Combining standard and ultrashort implants in full-mouth rehabilitation

18 months of follow-up

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Introduction

The use of shorter implants was introduced in the early 1990s to overcome the necessity of complex and expensive bone augmentation procedures associated with implant therapies. In recent years, different proposals have been made regarding the length that would classify implants as short in comparison with standard implants. Now, there is consensus that implants with a length of ≥8 mm are considered as standard, 6–8 mm long implants are classified as short and implants with a length of <6 mm are defined as ultrashort.[1]

Since 2011, the results of several clinical trials regarding the predictability and the clinical reliability of ultrashort implants have been published, considered by themselves or in comparison with some of the most commonly utilised guided bone regeneration procedures. In 2012, Felice and co-workers reported a significant minor occurrence of complications in relation to 5x5 mm hydroxyapatite-coated implants compared with 11.5 mm long implants placed in augmented bone after six months of follow-up in a randomised clinical trial conducted on 80 patients (40 of them with a reduced height of bone below the maxillary sinus and 40 over the mandibular nerve).[2] In a single cohort study on 110 implants, followed up for five years, Perelli and colleagues described a cumulative success rate of 90% for the implants and 93% for the prosthetic rehabilitation.[3] In 2015, Esposito et al. published the results of three years of follow-up results of the same group of patients, who presented with significantly less marginal bone loss for the implants placed in the maxilla and no differences for the ones in the mandible.[4]

More recently, in 2016, the same researchers started a multicentre clinical trial on 4x4 mm implants. They published the preliminary report of a one-year follow-up, in which they did not find differences in the outcomes between ultrashort and standard (at least 8.5 mm long) implants.[5] It should be pointed out that the patients participating in the study received a three-unit implant-supported prosthesis, for which there was at least one standard implant, in the absence of significant bone atrophy. Diversely, a recent review by Papaspyridakos et al. compared the clinical efficacy of ultrashort implants and longer implants.[6] The multivariate analysis described in this review assigned an odds risk ratio of 1.29 to the ≤6 mm implants compared with the standard ones. A common conclusion of papers on short implants is that they are advantageous in that they present significantly fewer postoperative complications and are faster and simpler for patients with significant bone resorption and that treatments are less expensive for such patients.

Immediate loading is a therapeutic approach that has demonstrated long-term results regarding high reliability and efficacy.[7] It is beyond the aim of this case report to describe the evidence that supports the predictability of this approach. However, it has been definitively stated that primary stability is a key factor for success. Achieving a sufficient degree of primary stability with short and, above all, ultrashort implants is a true challenge. Anitua published a case series of ten immediately loaded implants in the posterior maxilla with more than four years of follow-up.[8] Among the implants placed, five were 7.5 mm in length and the other five 8.5 mm. Nine out of ten implants (cumulative success rate of 90%) were considered stable at the follow-up. In 2018, Weerapong et al. compared 23 immediately loaded short implants of 6 mm in length with 23 conventionally loaded standard implants of 10 mm in length.[9] All the cases evaluated were intercalated mandibular first molars. They concluded that the results achieved with immediate loading of the short implants was comparable to those achieved for the standard implants in terms of implant survival, marginal bone level change and implant stability quotient value. To the best of our knowledge, there are no published papers reporting on immediate loading on ultrashort implants. The following case report describes an implant-supported full-mouth rehabilitation realised with a combination of ultrashort and standard implants with a follow-up of 18 months.

Clinical case

The 66-year-old male patient, classified as ASA II, presented to the clinic complaining of pain, mobility and

