined portion specific to implants of this kind.

Implants of this kind eliminate the need observed with other types of implants to perform aggressive drilling of the bone crest to accommodate the tilted implant in order to submerge its distal occlusal table in the bone and avoid mesial thread exposure. This type of treatment avoids the appearance of cratering effects arising from the location of the implant–transepithelial junction gap at infrabony level (Fig. 10).

There is no need to use transmucosal abutments on the 2 mesial straight implants on which the provisional titanium prosthesis is directly screwed. The resulting intraoral clinical work is more convenient as a result, and fewer screws and accessories are used. Furthermore, the chosen titanium abutment design, with anatomical emergence, facilitates smooth and hygienic fitting of the resin of the prosthesis on its tissue aspect facing the implant.

Frequent exposure of the polished neck of the implant secondary to physiological gingival retraction in the context of the postoperative tissue remodeling process is no problem for the definitive prosthesis, since the tapered coronal part of the implant has no limiting chamfer or shoulder, and the prosthesis can be freely adjusted over any level of its coronal hyperbolic portion.8–12
This All-on-4 immediate occlusal loading protocol for completely edentulous mandibles has yielded long-term success rates of over 95% at 7 years for implants and 99% for prostheses and a mean crestal bone loss of 1.81 mm at 5 years.\textsuperscript{13}

Biomechanical properties are an essential element in this rehabilitation protocol. The tilted implants afford an optimum distance between implants, allowing support of the free ends of the prosthesis.\textsuperscript{14} In a systematic review and meta-analysis no effect of implant inclination on implant survival or periimplant bone loss were found as in our case.\textsuperscript{15} With regard to the restoration phase in our patient, the novel fiberglass- and resin-reinforced internal structure appears to offer a number of interesting advantages. It consists of a new-generation polymer composed of thermally hardened resin with multidirectional fiberglass reinforcement. Such fiber-reinforced composites (FRCs) are used in aeronautical engineering and in many other fields where high resistance and low weight are key requirements. The multidirectional braided-fiber structure of the reinforcement offers good performance in terms of load and tension distribution in response to forces applied from different incident angles.

The technique simplifies the manufacture of reinforcing superstructures with passive fit by only requiring manual processing in the laboratory, with no need for CAD/CAM procedures. The preformed presentation in the form of a flat arc makes it possible to establish connecting structures between the implant abutments or reinforcing elements for removable prostheses. These structures and elements can easily be incorporated within the fiberglass- and resin-reinforced internal structure of the prosthesis, establishing true chemical bonding, in contrast to what is seen with metal reinforcement structures.

**Conclusion**

In the case reported, tapered neck implants with immediate occlusal loading based on the All-on-4 technique, with the use of a nonmetallic reinforcing structure in the hybrid prosthesis, afforded optimum biomechanical performance and hygiene after 2 years of follow-up. Further studies are needed to assess the mid- and long-term outcomes of the procedure.

**Competing interests**

The authors declare that they have no competing interests.

**Figure legends**

- **Fig. 1** – Initial panoramic radiographic view.
- **Fig. 2** – (A) Full-thickness mucoperiosteal flap. (B) Placement of the tilted distal implant with the surgical guide. (C) Implants placed with 2 transmucosal abutments to correct tilting of the distal implants. (D) Provisional straight titanium abutments. (E) Wound suture. (F) Final panoramic radiographic view after placement of the 4 Prama implants.
- **Fig. 3** – (A) Tissue aspect of the prosthesis coated with soft wax. (B) Perforations in the provisional complete prosthesis. (C) & (D) Fitting and splinting of the titanium abutments in the provisional prosthesis.
- **Fig. 4** – (A) Tissue aspect of the provisional prosthesis with the wings trimmed. (B) Provisional prosthesis placed 3 h after surgery. (C) Control radiograph after placing of the prosthesis.
- **Fig. 5** – (A) & (B) Impression using silicone of 2 consistencies, registering the soft tissue and implant positioning.
- **Fig. 6** – Mandibular baseplate for determining vertical dimension (A) and checking of passive fit of the resin-splinted abutments (B).
- **Fig. 7** – TriLor Arch structure with the orifices for fitting of the definitive titanium abutments with composite cement and wax tooth testing.
- **Fig. 8** – Completed definitive implant-supported hybrid prosthesis with TriLor Arch reinforcement.
- **Fig. 9** – (A) Tissue aspect of the prosthesis after 2 years. (B) & (C) Perimplant soft tissue condition after 2 years. (D) Panoramic radiographic view after 2 years of follow-up.
- **Fig. 10** – Advantages of tapered neck transmucosal implants (A) over conventional implants (B).

