Consecutive treatment failures of an immediate maxillary canine implant and the subsequent replacement and reconstruction of the site

Howard Gluckman,[1] Jonathan Du Toit[2]

Abstract

Implant therapy is a valuable and reliable treatment in the restorative and reconstructive dentistry milieu. Many of the techniques employed are advanced and yet implant dentistry is routine in today's specialist and general dental practices. The volume of treatment delivered though should never disregard the importance of thorough and concise treatment planning. A lack of knowledge and misapplication of fundamental implant therapy principles is demonstrated hereafter where an edentulous space at a missing maxillary canine was treated by an implant-supported crown, yet the complete failure of adequate treatment planning resulted in a bizarre clinical outcome requiring significant revisions to correct. Paramount to the implant dentist and surgeon are the treatment planning principles highlighted by this case.

Keywords: Dental implant, implant therapy, treatment planning

Introduction

The approach to treating an edentulous or partially edentulous jaw presents both clinician and patient with a clinical challenge addressed by several treatment options.[1] Restorative implant treatment is among the more advanced options, and yet it is highly predictable and potentially very rewarding for the patient. Fundamental principles, though, are to be adhered to.[2]

Chief among these is thorough, concise, evidence-based treatment planning.[3] The clinician is cautioned not to overlook the crucial importance thereof. All too often neglected are the most basic of examinations and thorough history taking. The reader may challenge him or herself, asking when last did I carry out a standard, full mouth periodontal examination to identify any periodontal disease that requires treatment before embarking on implant therapy?[4]

Thorough implant treatment planning almost always necessitates the use of special investigations and additional diagnostic aids. Whilst costly, the value of a cone-beam computed tomography (CBCT) scan to visualize the edentulous ridge or site in its 3-dimensional aspects cannot be stressed enough.[5] The treating clinician is to be cognizant of the recommended tissue parameters needed to support the dental implant and its restoration. The clinician is required to diagnose the need to augment these.[6-8]

The above-mentioned by no means addresses the entirety of the possible implant treatment planning aspects. However, the main shortcomings are highlighted, drawing attention to the case presented here and what led to the treatment failure.

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Figure 1: The preoperative presentation.

Figure 2: A draining sinus was noted buccal to the implant crown at 13.

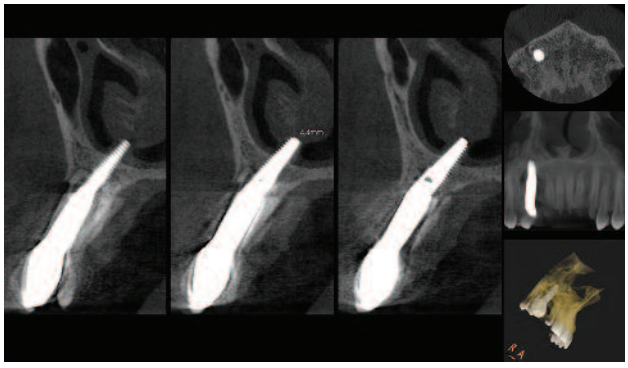

Figure 3: Preoperative CBCT showed a dental implant with about half the body inserted into the nasal cavity, a root remnant buccal, and an angled abutment as long as the implant fixed to a crown restoration.

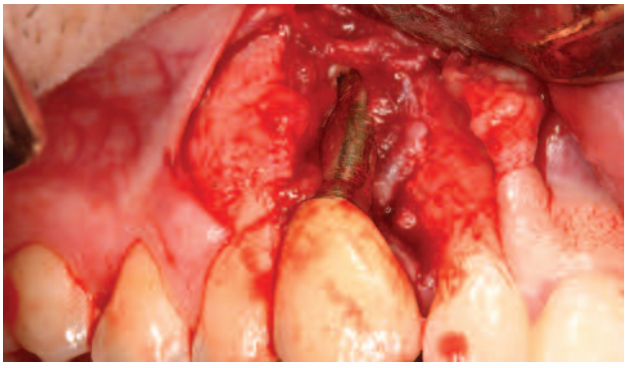

Figure 4: Full-thickness flap exposure of the site revealed an extensive buccofacial bony defect and soft tissue encapsulation of the implant abutment.