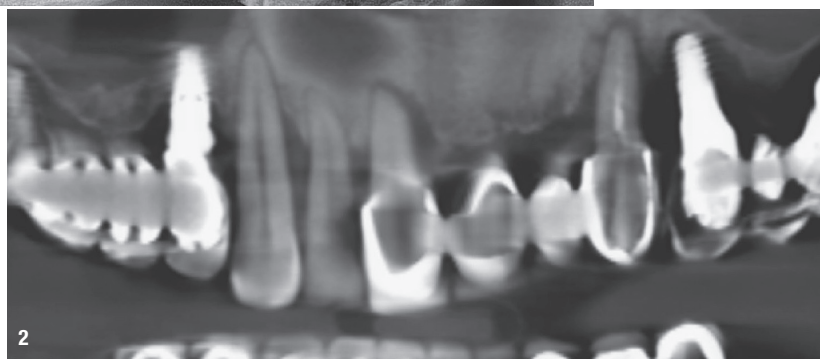


Fig. 1: Dental panoramic tomogram of the patient, showing severe bone resorption. **Fig. 2:** CBCT scan showing the sinus floor and reduced bone height on both sides of the maxilla.

discomfort in the maxillary left region. The clinical examination revealed advanced periodontal disease, Grade C and Stage IV according to the new periodontal disease classification. Spontaneous bleeding, suppuration and a general high degree of inflammation were evident.[10] He had metal–ceramic crowns in the lower jaw and three different bridges in the maxilla. All of them were extremely mobile, to between Grade II and Grade III. The panoramic radiograph showed a diffuse and advanced level of bone resorption extending to all remaining teeth (Fig. 1). Four implants were in the upper jaw, two of them with deep bone defects all around the implant bodies. The CBCT scan confirmed the teeth diagnosed on the panoramic radiograph and evidenced a large, deep bone defect extending from the canine beyond the left first premolar and a very low bone height below both the right and left sinus floor (Fig. 2). The left sinus appeared almost totally filled with inflammatory hyperplasic tissue.

Based on the clinical and radiographic examinations, all the teeth of the patient as well as the implants in positions #16 and 24 were evaluated as unsalvageable. On the contrary, the fixtures in positions #14 and 27 were stable and usable. The patient did not want to wear a removable prosthesis during treatment, not even for a short period. He also expressed his expectations about the level of aesthetics. For this reason, the treatment plan that was decided on was immediately loaded full-mouth implant rehabilitation in both jaws. Thereafter, a diagnostic wax-up was done, and it was decided not to modify the habitual occlusal vertical dimension of the patient at this stage of treatment. The dental technician created two surgical templates and two prosthetic templates for the impression, according to the protocol already published by Ghirlanda et al. Intravenous sedation and local anaesthesia (Scandonest 2 %, 1 : 100,000 adrenaline; Septodont) were administered.[11] First, all of the remaining teeth and mobile implants were extracted (Fig. 3). Thereafter, the prosthetic templates were tried in to check the occlusion and the reproducibility of the diagnostic wax-up (Fig. 4). The maxillary template was then stabilised to the abutments screwed on to the existing implants.

Afterwards, a full-thickness periosteal flap was raised in the mandible, and the bone crest was flattened using a round bur mounted on a surgical handpiece under irrigation with sterile saline. Four implants (blueSKY, bredent medical), two axially placed (4 x 12 mm) and two tilted (4 x 10 mm, 4 x 12 mm), were then placed, and the flap was sutured with interrupted sutures. All implants had an insertion torque of ≥ 35 Ncm. Four multi-unit abutments (SKY fast & fixed, bredent medical), two at 0° and two at 35°, were then screwed into the fixtures at 25 Ncm. According to the cited immediate loading protocol,[11] the prosthetic copings were positioned on the multi-unit abutments, instead of the impression transfers, and then the prosthetic template was adapted to the implant positions. A light-polymerised composite (compoForm, bredent medical) was light-polymerised to join the pros-