**References**

1. Maló P, Rangert B, Dvärsäter L. Immediate function of Brånemark implants in the esthetic zone: a retrospec-
tive clinical study with 6 months to 4 years of follow-up.
→ Clin Implant Dent Relat Res.

→ Clin Implant Dent Relat Res.

→ Clin Implant Dent Relat Res.

→ J Clin Exp Dent.

→ J Clin Exp Dent.

→ Periodontol.

→ Clin Oral Implants Res.

→ Clin Implant Dent Relat Res.
1999;1:2–16.

→ Quintessenza Int.

10. Loi I. Protesi su denti naturali nei settori di rilevanza estetica con tecnica BOPT: Case series report (Prosthesis on natural teeth in areas of aesthetic relevance with BOPT technique: Case series report).
→ Dent Cadmos.

→ Quintessenza Int.

→ Eur J Esthet Dent.


→ Clin Implant Dent Relat Res.

15. Apaza Alccayhuaman, KA, Soto-Peñaloza, D, Nakajima, Y, Papageorgiou, SN, Boticelli, D, Lang, NP. Biological and technical complications of tilted implants in comparison with straight implants supporting fixed dental prostheses. A systematic review and meta-analysis.
→ Clin Oral Implant Res.
2018; 29(Suppl. 18): 295–308.
An unusual case of sublingual ranula with submandibular gland involvement

Lim Min Jim

*Oral and Maxillofacial Surgery Unit, Hospital Tanah Merah, Kementerian Kesihatan Malaysia, Kelantan, Malaysia

Corresponding author:

Dr. Lim Min Jim
Pejabat Kesihatan Pergigian Daerah Tanah Merah
Jalan Pasir Mas
17500 Tanah Merah
Kelantan
Malaysia

minjimlim@hotmail.com

How to cite this article: Min Jim L. An unusual case of sublingual ranula with submandibular gland involvement. J Oral Science Rehabilitation. 2019 Sep;5(3):24–27.

Abstract

Background
A ranula is a diffuse swelling on the floor of the mouth resulting from extravasation of mucous secretion from salivary glands. A ranula is commonly presented as a painless, soft, mobile, slow-growing mass on the floor of the mouth. Occasionally, a ranula may present with misleading signs and symptoms. We present an unusual case of intraoral swelling associated with signs of submandibular gland involvement.

Methods
Ranulas of both the submandibular gland and the sublingual gland were suspected and excisions of both glands were planned. Surgical exploration revealed only sublingual gland swelling causing obstruction of the submandibular gland. Sublingual gland removal resulted in complete restoration of salivary flow from the submandibular gland.

Conclusion
This article highlights that misleading signs may lead to unnecessary surgery and cosmetic disfigurement, as submandibular gland excision is approached extraorally. If the pathology is suspected in both glands, an intraoral approach should be opted for first.

Keywords: Ranula; sublingual gland; submandibular gland; obstruction; sialadenitis.

Introduction

A ranula is formed mainly from extravasation of the saliva, forming cyst on the floor of the mouth. It can be derived from either the sublingual gland or the submandibular gland. The most common presentation of a ranula is as a soft, fluctuant, slow-growing mass on the floor of the mouth. If the ranula is left in situ, it may continue enlarging and thus cause compression of the nearby structures. In this paper, we report an unusual case of a ranula that originated from the sublingual gland, but presented with signs and symptoms of submandibular gland involvement.

Fig. 1
Case report

A 39-year-old female patient was referred to our oral and maxillofacial surgery department for an intraoral swelling that had persisted, waxing and waning, for 2 years. The swelling had been increasing in size gradually. It was associated with discomfort on the floor of mouth and pain in the right submandibular region. The patient was otherwise in good health with no history of systemic or constitutional symptoms.