Case report

A 21-year-old male presented with the main complaint of a persistent infection around an implant that had been placed about 1 year prior. The patient was a non-smoker, healthy, with a clear medical history and currently not taking any chronic medication. According to the patient's history, the infection had persisted and the practitioner who placed the implant advised the patient the situation was not a problem. The patient's history entailed a retained deciduous canine with a congenitally missing tooth 13. The deciduous tooth was removed and an immediate implant was inserted at the site. The implant developed an infection and was removed. A second implant was placed at the time of the first's removal. This implant also became infected and was subsequently removed. The patient then saw a different practitioner who placed a third implant and restored it after a period of healing. Subsequent to the chronic draining sinus buccal to the implant, the patient was advised by his general dentist to seek a third opinion. Clinical examination of the patient noted a screw-retained, implant-supported crown at site 13. Circumferential probing of the implant exceeded 15 mm, with bleeding upon probing, and exudate draining from a sinus midfacial at the implant site (Figs. 1, 2).

CBCT examination noted a custom abutment that extended about 8-10 mm in length, screw-retained to an external connection implant. The implant-abutment interface was positioned at approximately as deep as the root apices of the adjacent teeth, with about half the implant body penetrating into the nasal cavity (Fig. 3). There was also evidence of a root fragment adjacent to the implant. The extended custom abutment supported a cement-retained crown in the occlusal position. The mesial of tooth 14 had

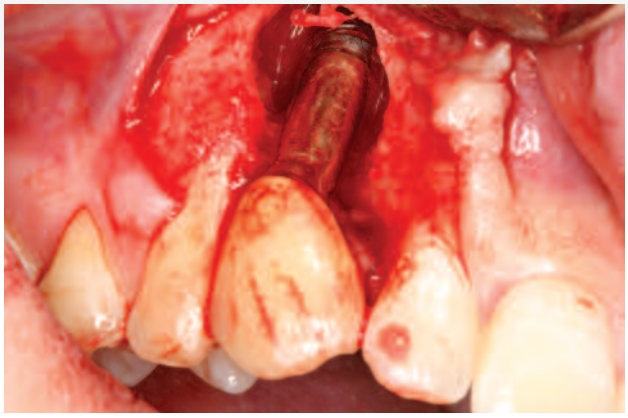

Figure 5: Removal of the pathological soft tissue revealed the extent of the bony destruction.

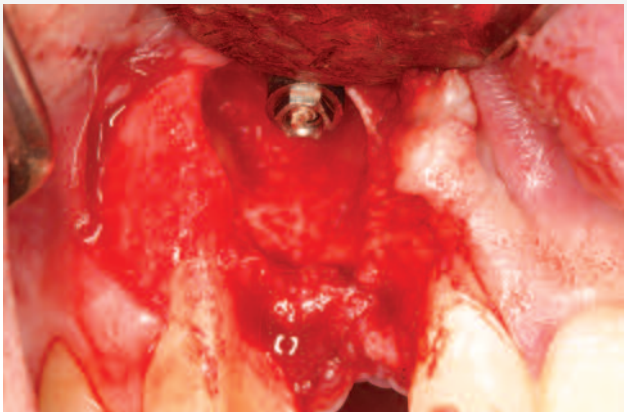

Figure 6: The abutment was torqued to fracture, revealing an external hex connection implant.

Figure 7: The infective tissue at the implant and root remnant.

Figure 8: After removal, the restoration and abutment to implant ratio could be appreciated.

been reduced to accommodate the implant crown.

A detailed examination predicated the diagnosis of a severely malpositioned implant with a chronic peri-implantitis and unacceptable restoration. The treatment planning proposed removal of the implant and restoration, allowing for a period of healing and resolution of infection, and a re-assessment of the site's treatment needs.