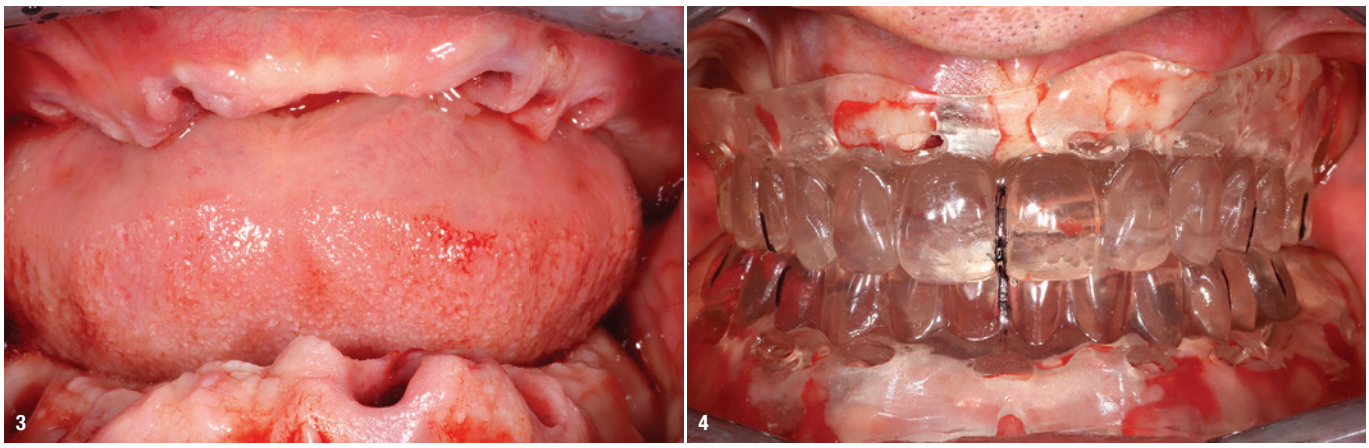


Fig. 3: Extraction of all compromised teeth and implants. **Fig. 4:** Prosthetic templates used to check occlusion and assure reproducibility.

thetic copings with the template positioned in centric occlusion of the patient. Once the polymerisation process was complete and the perfect stability of the template to the copings had been checked, a light impression material was injected below the template through the small holes that had been prepared in advance. Afterwards, the mandibular prosthetic template was sent to the laboratory for the production of the temporary prosthesis.

Thereafter, a full-thickness flap was elevated that extended all along the maxillary arch. Careful debridement was performed to remove all the inflammatory and fibrous tissue and to expose all the bone defects. Afterwards, the shallow defects were reshaped with bone chisels and round burs, while the deep defects were filled with xenograft (Geistlich Bio-Oss, Geistlich Biomaterials) and covered with a resorbable barrier (Geistlich Bio-Gide, Geistlich Biomaterials). In the anterior region, standard implants were inserted (blueSKY), while in the first molar sites, two 5.2x6.0mm fixtures (copaSKY, bredent medical) were inserted (Fig. 5). To maximise the degree of primary stability of the ultrashort implants, bicorticalism was considered for the creation of an in-fracture of the sinus floor by means of osteotomes so that the ultrashort implants would have improved stability. The fixtures did not protrude into the sinus, nor was there evidence of elevation of the sinus mucosa. All the implants achieved a primary stability of ≥35Ncm. The panoramic radiograph taken at the end of the surgery showed the correct positioning of the implants (Fig. 6).