There was no significant swelling in the head and neck region. However, tenderness was elicited on bimanual palpation over the left submandibular gland region. The overlying skin was normal in both color and temperature. Intraoral examination revealed a diffuse, soft, fluctuant swelling with a size of $4 \times 3$ cm on the right side of the floor of mouth (Fig. 1). The swelling was not tender or discolored and did not cross the midline. Posteriorly, the swelling extended up to the first molar. The right submandibular duct was not visible, unlike the contralateral duct. On milking of both submandibular glands separately, there was limited flow of saliva from the right submandibular duct opening compared with the left. Radiographic examination showed no sign of calcification (Fig. 2). An initial diagnosis of a ranula with sublingual gland and submandibular gland involvement was made, and surgery was advised.

After preparing the patient for the surgery, adequate local anesthesia was administered in the surrounding region. The lesion was approached intraorally through a mucosal incision directly above the swelling. Blunt dissection was performed carefully in the submucosal plane to reveal an enlarged sublingual gland with multiple well-encapsulated cysts attached to it. The right submandibular duct was located after careful dissection. The right submandibular duct was found to have been displaced by the swollen sublingual gland. It was positioned posteriorly and inferiorly in relation to the sublingual gland. Blunt dissection was performed around the sublingual gland to separate it from the surrounding tissue (Fig. 3). The sublingual gland with its duct was then completely excised. The right submandibular duct was checked again to ensure no dissection (Fig. 4). Immediately after the surgical site had been
closed and sutured, there was significant improvement in salivary flow from the right submandibular duct. Histological examination confirmed a ranula with moderate chronic inflammatory infiltration, suggestive of sialadenitis of the sublingual gland. The subsequent follow-up showed full recovery with no complication or recurrence (Fig. 5).

Discussion

A ranula is a cystic formation that develops from extravasation of saliva due to traumatic rupture of a salivary duct may lead to accumulation of saliva within the tissue. When the saliva-filled cyst herniates through the mylohyoid muscle into the submental or submandibular space, it is termed plunging ranula. However, the patient did not recall any trauma to the floor of the mouth. The decision to surgically excise the sublingual gland was made as quickly as possible owing to the fact that the patient experienced tenderness of the submandibular gland region.

The main concern for this patient was the tenderness on the right submandibular region, accompanied by reduced salivary flow from the submandibular duct. These signs indicated that there was a partial obstruction of the right submandibular duct. It was postulated that the enlargement of the sublingual gland had resulted in significant pressure on the submandibu-
lar duct. This postulation was proved intraoperatively, as the submandibular duct had been significantly displaced. A similar finding in the literature has been reported regarding a case in which the submandibular duct was compressed by a tumor originating from the sublingual gland. The partial obstruction of the submandibular duct could lead to the formation of a sialolith. In this case, the enlarged sublingual gland was compressing the submandibular duct. A sialolith is commonly formed in the submandibular gland, as it produces mainly mucous saliva with a high level of calcium and phosphate. If the surgical removal of the sublingual gland is further delayed, the submandibular duct may become fully obstructed. This may lead to the formation of a sialolith along the submandibular duct and gland, leading to sialadenitis of the submandibular gland. Although the occlusal radiograph did not show any radiopaque calculi in this case, it is critical to assess the salivary flow after removal of the sublingual gland. This is because 20% of sialoliths in the submandibular gland system are radiolucent. If the salivary flow is still obstructed, sialography may be required.

**Conclusion**

This case report highlights that misleading signs may lead to the wrong initial diagnosis. It is important to take into account the surrounding structure when treating a case of ranula. An incorrect diagnosis may lead to unnecessary surgery and cosmetic disfigurement, as submandibular gland excision is usually approached extraorally. If pathology of both glands is suspected, an intraoral approach should be opted for first.

**Acknowledgment**

We would like to thank the Director General of Health, Ministry of Health, Malaysia, for his permission to publish this article.

**Competing interests**

The author declares that he has no competing interests.

