

Immediate implant restoration with partial extraction therapy using an implant with a new internal conical-parallel connection

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The maintenance of adequate and stable level of bone all around the implant is one of the key factors influencing the long-term success of implant therapy. In the past, a moderate degree of marginal bone loss (MBL) has been evaluated as acceptable among the criteria stated to define the long-term implant success rate. At the beginning of the era of Osseointegration, Albrektsson et al. considered the bone loss of 0.1 mm per year around the implant negligible and classified such cases as successful.¹ The development of new geometry of the implant shoulder and platform, together with new treatment modalities of the implant surface, has progressively changed the protocols of implant placement timing, implant positioning and, accordingly, the paradigms of implant therapy outcome. Several factors can influence the rate of crestal bone resorption and, therefore, be responsible for the development of complication. Some of these could be biological factors such as the non re-establishment of the biological width or bacterial colonisation of the implant-abutment interface or, even, peri-implantitis.²⁻⁴ Oth-

ers could be related to mechanical aspects and prosthetic components, e.g., misfits of the prosthetics could lead to sup-optimal dissipation of the masticatory force with the consequence of overloading the crestal bone.⁵

In recent years, the influence of the implant connection on marginal bone loss has been one of the factors most investigated.⁶ This has led to a plethora of implant-abutment interface geometry and morphology. Implants are basically distinguished based on external connections, which principally have a hexagonal geometry at the top of the implant, and internal connections which have different interface shapes. In addition to these two connections, the Morse conical taper connection which has its own unique characteristics must be considered. Some authors have hypothesised that the flat-to-flat interface between implant and abutment, as in the Morse conical connection, could offer a better seal against bacterial infiltration and contamination, thereby reducing the risks of implant failure associated with the implant being located in a bacteria-



Fig. 1: Intra-oral situation of the patient at the beginning of the therapy. The buccal migration of the upper teeth due to the periodontal disease and the presence of the gingival recessions of Class III and IV, Miller Classification are evident. **Fig. 2:** The smile line of the patient.

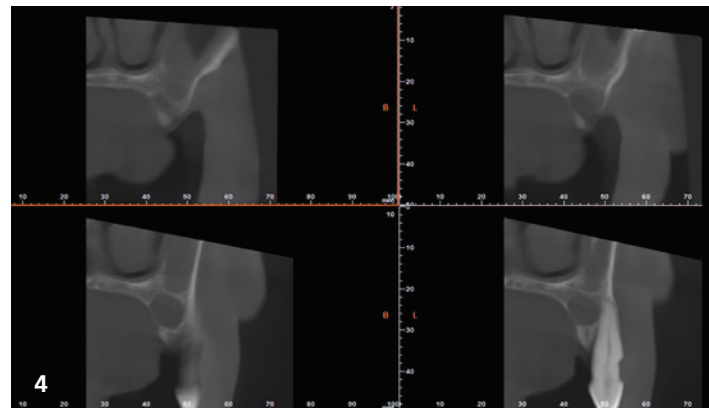
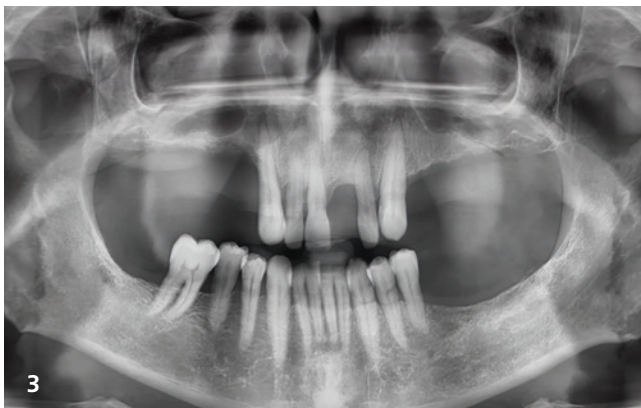


Fig. 3: Pre-op dental panoramic tomogram showing bone atrophy of the posterior sextants in the maxillary arch. **Fig. 4:** Detail of the CBCT scan showing the bone lacuna localised in the maxillary right posterior sextant and a moderate degree of hyperplasia of the sinus mucosa.

rich oral environment.⁷ However, this hypothesis has not been confirmed in further studies specifically focused on this subject matter.^{8,9}

Zipprich et al. compared the behavior of the implant abutment connection under non-axial loading and concluded that the morse-taper showed better stability than both external and internal hexagons or similar geometries.⁹ Moreover, it could be speculated that the presence of a micro-gap in the hexagon connections, with the potential of infiltration from the oral fluid could lead to an increase of the MBL around the implant.