The site was anaesthetized and a full-thickness flap was raised over the implant at 13, exposing soft-tissue encapsulation of the abutment extending to the apices of the adjacent teeth (Fig. 4). The pathologic soft tissue was removed to send for histological examination, and the extent of the bony destruction at the area was exposed (Fig. 5). Bone appeared eroded at the surfaces proximal to the implant. The buccal bone had a large defect yet the palatal bone remained coronal. The prosthesis and restoration were torqued and fractured from the implant and thereafter the implant torqued out (Figs. 6-8). The root fragment was also located and removed, the area meticulously debrided and copiously rinsed with saline. Platelet-rich fibrin (PRF) membranes were placed within the defect and the site sutured closed with 6/0 nylon.

After 8 weeks of healing the edentulous site was re-approached and treatment planned from start. This included among many others a thorough clinical exam, periodontal examination, a holistic documentation of all pathologies and treatment needs, concise photographic documentation, study casts, restorative mock-up, and special investigative adjuncts including CBCT. The diagnostic list for the patient included a Class I malocclusion, recession defects, a mild fluorosis, and a missing 13. Diagnosing the healed, edentulous site at 13 noted a significant ridge defect, both horizontal and vertical, with a deficit of both hard and soft tissues. The soft tissue already showed significant scarring, recession distal to 12, and severe recession mesial to 14 with complete loss of the papillae (Figs. 9, 10). There was insufficient attached, keratinized tissue at the 14 with a Class IV recession defect.

The treatment planning entailed a bone augmentation of

Figure 9: After initial healing of the site. Note the mesial of tooth 14 that was cut away. And the horizontal defect, as well as the extensive scarring is evident.

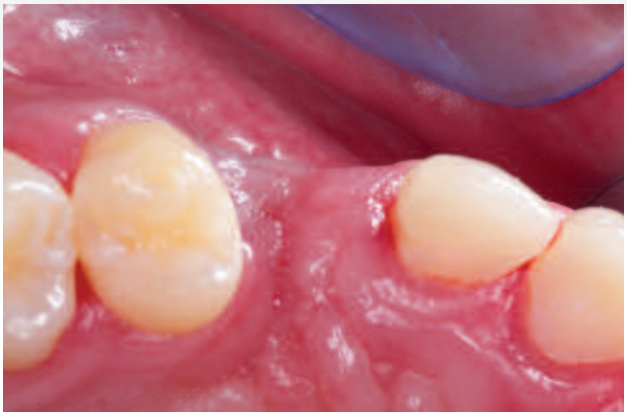

Figure 10: Tooth 14 was restored. Occlusal view accentuates the buccal defect.

Figure 11: Re-entry at the site illustrated the extent of the horizontal defect.

Figure 12: The radiographic-surgical guide in position and zenith of the pontic at the correct height. A severe vertical ridge deficit is not evident.

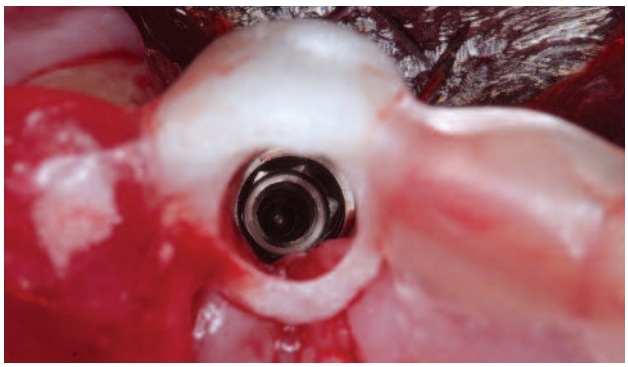

Figure 13: Placement via the guide confirmed a restoratively planned implant positioning for a screw-retained crown.