**Figure legends**

- **Fig. 1** – Intraoral swelling on the right side of the floor of the mouth.
- **Fig. 2** – Occlusal radiograph of the mandible shows no abnormalities.
- **Fig. 3** – Excision of sublingual gland.
- **Fig. 4** – Ensuring the right submandibular duct is intact.
- **Fig. 5** – Postoperative healing after 1 week. Good healing with slight inflammation.

**References**

Immediate dentoalveolar restoration

Igor da Silva Brum, a Renan Ferreira Natal, a Jorge Luís da Silva Pires, a Paulo Gonçalo Pinto dos Santos, a Marco Antonio Alencar de Carvalho, a Jorge José de Carvalho a

a Department of Implantology, faculty of Dentistry, State University of Rio de Janeiro, Rio de Janeiro, Brazil

Corresponding author:
Dr. Igor da Silva Brum
Universidade do Estado do Rio de Janeiro
Rua Leite Ribeiro 122, Apt. 702 Fonseca
Niterói—RJ
2412-210
Brazil


Abstract

Background
The replacement of an anterior tooth with an implant has become frequent in the daily routine of an implantologist. This procedure is an enormous challenge because of its esthetic potential and possibility of implant failure. In this article, we report a case of immediate dentoalveolar restoration, based on the 1-stage protocol proposed by José Carlos Martins da Rosa.

A 57-year-old female patient presented with pain and a fractured root with mobility of the crown. After analysis of the cone beam computed tomography scan, fracture of the maxillary left central incisor was confirmed and periapical inflammatory lesions affecting both central incisors could be seen. A cross-sectional image revealed substantial loss of the buccal bone wall and confirmed the 7 mm probing depth.

The treatment entailed atraumatic extraction of both central incisors, curettage and preparation of the sockets. Two provisional crowns were fabricated previously using composite, simulating the implants’ position on the cast. The implants and abutments were placed. The crowns were adjusted. A cortical triangular bone graft was removed from the maxillary tuberosity and inserted into the socket of the left central incisor. After that, the provisional restorations were reinserted to seal the gingival margin. After 1 week, the patient showed no postoperative pain or swelling. No mobility of the crowns or implants was observed. Periodic follow-ups were necessary to assess bone formation in the grafted area and to check whether the gingival profile had been maintained.

Conclusion
The technique proved to be clinically effective for esthetic edentulous areas and showed significant predictability of results. Throughout the follow-up, the stability of the hard and soft tissue had been observed.

Keywords: Dental implant; fresh socket; immediate provisionalization; immediate loading; maxillary tuberosity; autologous bone graft.

Introduction
Periapical infections caused by periodontal disease, fractures, endodontic lesions or root resorption may directly promote severe alveolar bone resorption and soft-tissue loss surrounding the tooth. When such infections are present, more surgical procedures may be needed to regenerate and prepare the tissue to receive the implant. The lack of a buccal bone wall to support the attached gingiva can cause recession and papillary loss, influencing the esthetic characteristics. Furthermore, further reconstructive stages such as bone and soft-tissue grafts may be needed.

Owing to the evolution of implantology, techniques are being improved and the period of healing between surgery and prosthetic restoration is being reduced. Several authors have described success rates of higher
Immediate dentoalveolar restoration

than 90% for implants placed immediately after tooth extraction and immediately loaded using provisional crowns. The technique is indicated for low-stress areas and when initial stability has been achieved. Some papers have shown that certain forces are important for triggering a series of biological reactions that accelerate the bone repair process, thus supporting 1-stage implant treatment.²

Immediate implant placement followed by immediate loading can provide numerous advantages, such as reduced treatment time and procedures, a potentially lower cost and a smaller number of provisional crown adjustments. Furthermore, the esthetic benefits are the maintenance of the gingival architecture and a reduced loss of bone volume. If correctly planned and executed, the procedure promotes really impressive results, though there are requisites that must be followed for clinical safety. Among them are initial implant stability, adequate bone volume to accommodate the implant, no gingival recession, and proximity to vital structures.³

The immediate dentoalveolar restoration (IDR) technique was created to enhance the clinical efficacy and esthetics in these kinds of clinical cases. Furthermore, it reduces the treatment time and promote superior results. To achieve the expected esthetic results, careful surgical and prosthetic protocols are of great importance.⁴