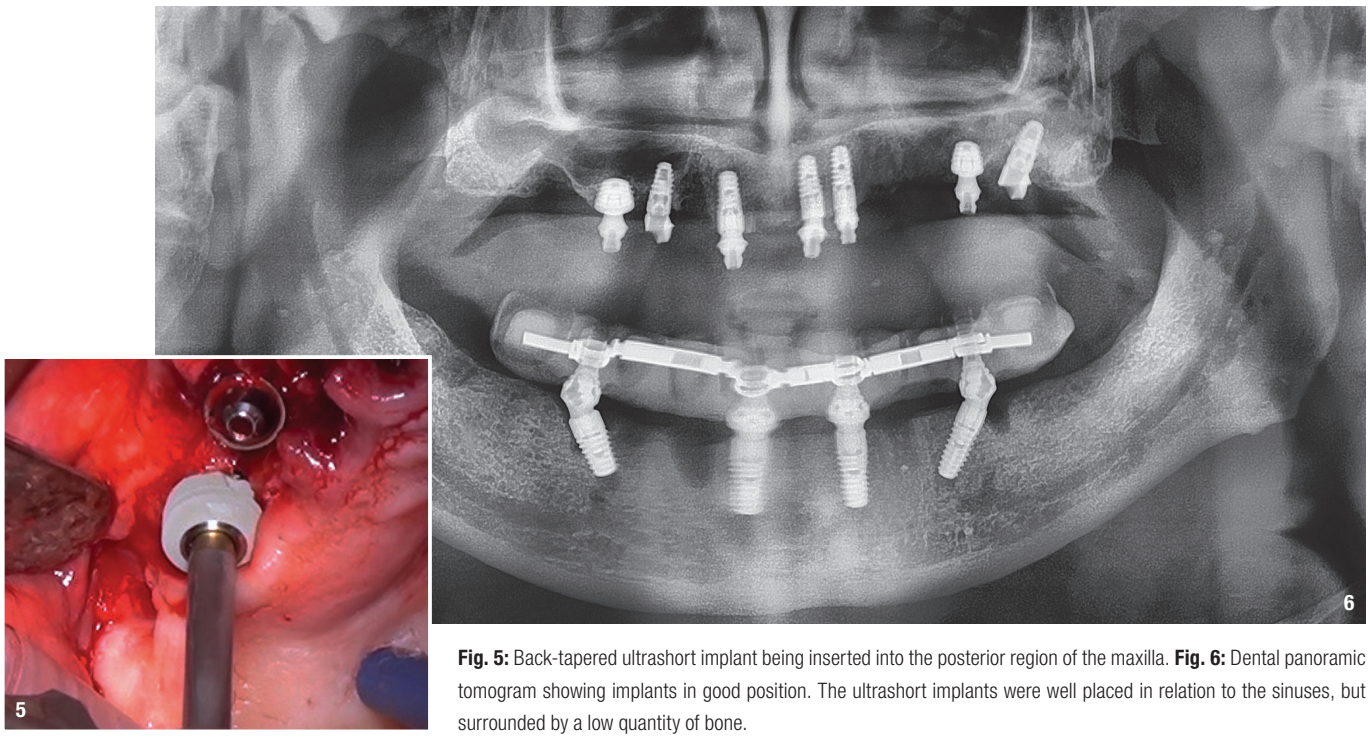


Fig. 5: Back-tapered ultrashort implant being inserted into the posterior region of the maxilla. **Fig. 6:** Dental panoramic tomogram showing implants in good position. The ultrashort implants were well placed in relation to the sinuses, but surrounded by a low quantity of bone.

Fig. 7: Occlusion check for the immediate temporary prostheses delivered to the patient. **Fig. 8:** Clinical situation of the soft tissue in the maxillary and mandibular arches after two months with temporary prostheses in place. **Fig. 9:** Definitive prostheses at delivery. **Figs. 10a & b:** Satisfied patient with beautiful smile and improved facial profile.

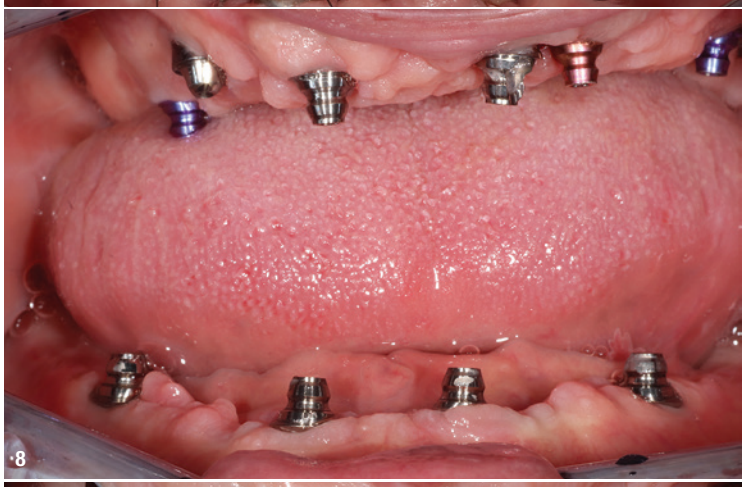
Afterwards, the same impression protocol already described was followed for the maxillary temporary rehabilitation. To stabilise the maxillary prosthetic template in centric occlusion, the temporary mandibular prosthesis, delivered in the meantime from the laboratory, was positioned and checked. Once the impression phase had been completed, the prosthetic template was sent to the laboratory and the flap sutured with interrupted sutures. After two hours, the maxillary temporary prosthesis was delivered, and the occlusal contacts were checked and balanced (Fig. 7). The patient was discharged with a prescription of amoxicillin (875 mg) in combination with clavulanic acid (125 mg), twice daily for six days, and ibuprofen (600 mg) and 0.12 % chlorhexidine mouthrinses, starting from the following day for three weeks. The postoperative phase was uneventful, and the patient was reviewed every two weeks for two months, after which the prostheses were unscrewed, and each implant was evaluated. None of the implants showed signs of inflammation or mobility (Fig. 8).