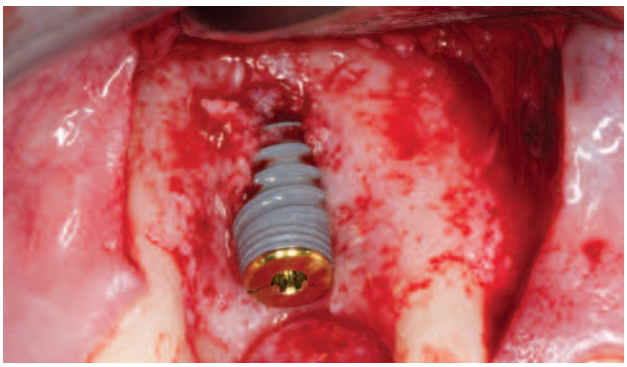

Figure 14: The implant fully inserted with an extensive buccal dehiscence that required augmentation.

the hard tissue defect, augmentation of the soft tissue deficit, and implant placement to restore with a screw-retained crown. Tooth 14 was first restored to re-establish a normal emergence profile and anatomy (Fig. 10). CBCT and virtual implant planning indicated that implant placement in the restoratively correct 3-dimensional positioning with simultaneous augmentation with an autogenous corticocancellous bone block was a viable option. After local

Figure 15: Harvesting of the ramus block.

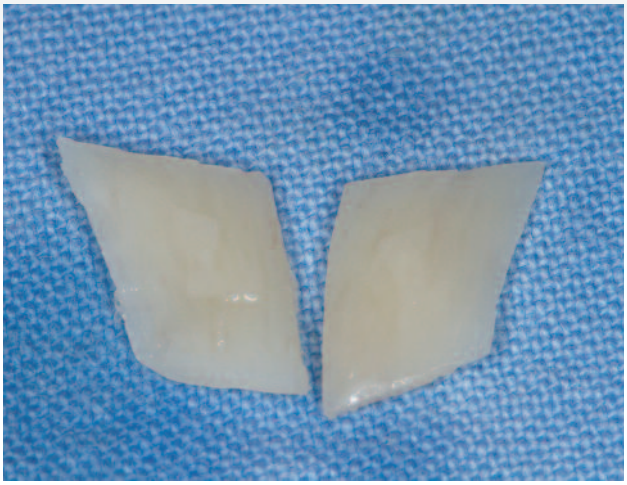

Figure 16: The ramus block sectioned into two thinner grafts.

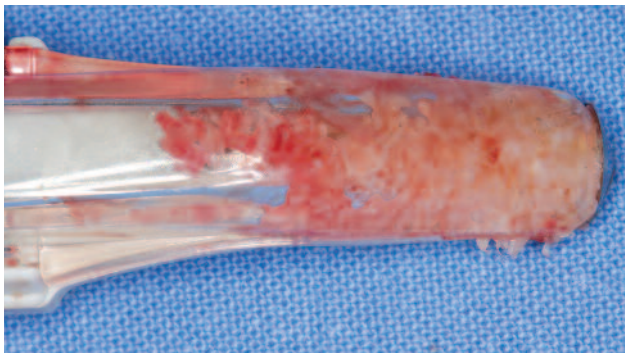

Figure 17: Bone shavings harvested by scraping and refining the block grafts.

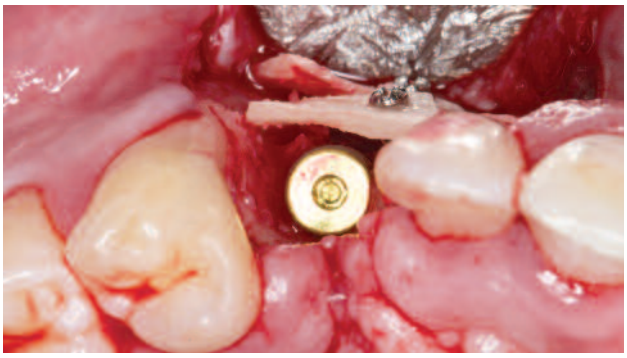

Figure 18: The blocks fixed to the bony ridge buccal to the implant.

Figure 19: Buccal view of the bone blocks fixed in place.