Case report

A 57-year-old woman was referred to the department of implantology for treatment of her maxillary
central incisors. The patient complained of pain and a fractured root with mobility of the crown. She had no relevant medical history and denied deleterious habits such as smoking or alcohol consumption. Her oral hygiene was satisfactory. During the clinical examination, the left central incisor presented class I mobility and a probing depth of 7 mm in the buccal region, indicating a vertical bone defect (Fig. 1). A cone beam computed tomography (CBCT) scan was captured, from which fracture of the left central incisor was confirmed and periapical inflammatory lesions affecting both central incisors could be seen (Figs. 2a–c).

A cross section on the CBCT scan showed substantial loss of the buccal bone wall, which accounted for the deep probing depth at that aspect of the tooth. The maxillary right central incisor presented a recurrent periapical inflammatory lesion. Both maxillary central incisors had large metal core buildups. The mentioned features confirmed the need to extract the incisors. Subsequently, planning was performed based on the IDR technique, and the procedures to be performed were explained to the patient. The informed consent form was signed and a blood analysis was done to evaluate the patient's general health. The results permitted us to proceed with the surgical procedure.

**Pharmacological protocol**

Antibiotic therapy (amoxicillin, 1 g) was administered 1 h before the surgical procedure, and antibiotic doses (500 mg) 3 times a day for 7 days after the procedure were prescribed. Dexamethasone (4 mg, 2 tablets) was administered 1 h before the surgical procedure and continued twice a day for 3 days. Ibuprofen (600 mg, 1 tablet) 3 times a day for 5 days after the procedure was prescribed.
Technique

Local infiltration of anesthetic near the roots of the maxillary central incisors and a block of the nasopalatine nerve were done. Afterward, an intrasulcular incision was made following the contour of the incisors. Furthermore, periotomes and a manual root extractor were used to realize the minimally invasive procedure and avoid the necessity of flap creation. During the extraction, the inflammatory lesions came out attached to the roots (Fig. 3a). After the tooth removal, socket curettage was performed to remove any granulomatous tissue and the remains of the periodontal ligament. The fresh socket was evaluated using a millimeter probe to confirm the buccal bone defect observed on the CBCT scan (Fig. 3b).

The preparation of the sockets for the implants was performed approaching the palatal bone. Two Systhex implants were placed (Attract and Attract ts; Figs. 4a–d). Both implants were 3.5 mm in diameter and 12.0 mm in height, had a Morse taper connection and had undergone the same surface treatment. The initial torque achieved was approximately 45 N cm. The provisional crowns were fabricated using composite before the procedure and adjusted to the ideal emergence profile and vestibular-palatal angle. It is important to note the necessity of 3 mm in height, from the bone crest to the contact point, to stimulate coronal growth of the papilla. This distance extends from the bone crest to the contact point.

Anesthesia of the maxillary tuberosity was then administered and the triangular bone graft removed. The cortical bone fragment was positioned between the vestibular plate and the implant placed in the left central incisor region (Fig. 5). The right central implant did not need any grafting. The occlusion was adjusted for both incisors, and any occlusal contact was avoided. Thereafter, the provisional crowns were polished and reinserted. Finally, the tissue was sutured with simple stitches.

After the procedure, the patient was instructed to avoid any loading on the area for 3 months, as also spitting over 3 days. Application of a 0.12% chlorhexidine gluconate topical gel (Perioxidin, Gross) once a day before bedtime was recommended. Follow-ups were done once a week for 1 month and continued every 15 days for 1 month. After 1 week, the patient showed amazing results, with no complaint of post-operative pain or swelling. No mobility of the crowns or implants was observed. Periodic clinical monitoring is necessary to assess whether there has been bone formation in the grafted area and whether the gingival profile has been maintained over the years.
After 6 months, the period of bone remodeling and soft-tissue healing was done, and the periimplant tissue analyzed. Furthermore, a periapical radiograph was performed to evaluate the final aspect of the healing and bone–implant contact (Figs. 6a & b). The results showed complete adaptation of the periimplant tissue without any sign of inflammation.