Furthermore, the introduction of the platform switch concept has demonstrated positive effects on the long-term reduction of MBL. The hypothesis, initially postulated by Lazzara et al., that leaving more space to the supracrestal tissues thereby modifying the emergence profile of the abutment, could have an influence on the rate of MBL has now been supported by many publications in peer-reviewed journals.¹⁰⁻¹³

Recently, a brand-new type of implant has been introduced into the market in which the morphology of the implant–abutment interface has been mainly developed to amplify the application of the concept of the platform switch together with the benefits derived from an indexed morse taper connection. A unique back-tapered shape at the top of the implant gives, in fact, the opportunity to leave enough space to the supracrestal connective tissues without any negative effect on the mechanical properties and stability of the implant–abutment interface.

The case presented hereunder describes the application of the above-mentioned concepts through the use of a new implant macrogeometry in a challenging clinical situation.

Case presentation

The 65-year-old male patient, ASA 2, presented at our clinic complaining about the functional and aesthetic situation of his dentition (Fig. 1). The clinical examination revealed multiple missing teeth on the upper arch and of the teeth 38,37,36,47 and 48. There was significant gingival recession, Class III and

IVb according to Miller Classification, with loss of clinical attachment (CAL) and a mobility degree between two and three associated with the remaining maxillary teeth.¹⁴ The interproximal spaces appeared opened due to the buccal migration of the upper teeth because of the development of a deep bite related to the complete loss of interarch dental relationship and vertical dimension (Fig. 2). The teeth 14, 12, and 21 were considered hopeless while the other teeth had a questionable prognosis. To all the mandibular teeth were attributed a favourable prognosis except tooth 46, which was considered questionable due to the furcation involvement.

The OPG confirmed the loss of bone support around the maxillary teeth associated with a vertical bone atrophy mostly evident in the posterior regions of the maxilla (Fig. 3). A moderate degree of bone resorption was also present around the mandibular teeth. The CBCT revealed a moderate degree of mucosal hyperplasia of both the maxillary sinuses which contraindicates an extensive sinus lift. Moreover, a bone lacuna or a residual cyst, was also seen following the CBCT evaluation (Fig. 4). The clinical and radiological situation of the patient were compatible with periodontitis stage IV degree C, according to the classification of Periodontal Disease published in 2018.¹⁵