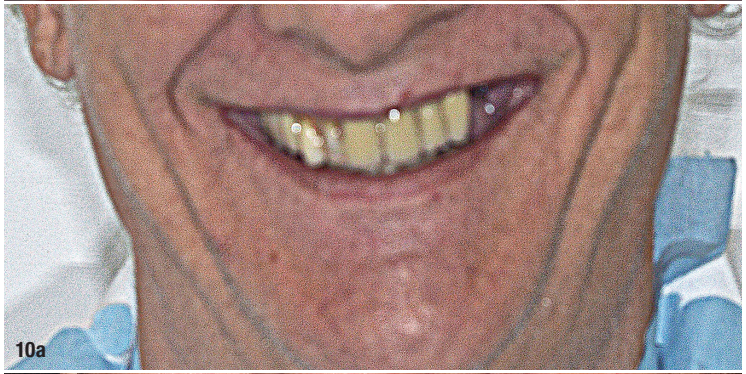
Thereafter, the occlusal vertical dimension of the patient was readapted, adding occlusal stents joined to the temporary prostheses until a correct and fully comfortable balance was accomplished. For the definitive prostheses, two titanium bars were made, and composite dental veneers were positioned over the bar in the laboratory. The pink aesthetic portion of the prostheses was also achieved with composite (crea.lign, bredent medical). The definitive titanium and composite prostheses were then delivered to the patient (Figs. 9 & 10).

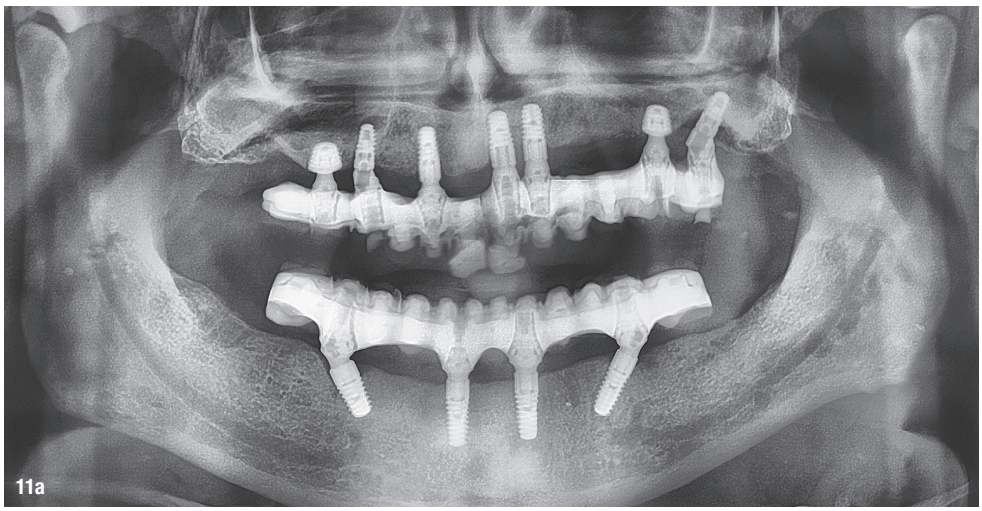
Afterwards, he was reviewed on a six-monthly basis. At the time of writing this report, the patient was followed up for 18 months. During this period, the only minor complication was the breakage of an incisal edge of a central incisor, which was repaired chairside. After 18 months, the panoramic radiograph control revealed perfect stability and even an improvement of the bone levels around all the implants placed. The ultrashort implants, especially, revealed a better bone density all around the bodies of the fixtures and at the top, where an increased amount of bone height was present in comparison with the immediate postoperative panoramic radiograph (Figs. 11a & b).