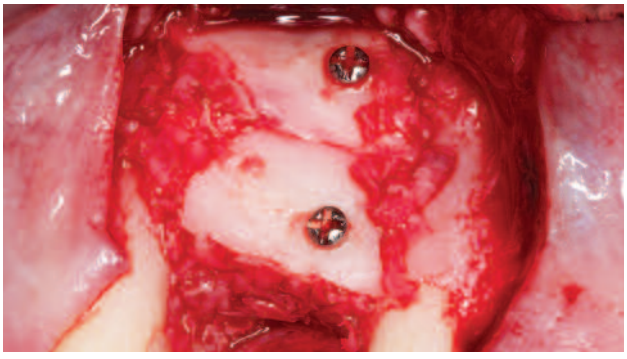

Figure 20: The harvested autogenous bone shavings were packed beneath and around the blocks.

anaesthesia a full-thickness flap was again raised at the site and the implant osteotomy was prepared via a restorative-planned surgical guide (Figs. 11, 12). A morse-taper, conical internal connection implant, 3.5 x 10 mm (NobelActive, Nobel Biocare) was inserted at the correct restoratively planned level, 2 mm below the palatal crest (Figs. 13, 14). A corticocancellous bone block was then harvested from the left mandibular ramus, and split into two block veneer grafts as per Khoury's protocol (Figs. 15, 16).[9] The blocks were thinned with a bone scraper (Safescraper, Geistlich) further harvesting autogenous bone shavings (Fig. 17). The blocks were then secured to the ridge buccal to the implant

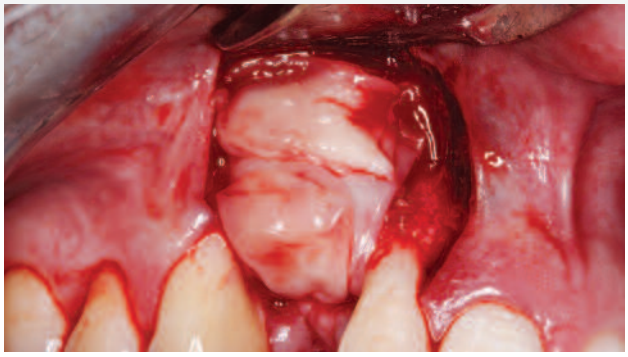

Figure 21: PRF membranes were layered atop the completed bone augmentation.

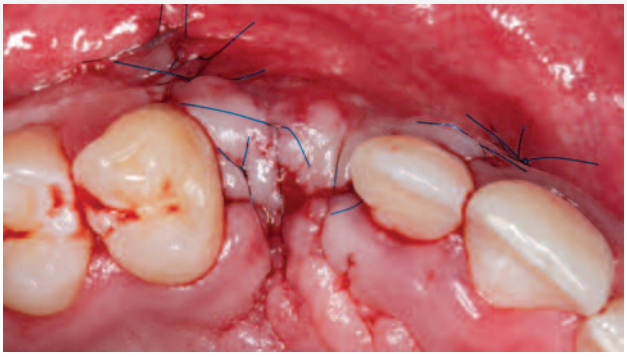

Figure 22: Site closure with 6/0 nylon sutures.

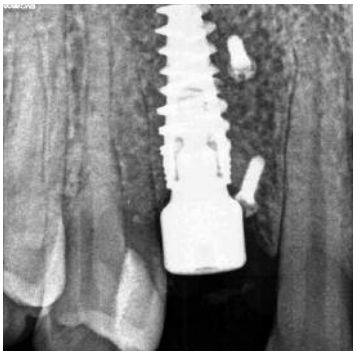

Figure 23: Immediate postoperative periapical radiograph. This short, wide healing abutment is not ideal.

Figure 24: 12 weeks of healing.