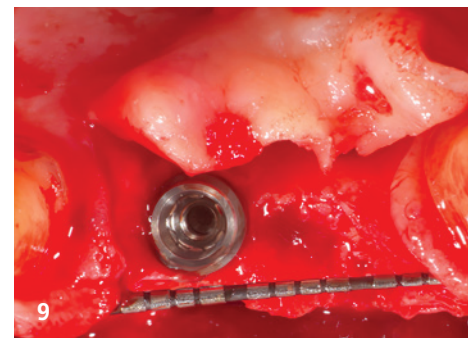
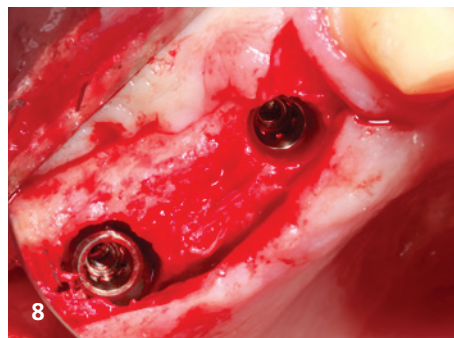
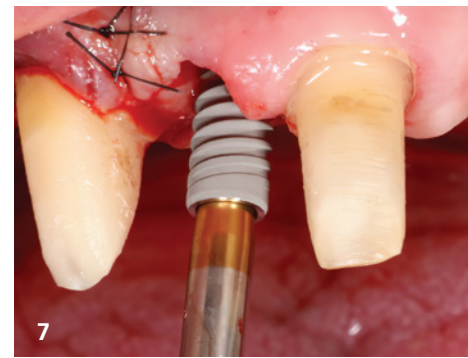
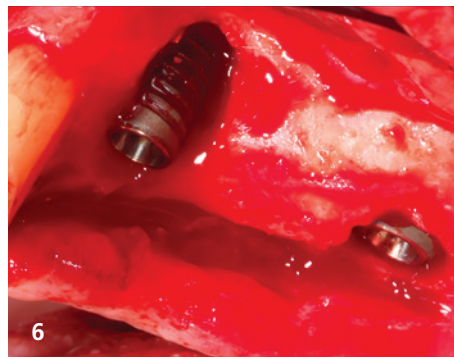
The wish of the patient was to be fully rehabilitated by means of an implant supported prosthetic restoration avoiding in every step of the therapy any kind of temporary removable prosthesis. The patient also expressed the desire to avoid the use of gingival camouflage in the final prosthesis as usually seen in FP3 restoration.¹⁶

Accordingly, a staged treatment plan was proposed to the patient in relationship to his dental condition and the goals of the therapy.

The patient was first enrolled in a programme of periodontal therapy including reinforcement of the daily oral hygiene procedures and professional visits for scaling and root planing of the lower teeth. The hopeless teeth in the maxillary arch were extracted and a temporary rehabilitation was fitted using the remaining teeth as support (Fig. 5). Once an optimal level of the



Fig. 5: First set of temporary crowns borne on the remnant teeth. **Fig. 6:** Implants positioned in the maxillary right posterior sextant, a standard implant placed inside the bone lacuna and an ultrashort implant in position #16. **Fig. 7:** Standard implant positioned immediately after the extraction of tooth #12, according to the partial extraction technique. Note the unique morphology of the top of the implant. **Fig. 8:** Implants positioned in the maxillary left posterior sextant. **Fig. 9:** Implant placed in position #21 and bone atrophy, especially on the buccal side.



oral hygiene was achieved and inflammation was controlled (PBI and PLI < 20%), the patient was scheduled for the implant therapy.

Two implants were planned in the right maxillary sextant together with a guided bone regeneration to manage the bone defect present in the position of the first premolar. A full thickness flap was elevated and then, all the area of defect was debrided before preparing the implant sites. Due to the mucosal hyperplasia of the sinus, it was decided to insert an ultrashort implant (copaSKY, bredent medical) below the sinus floor, in the position of the first molar. Care was taken in order to reach the best level of primary stability by engaging the cortical bone of the floor of the sinus with the threads of the apical portion of the implant. At the same time, a mix of autogenous bone chips, scraped all around the area of the defect (SafeScraper, META), and a xenograft (TIXXU bone graft, bredent medical) was used to fill up the bone defect simultaneously with the insertion of a standard long implant in the region of the 14 (Fig. 6). The graft and the implant were then covered with a collagen barrier. It was decided to extract the maxillary right lateral incisor and to insert an immediate postextraction implant according to the protocol of the Partial Extraction Technique (PET), proposed by Hurzeler et al. in 2010.¹⁷ A straight sectioning in the long axis of the tooth was carried out with a carbide burr, splitting the buccal portion from the rest of the root. Once complete separation of the two parts of the root was verified, the palatal portion of the tooth was carefully extracted paying attention to remove the apex and to eliminate all remnants of the pulp tissue. Afterwards, the implant was positioned in a flapless mode attaining an optimal primary stability (Fig. 7).

The post-op healing was uneventful, and the sutures were removed after 15 days.