Discussion
The IDR technique in compromised sockets of anterior teeth has been proved to be a complex clinical challenge. Immediate loading of implants placed immediately after extraction has been very well documented in the literature in cases where the supporting tissue is undamaged.\(^5\) Furthermore, for the initial stability, the

Final restoration
Prosthetic procedures were started with a transfer impression of the esthetic abutments. A final impression was carefully performed using autopolymerizing resin to copy the emergence profiles (Figs. 7a & b) and addition silicone for the impression (Figs. 8a–c). The working cast was sent to the laboratory for production of the metal superstructure and porcelain application. Monolithic ceramic crowns were prepared, adjusted and screwed onto the abutments (Figs. 9a–c). In both steps, periapical radiographs were taken to evaluate the adaptation level. Additionally, features such as emergence profile, contact point and esthetic were analyzed.
Immediate dentoalveolar restoration

biological changes that occur when immediate loading is performed are of great importance in the repair process. The maintenance of the tissue is more predictable than the re-covering of the buccal bone wall and the emergence profile.

According to Zhang, their analysis of patients who had received immediate, early or conventional loading showed that the patients who had undergone immediate loading had reduced marginal bone level changes in comparison with those who had not received immediate loading. Although, some factors, such as the loading protocol for non immediate loading, implant number and location, type of prosthesis, loading concept and follow-up time, could modify these results. Marginal bone level is a surrogate measurement for the esthetic outcome.

The cosmetology assessment has been used in some papers to analyze the clinical outcomes of treatment with dental implants. This index is of great importance and should be evaluated in further studies. When comparing immediate and non immediate loading, some authors found that the ideal gingival margin was achieved in more cases of immediate loading than in cases of conventional loading.

The loss of tooth support greatly increases the risk of poor esthetics reducing the predictability of results. Implants inserted in association with bone grafts or membranes are indicated for procedures on the esthetic zone, but function is restored only after the healing period. Many types of grafts have been used to restore bone and gingival defects. The maxillary tuberosity is one of the important donor areas mentioned in many papers for correcting socket defects in esthetic areas. This kind of graft has shown some advantages, such as bone malleability facilitating adaptation to the defect, greater speed of graft repair, the ease of harvesting and excellent postoperative recovery; however, the disadvantages are low bone quality, limited quantity of material and difficult surgical access.

In the present study, there was total adaptation of the soft tissue in relation to the metal-free zirconia prostheses. According to papers comparing the cell infiltration and expression of pro-inflammatory cyto-
kines (lymphocytes, plasma cells) between titanium and zirconia implant abutments, higher rates were found around the titanium abutments, and our clinical results showed the same.

In the present study, we can observe that the physical properties of zirconia, like those of other ceramics, can deteriorate over time; however, a long period is necessary for this deterioration to appear, so it is very safe to predict long-lasting results for customized zirconia crowns supported on implants.\(^\text{18}\)

**Conclusion**

The proposed technique, as described in the literature, has proved clinically effective for esthetic edentulous areas and shown significant predictability of results. The immediate reconstruction of the buccal plate with an autologous graft was an efficient procedure for recovering lost anatomical structure. Throughout the follow-up, the stability of hard and soft tissue was observed. Despite the positive outcomes, there is a need for further research to improve the technique and compare the results between different types of grafts for use in this type of case.

**Competing interests**

The authors declare that they have no competing interests.

**Legends**

Fig. 1 – Initial clinical condition.

Figs. 2a–c – Confirmation of fracture and inflammatory lesions on the CBCT scan.

Fig. 3a – Inflammatory lesion attached to the fractured tooth.

Fig. 3b – Confirmation of the probing depth and buccal bone loss.

Figs. 4a–d – Socket preparation and placement of the dental implants.

Fig. 5 – Maxillary tuberosity graft positioned between the vestibular plate and the implant.

Figs. 6a & b – Final aspect after 6 months of healing.

Figs. 7a & b – Copying the emergence profiles.

Figs. 8a–c – Final impression and working cast.

Figs. 9a–c – Final prosthesis.