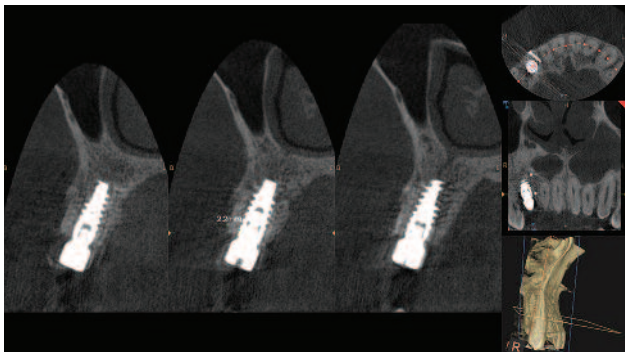

Figure 25: CBCT scan showed the healed bone augmentation buccal to the implant 2.2 mm thick.

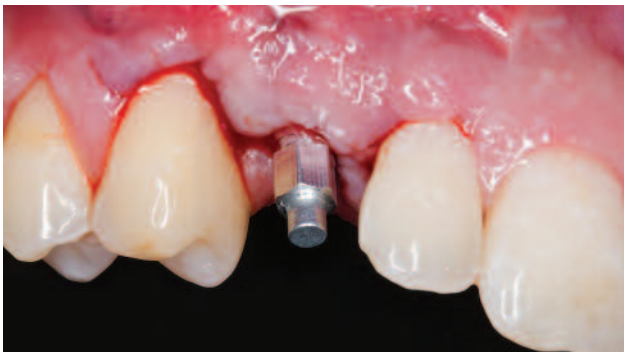

Figure 26: ISQ readings indicated high stability, positively confirming osseointegration.

with fixation screws, and the bone shavings packed within the defect between the implant and blocks (Figs. 18-20). PRF membranes were layered over the bone augmentation and the tension-free flap repositioned and sutured with 6/0 nylon (Figs. 21, 22). The site was then restored with a provisional partial denture free of pressure to the underlying augmentation site.

After 12 weeks of healing the implant was exposed and its implant stability quotient (ISQ) checked – 78D 75M 75B (Fig. 23-26). The buccal soft tissue was undermined by a tunneling approach, creating a split-thickness envelope. A connective tissue graft (CTG) was harvested from the palate and transferred into the pouch, sutured in position, thereby augmenting the soft tissue buccal and coronal to the site (Figs. 26-28). The implant was then restored with a provisional restoration to begin developing the soft tissue profile. At 4 weeks of healing a black triangle was evident

Figure 27: The connective tissue graft (CTG) harvested from the palate positioned over the recipient site.

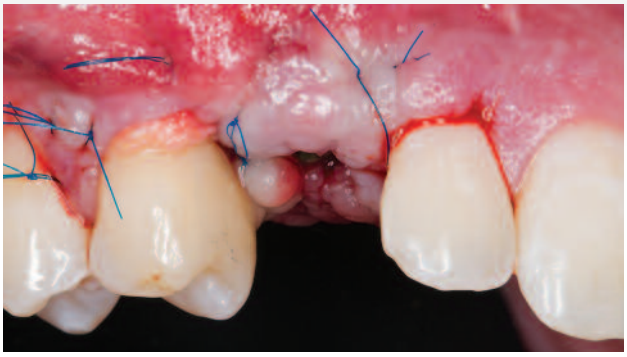

Figure 28: The implant exposed with CTG inserted and sutured inside a split-thickness tunnel flap.

Figure 29: 10-day follow-up with the provisional restoration in place. The soft tissue augmentation healing without complication.

Figure 30: 4-week follow-up, soft tissues healed, provisional in place, yet the absence of a distal papilla is obvious.

where the distal papilla was absent. A further 8 weeks of healing allowed time for soft tissue in-fill of the area (Figs. 28-31).

At final restoration of the implant a bulk of ridge tissue buccal to the implant could be noted, with near complete restitution of both mesial and distal papillae (Fig. 32). Functional treatment goals were realized and adequate aesthetic rehabilitation of the previously failed treatment was achieved. The patient was satisfied, with the tissues and outcomes remaining stable at the 2-year recall (Fig. 32).