The following month, the patient returned for implant placement in the left posterior sextant of the maxilla. In this sextant two implants were planned and, similarly to right posterior sextant of the maxilla, an ultrashort implant, 5.2 x 6 mm, was inserted below the floor of the maxillary sinus (copaSKY, bredent medical; Fig. 8).

The next step of the treatment plan was to carry out the bone regeneration and the implant insertion in the left maxillary central incisor site, at the same time (Fig. 9). Therefore, a full thickness flap was elevated which exposed the bone defect. Debridement was carefully done and then, autogenous bone chips were

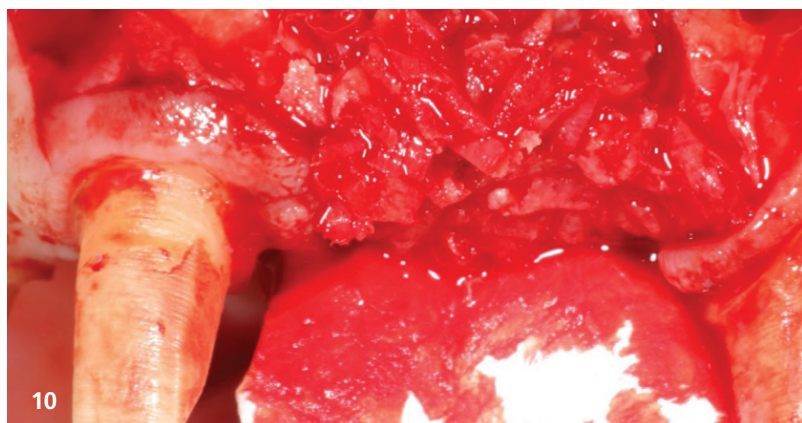


Fig. 10: Mix of autogenous bone chips and a xenograft fully covering implant #21. The collagen membrane on the palatal side would be used to cover the graft.

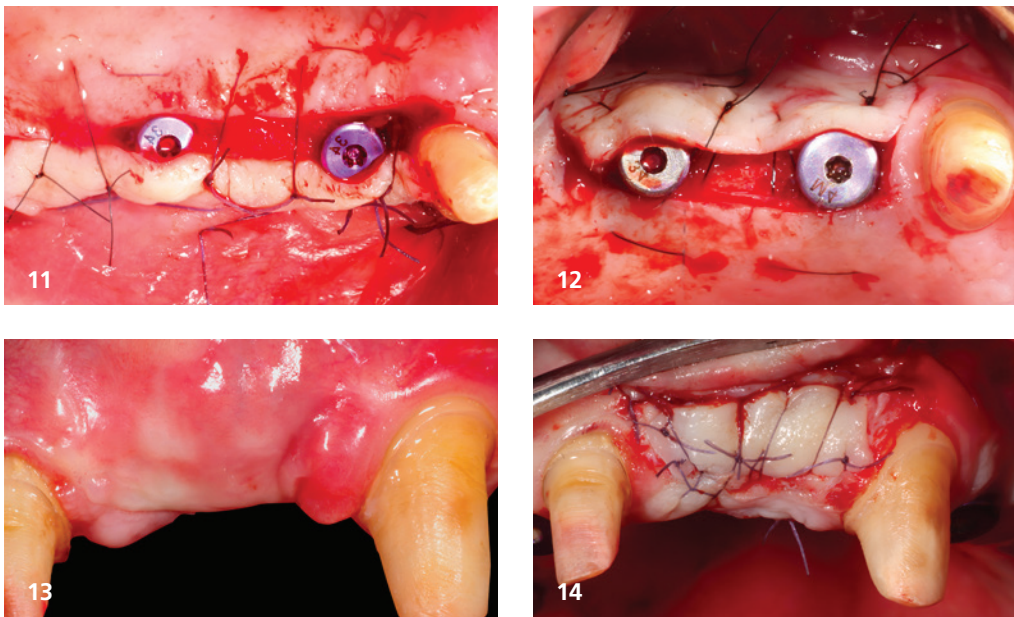


Fig. 11: Apically positioned flap to augment the width and thickness of the keratinised tissue around the implants after re-entry surgery in the maxillary right posterior sextant. **Fig. 12:** Apically positioned flap after re-entry surgery in the maxillary left posterior sextant. **Fig. 13:** Clinical aspect of the anterior zone two months after guided bone regeneration, showing the coronal displacement of the mucogingival junction. **Fig. 14:** Free gingival graft sutured on the buccal side in order to reestablish the correct profile of the mucogingival junction.