**References**


Authors must adhere to the following guidelines

Informed consent
Patients have a right to privacy that should not be violated without informed consent. Identifying information, including patients’ names, initials or hospital numbers, should not be provided in the manuscript or visual material unless the information is essential for scientific purposes and the patient (or parent or guardian) has given written informed consent for publication. Informed consent for this purpose requires that an identifiable patient be shown the manuscript to be published. Authors should disclose to these patients whether any potential identifiable material might be available via the Internet, as well as in print after publication. Nonessential identifying details should be omitted. Informed consent should be obtained if there is any doubt that anonymity can be maintained. For example, masking the eye region in photographs of patients is inadequate protection of anonymity. If identifying characteristics are altered to protect anonymity, authors should provide assurance that alterations do not distort scientific meaning. When informed consent has been obtained, it should be indicated in the manuscript.

Human and animal rights
When reporting experiments on human subjects, authors should indicate whether the procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Declaration of Helsinki of 1975, as revised in 2013 (www.wma.net/policies-post/wma-declaration-of-helsinki-ethical-principles-for-medical-research-involving-human-subjects). If doubt exists whether the research was conducted in accordance with the Declaration of Helsinki, the authors must explain the rationale for their approach, and demonstrate that the institutional review body explicitly approved the doubtful aspects of the study. When reporting experiments on animals, authors should indicate whether institutional and national standards for the care and use of laboratory animals were followed. Further guidance on animal research ethics is available from the International Association of Veterinary Editors’ Consensus Author Guidelines on Animal Ethics and Welfare (static1.squarespace.com/static/53e1616b74e4b0528c244ec998/t/543acda6e4b094d04bcacab1/1413139878532/IAVE-AuthorGuidelines.pdf).

Preparing the manuscript text
General
The manuscript must be written in U.S. English. The main body of the text, excluding the title page, abstract and list of captions, but including the references, may be a maximum of 4,000 words. Exceptions may be allowed with prior approval from the publisher.

Authors will have the opportunity to add more information regarding their article, as well as post videos, present a webinar and blog on the DT Science website.

It is preferred that there be no more than six authors. If more authors have participated in the study, the contribution of each author must be disclosed at the end of the document.

Title
Capitalize only the first word and proper nouns in the title. Please include a running title as well. The running title should not exceed 45 characters, including spaces.

Author information
The following information must be included for each author:
• Full author name(s)
• Full affiliation (department, faculty, institution, town, country).

For the corresponding author, the following information should be included in addition:
• Full mailing address
• Email address

Abstract and keywords
The manuscript must contain an abstract and a minimum of 3, maximum of 6 keywords. The abstract should be self-contained, not cite any other work and not exceed 250 words. It should be structured into the following separate sections: objective, materials and methods, results, conclusion and keywords. For case reports, the sections should be background, case presentation, conclusion and keywords.

Structure of the main text
The body of the manuscript must be structured as follows:
• Introduction (no subheadings)
• Materials and methods
• Results
• Discussion
• Conclusion

Competing interests
Authors are required to declare any competing financial or other interests regarding the article submitted. Such competing interests are to be stated at the end of manuscript before the references. If no competing interests are declared, the following will be stated: “The authors declare that they have no competing interests.”
Acknowledgments
Acknowledgments (if any) should be brief and included at the end of the manuscript before the references, and may include supporting grants.

References
Authors are responsible for ensuring that the information for each reference is complete and accurate. All references must be cited within the manuscript. References appearing in the list but not in the manuscript will be removed. In-text citation should follow the citation-sequence format (e.g., “as discussed by Haywood et al.15”) using superscript numbers placed after the punctuation in the relevant sentence. The references must be numbered consecutively.

The reference list must be numbered and the references provided in order of appearance. For the reference list, the journal follows the citation style stipulated in Citing medicine: the NLM style guide for authors, editors, and publishers. The guidelines may be viewed and downloaded free of charge at www.ncbi.nlm.nih.gov/books/NBK7256/
The reference list may not exceed 50 references.

List of captions
Please provide the captions for all visual material at the end of the manuscript.

Abbreviations
Abbreviations should be used sparingly and defined when first used. The abstract and the main manuscript text should be regarded as separate documents in this regard.