Discussion

It is likely that with the ever-increasing availability of implant treatment, a greater number of implant procedures will produce increasing implant failure data.[10, 11] Implant treatment has become commonplace in daily practice, yet the practitioner should never discount the importance of a correct approach and health care fundamentals.[12-15] The foundation thereof is a comprehensive patient history, thorough clinical examination, the use of special adjunct investigations where necessary, a review of the patient's risk factors, all to derive accurate diagnoses.[6, 16] It is evident from the failed case presented here that these principles were not adhered to. The site and its retained root were not diagnosed properly and thus the patient went through multiple and unnecessary procedures that ultimately required extensive reconstruction to rehabilitate the site. The ridge deficits were not diagnosed correctly and the need for bone and soft tissue augmentations was not identified. The value of a CBCT scan in planning implant treatment cannot be over-emphasized.[14, 15, 17] Literature does not necessitate CBCT as an absolute for every implant treatment case planned, but it is difficult to identify a planned implant, verifying adequate bone circumferential to the implant, to locate anatomical structures of risk, to orientate a correct restoratively planned placement positioning.[16, 18]

Sound knowledge of implant dentistry principles are essential when delivering such treatment to a patient and the clinician is required to have a thorough understanding of anatomy, biology, prosthodontics, and implant hardware.

Figure 31: A further 8 weeks allowed for soft tissue maturation and infill of the distal interproximal space.

Figure 32: The final screw-retained crown in place. Adequate bulk of tissue buccal to the implant restoration.

Figure 33: 2-year follow-up, tissues stable with adequate aesthetic and functional results.

Evident in the original failed treatment, a knowledge of the minimum bone required to accommodate the implant inserted at the correct height and position to ensure long-term tissue stability was lacking.[6] Recognizing the need for a soft tissue augmentation that in turn supports healthy bone at the implant, that can be developed and sculpted to frame the implant restoration, potentially creating pseudopapillae as with the revised rehabilitation presented here, was also lacking.[19] The attempt at placing a non-internal conical connection implant, and attempting to restore at occlusal level via a highly unconventional customized abutment contributed to the failure. Compromising established, evidence-based, reliable procedures and opting for an alternative compromise introduces a debate for clinical innovation versus jeopardizing treatment. But in this case the 3rd implant placement and restorative approach were both indisputably unacceptable. It is accepted clinical practice to place an implant beyond the sinus or nasal floor cortex contained within an intact membrane and most often a bone augmentation, when a vertical ridge deficiency presents in the maxilla.[20, 21] But entirely perforating into the nose, and placing a large portion of the implant body unsupported by augmented bone is not clinically acceptable and does not contribute to the integration of the implant. Of greatest concern in the case presented here was the disregard for principles of beneficence and non-maleficence.[22] The persistent infection was not addressed and the underlying cause, likely the infected root fragment, was not diagnosed. The failure of the previous two implant treatment attempts should have been investigated. Moreover, tooth 14 should not have been cut away to accommodate the implant restoration.

Managing increased crown height space to implant ratio is acceptable and common at resorbed, post-extraction sites.

But extending a customized abutment transgingivally to bring the crown into occlusion as with this case is not acceptable. The cantilever forces exerted in the failed treatment are not conducive to health.[23] Moreover, the soft tissues when healed at the neck of an implant crown seek to establish a biological zone, commonly of long junctional epithelium with underlying connective tissue along the abutment.[19] A tissue seal and attachment along the entirety of the failed abutment here was unlikely. As such, the long junctional epithelium may allow for bacterial plaque ingress and colonization along the length of the abutment that cannot be cleaned by the patient, resulting in the infective, granulation tissue seen at the implant's removal.[24]

Conclusion

A lack of sound knowledge in implant dentistry and an attempt at a compromise resulted in a drastic failure that required several additional procedures to rehabilitate. The failure presented here underpins the importance of basic and fundamental principles when approaching any treatment. Key are proper examinations, diagnoses, and treatment planning, that substantiate ethical treatment options.

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