collected using a bone scraper. A standard implant, 4.0 x 12 mm, was inserted according to the surgical template and the graft was placed in an attempt to restore the bone quantity to the correct bone volume (Fig.10). Thereafter, the graft was covered with a collagen barrier and the flap was sutured back with interrupted sutures which were removed after 15 days.

Two months later, the re-entry surgery on the maxillary right sextant was scheduled to expose the osseointegrated implants. The surgical approach was based on an apically repositioned flap in order to reestablish a normal profile of the mucogingival junction, which was coronally displaced in the aftermath of the previous surgery. A straight incision line on the palatal third of the alveolar crest was drawn beginning from the maxillary tuberosity until the palatal gingival margin of the canine. A split thickness flap was then moved from the palate to the vestibule which was, simultaneously, deepened to create space and anchorage for the keratinised tissue. After the flap elevation, the area of the GBR was checked to evaluate how well the defect had been filled and the condition of the implant (Fig. 11). The re-entry surgery on the left side was then performed in a couple

of weeks from the aforementioned procedure, following the same protocol already used on the right side of the maxilla (Fig. 12).

In the meantime, the healing of the anterior bone regeneration site was running uneventfully but showed an excessive displacement of the mucogingival junction with lack of keratinised tissue on the vestibular aspect of the crest (Fig. 13). According to the protocol proposed by Urban et al., it was decided to increase the band of keratinised tissue before the re-entry of the implant in order to ease the second surgical stage and to recover the mucogingival junction profile.¹⁸ Subsequently, a free gingival graft (FGG) was then sutured above the vestibular crest after the preparation of an adequate vascular bed (Fig. 14).

After the maturation of the soft tissues around the maxillary posterior implants, a new impression was taken for the fabrication of a second set of temporary crowns supported by the implants, instead of the teeth. The final surgical step, consisting of re-entry surgery of the implant in the position of left central incisor and the extraction of the remnant teeth, was carried out.

In order to minimise the post extraction alveolar shrinkage and maintain the buccal contour, PET approach was performed

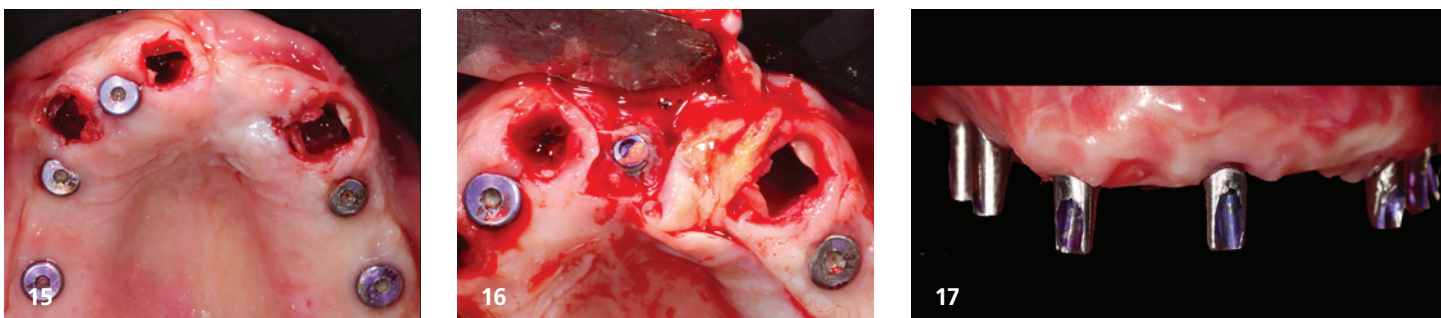


Fig. 15: After extraction of the remnant teeth following the partial extraction technique to preserve the volume of the alveoli. **Fig. 16:** Re-entry surgery for implant #21, after elevating a palatal pedicle flap. **Fig. 17:** Profile of the tissue after prosthetic conditioning.