Discussion

The case described in this article provides the first clinical evidence of immediate loading with standard implants in combination with the ultrashort implants that



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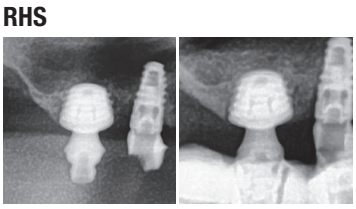

11b

Fig. 11a: Dental panoramic tomogram at the 18-month follow-up, showing increased bone density around the ultrashort implants. **Fig. 11b:** Comparison of the bone quality to the right and left of the ultrashort implants at time of insertion and at 18 months.

were placed in the sites with poor bone quality. Ultrashort implants have already demonstrated substantial reliability in situations where the anatomy of the site does not allow the placement of a standard implant.[5,12] Even shorter implants than those used in the case described here have been successfully used. However, it has to be highlighted that the loading protocol utilised in the study design of those papers was a conventional one. Nowadays, immediate loading is considered a valid option among the possible approaches in implant treatment, especially using standard implants that are inserted into bone of good quality.[7] In the literature, there is only one clinical trial in which single short implants of 6 mm in length were compared with standard measures in the rehabilitation of a mandibular first molar.[9] There are some differences, beyond the negligible differences in length, between the design of the cited study and this case report. First, whereas our ultrashort implants were placed in an edentulous arch, in the study of Weerapong and colleagues, they were placed in the saddle area between the second molar and the first premolar.[9] Second, the implants were inserted into the mandible, whereas in our case they were placed in the maxilla in the regions of poor bone quality.

Anitua's case series reported a nine out of ten success rate for 8.5 and 7.5 mm long implants. The present case was followed for 18 months, during which only a minor prosthetic complication was noted.[8] The radiographic control showed perfect stability of the bone levels around all the implants. An improvement of the bone height and quality around the ultrashort implants was also evident. Theoretically, this evidence can be related to the anchorage to the sinus floor cortical bone that was intentionally searched in order to improve the degree of primary stability. Furthermore in Anitua's cases, no other procedure was performed, nor was grafting material used in the sites of the ultrashort implants.

Conclusion

This case report has shown the successful outcome of an immediately loaded full-mouth implant-supported prosthetic rehabilitation. The medium-term follow-up, 18 months, and the radiographic evidence support a positive clinical outcome of the case presented. Further studies and clinical series are necessary to validate the choice of ultrashort implants in relation to the immediate loading approach as a useful means of overcoming anatomical challenges related to the placement of standard implants.

Literature

about the author

Dr Giovanni Ghirlanda specialises in oral surgery, periodontics and implantology. He graduated in dentistry and dental prosthetics and later completed a master's programme in implantology at the University of Murcia in Spain. In 1992, he was a visiting lecturer at Harvard School of Dental Medicine in Boston in the US. From 1996 to 1999, he was an adjunct professor at the Sapienza University of Rome in Italy. He is a member of the Italian Society of Osseointegration.

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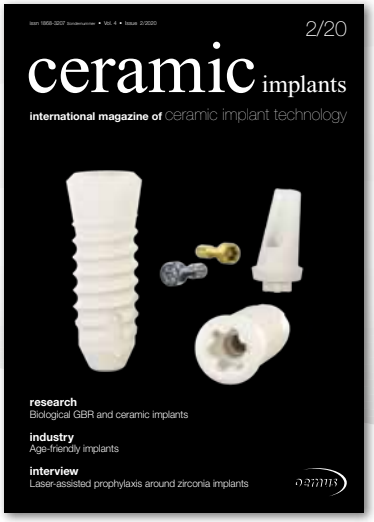

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