Typography
• Use Times New Roman regular with a font size of 12 pt.
• Use double line spacing with blank lines separating sections and paragraphs.
• Type the text unjustified and do not apply hyphenation at line breaks.
• Number all of the pages.
• Use endnotes if necessary, but not footnotes.
• Greek and other special characters may be included.

Preparing the visual material
Requirements for images
Each image should be supplied separately and the following formats are accepted: PSD, TIFF, GIF and JPEG. The image must have a resolution of 300 dpi and must be no smaller than 6 cm × 6 cm.

Please number the images consecutively throughout the article by using a new number for each image. If it is imperative that certain images be grouped together, then use lowercase letters to designate these in a group (e.g., “Figs. 2a–c”).

Place the references to the images in your article wherever they are appropriate, whether in the middle or at the end of a sentence. Provide a caption for each image at the end of your article.

Requirements for tables
Each table should be supplied separately and in Microsoft Word format. Tables may not be embedded as images and no shading or color is to be used.

Tables should be cited consecutively in the manuscript. Place the references to the tables in your article wherever they are appropriate, whether in the middle or at the end of a sentence. Every table must have a descriptive caption, and if numerical measurements are given the units should be included in the column headings.

Supplements/supporting material
DT Science allows an unlimited amount of supporting material (such as datasets, videos or other additional information) to be uploaded. This material should be presented succinctly (in English). The author bears full responsibility for the content. Color, animated multimedia presentations, videos and so on are welcome and published at no additional cost to the author or reader. Please refer briefly to such material in the manuscript where appropriate (e.g., as an endnote).

Submit your research and clinical articles to
Dr. Miguel Peñarrocha Diago
at penarrochamiguel@gmail.com
or Dr. Daniele Botticelli
at daniele.botticelli@gmail.com

For all other requests, contact
Nathalie Schüller
at n.schueller@dental-tribune.com
T +49 341 48474-136

Dental Tribune International Publishing Group
Holbeinstr. 29
04229 Leipzig
Germany

www.dtscience.com
www.dental-tribune.com
I would like to subscribe to:

- **CAD/CAM** 2 issues per year
  - e-paper: €5.50 per issue
  - print: €30 annual subscription

- **ceramic implants** 2 issues per year
  - e-paper: €5.50 per issue
  - print: €30 annual subscription

- **cosmetic dentistry** 1 issue per year
  - e-paper: €5.50 per issue
  - print: €15 annual subscription

- **digital dentistry** 4 issues per year
  - e-paper: €5.50 per issue
  - print: €20 annual subscription

- **implants** 4 issues per year
  - e-paper: €5.50 per issue
  - print: €46 annual subscription

- **laser** 4 issues per year
  - e-paper: €5.50 per issue
  - print: €46 annual subscription

- **ortho** 2 issues per year
  - e-paper: €5.50 per issue
  - print: €30 annual subscription

- **prevention** 2 issues per year
  - e-paper: €5.50 per issue
  - print: €30 annual subscription

- **roots** 4 issues per year
  - e-paper: €5.50 per issue
  - print: €46 annual subscription

- **digital dentistry**
  - e-paper: €5.50 per issue
  - e-paper: €20 annual subscription
  - print: €46 annual subscription

- **implants**
  - e-paper: €5.50 per issue
  - e-paper: €20 annual subscription
  - print: €46 annual subscription

- **orthodontics**
  - e-paper: €5.50 per issue
  - e-paper: €20 annual subscription
  - print: €46 annual subscription

- **digital dentistry**
  - e-paper: €5.50 per issue
  - e-paper: €20 annual subscription
  - print: €46 annual subscription

- **implants**
  - e-paper: €5.50 per issue
  - e-paper: €20 annual subscription
  - print: €46 annual subscription

www.dental-tribune.com/shop/
Surface chemistry cells can't resist.

Introducing Xeal and TiUltra – two new breakthrough surfaces derived from our decades of applied anodization expertise. From abutment to implant apex, we have reimagined surface chemistry and topography to optimize tissue integration at every level. We've now entered the Mucointegration™ era.

The new Xeal surface is now available for the On1™ Base and the Multi-unit Abutment. TiUltra is available on our best selling NobelActive® and NobelParallel™ CC implants.