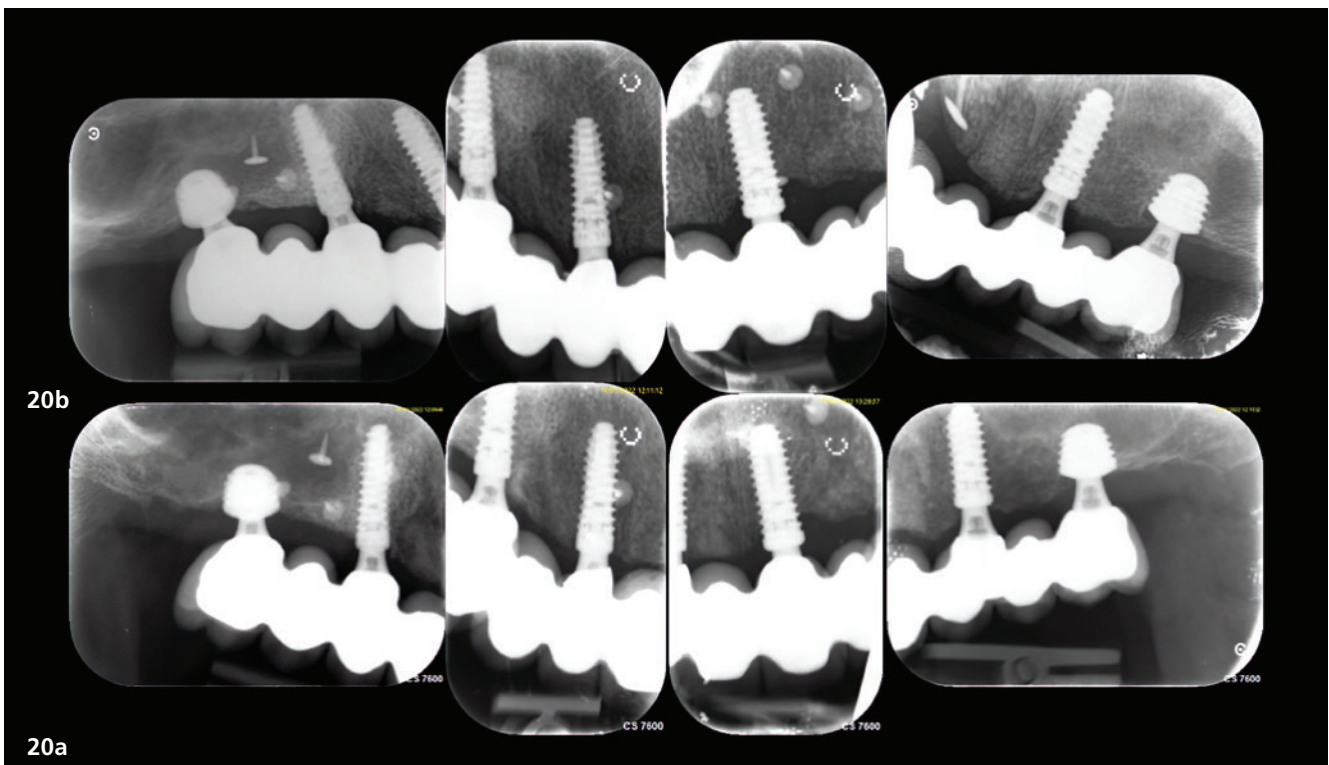


Fig. 18: Definitive restoration. **Fig. 19:** Patient's smile. **Figs. 20a & b:** Intra-oral radiographic status (a) at the end of treatment and (b) one year later. The marginal bone levels had been maintained, and there was good maturation of the bone all around the implants, especially the ultrashort implants, notwithstanding the reduced height of the native bone at the beginning of treatment.

on the right central incisor and both canines (Fig. 15).¹⁹ At the same time, a soft-tissue augmentation with a pedicle flap rotated from the palate was performed to increase the profile of the alveolar crest in the anterior aspect according to the protocol described by Sclar et al. (Fig. 16).²⁰

The implant placed in the lower left first molar was, simultaneously, reopened for the final prosthesis.

The soft-tissue conditioning was managed with progressive increment of the temporary crowns, until the maturation of the tissues was completed (Fig. 17).

The definitive full-arch implant supported restoration was then delivered to the patient and a three months recall programme was installed (Fig. 18).

The clinical and radiological one-year follow-up investigations revealed an optimal stability of the marginal bone levels as well

as progressive further maturation and an increase in the soft tissues volume (Figs. 19 & 20).

Discussion

The clinical case described in this case report could be considered an example of the application of several improvements of the implant therapy concepts of the most recent years. The development and maturation of a stable collar of connective tissue fibers all-around the neck of the implant seems to play a crucial role in the maintenance of the crestal bone levels.²¹ Different approaches have been proposed to preserve at best the integrity of the supracrestal peri-implant tissues in order to avoid or to control the marginal bone loss. On one hand, the height and the thickness of the soft tissues have been advocated as factors

implicated in the stability of the bone around the implant.²² In accordance with this statement, the features of the implants positioned in this case report could bring some advantages to the clinicians. The back-tapered profile of the implant shoulder, the surface treatment of the shoulder area and the subcrestal position of the implant could positively influence the soft-tissue histomorphology and, therefore, the relationship between the

implant and the crestal bone. On the other hand, alongside with the considerations related to the biology of the soft tissues, it is also necessary to pay attention on the role of the prosthetic management of implant rehabilitation. In fact, several authors have published multiple papers demonstrating how the emergence profile of the abutment could also influence the relationship between the implant and the bone.⁶ The platform switch concept has evidenced how much clinicians can influence the marginal bone behavior by just leaving space to the supracrestal tissues through the use of an abutment with a slimmer emergence profile. Another factor that could be considered is the stability of the abutment–implant interface. The morse taper connection has demonstrated better performances compared to the other types.²³

Another interesting aspect of this case report has been the use of ultrashort implants to rehabilitate the maxillary posterior sites instead of sinus floor elevation by means of augmentation where the height of the bone crest is not sufficient for the insertion of standard long implant. The patient presented a moderate level of hyperplasia in both sinuses which could have been a contraindication for a sinus lift procedure. Moreover, the healing time required for a complete osseointegration of the implant positioned simultaneously with a sinus lift is surely longer compared to the implants inserted into native bone. Nowadays, the clinical reliability achieved by the ultrashort implants makes them a valid alternative to external sinus floor elevation and augmentation. Further alternatives like, for instance, the zygomatic implant need, for sure, a more specialised skillset and are more indicated in those cases with higher level of bone atrophy.²⁴

The points of view expressed in this case report are based on recent protocols backed by clinical and scientific evidence in modern implantology including the compelling result of twelve months follow-up from this single albeit complex case. Although the use of PET and soft-tissue graft are established procedures, the use of ultrashort implants is a relatively new trend. Also, the novel internal conical–parallel connection is also a fairly recent development. Further long-term research is needed to validate the success achieved in this case report.

About...



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graduated with honours in dentistry in 1988 from the Sapienza University of Rome in Italy and later completed a master's degree in implantology from the University of Murcia in Spain. After his periodontics residency, he was a visiting lecturer at Harvard School of Dental Medicine in Boston in the US in 1992 and an adjunct professor of histology at Sapienza University from 1996 to 1999. Currently, he is a visiting professor at the Universidad Católica San Antonio in Murcia. He has extensive knowledge in oral surgery, implantology and periodontics and has a growing focus on aesthetics, immediate implant loading, including soft- and hard-tissue management in implantology. He is an active member of the Italian Academy of Osseointegration, the SIRIO ROMA dental association and the European Association for Osseointegration. Since 2006, he has been a key opinion leader for bredent medical.

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Literature



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