ARTICLES SCIENTIFIQUES

The Incisive Canal in Implantology: Anatomical Trap or Strategic Advantage?: A case report

Le canal incisif en implantologie : piège anatomique ou avantage stratégique ? : à propos d'un cas clinique

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Résumé

La réhabilitation implantaire de la région de l'incisive centrale maxillaire est souvent confrontée à une résorption osseuse alvéolaire et à la présence du canal incisif, longtemps considéré comme une structure anatomique à éviter en raison de son contenu neurovasculaire. Grâce aux progrès de la tomographie volumique à faisceau conique (TVFC), et à une meilleure compréhension de l'anatomie maxillaire, le rôle du canal incisif dans la planification implantaire a été réévalué, notamment dans les situations de volume osseux limité. Plusieurs auteurs ont proposé une modification contrôlée ou une utilisation stratégique du canal afin de faciliter la mise en place implantaire tout en réduisant le recours à des augmentations osseuses étendues. Un patient de 30 ans, en bonne santé générale, a consulté le service de consultations externes et d'implantologie de la Clinique dentaire de Monastir, Tunisie, pour la réhabilitation d'une incisive centrale maxillaire gauche absente. L'examen TVFC a montré une insuffisance de largeur osseuse associée à une proximité étroite du canal incisif. Une approche chirurgicale comprenant l'évidement du contenu du canal, la mise en place de l'implant guidée par son trajet et le comblement par un xénogreffe a été réalisée. Une stabilité primaire satisfaisante a été obtenue et la cicatrisation postopératoire s'est déroulée sans complication ni trouble neurosensoriel. L'objectif de cet article est d'illustrer, à travers ce cas clinique, le potentiel du canal incisif en tant que guide anatomique stratégique en implantologie antérieure maxillaire, ainsi que d'en discuter les avantages et les limites cliniques.

Mots clés : Canal incisif, région antérieure, implant dentaire, technique de Simonpieri, greffe osseuse.

Abstract

Implant rehabilitation of the maxillary central incisor region is frequently challenged by alveolar bone resorption and the presence of the incisive canal, which has long been considered as an anatomical structure to avoid because of its neurovascular contents. With advances in cone-beam computed tomography (CBCT) and a better understanding of maxillary anatomy, the role of the incisive canal in implant planning has been reconsidered, particularly in cases with limited bone volume. Several authors have suggested that controlled modification or strategic use of the canal may facilitate implant placement while reducing the need for extensive bone augmentation. A 30-year-old healthy male patient consulted the Outpatient and Implantology Department of the Dental Clinic of Monastir, Tunisia, for rehabilitation of a missing maxillary left central incisor. CBCT examination revealed insufficient bone width and close proximity to the incisive canal. A surgical approach involving enucleation of the canal contents, implant placement guided by the canal trajectory, and filling of the canal with xenograft material was performed. Primary stability was achieved, and postoperative healing was uneventful, with no neurosensory disturbances. The aim of this article is to illustrate, through this clinical case, the potential of the incisive canal to be used as a strategic anatomical guide in anterior maxillary implantology and to discuss the clinical advantages and limitations of this approach.

Key words : incisive canal, anterior region, dental implant, Simonpieri technique, bone grafting.

INTRODUCTION

Implant rehabilitation of the maxillary central incisor region poses significant clinical challenges, particularly in cases where post-extraction resorption or traumatic injury has compromised the alveolar ridge. The need to restore both esthetics and function in this highly visible area often requires innovative surgical strategies when conventional implant placement is limited by insufficient bone volume. Among the anatomical considerations that influence treatment planning, the incisive canal is traditionally regarded as a structure to avoid due to its neurovascular contents and its close proximity to the implant site.

Recent developments in three-dimensional imaging and a more refined understanding of maxillary anatomy have prompted a reevaluation of this perspective. Emerging clinical evidence suggests that, in selected cases, the incisive canal can be intentionally integrated into the surgical plan to facilitate implant placement. Controlled modification or utilization of the canal space may offer additional anchorage, improve implant trajectory, and reduce the need for extensive grafting procedures, without compromising long-term neurosensory function.

The present case report describes a clinical situation in which the incisive canal was strategically used as an anatomical advantage to enable the placement of a dental implant in the central incisor region. By illustrating the clinical decision-making process, surgical technique, and postoperative outcomes, this case highlights the potential role of the incisive canal as a supportive structure in anterior maxillary rehabilitation.

CASE PRESENTATION

Clinical history and patient information

A 30-year-old healthy, non-smoking, non-alcoholic male patient with no current medication or allergies consulted the Outpatient and Implantology Department of the dental clinic of Monastir/Tunisia, for rehabilitation of the missing central incisor in the left maxillary sector.

His main complaint was his unwillingness to smile due to absent anterior teeth and poor esthetics.

A panoramic X-ray was obtained for the patient using standard radiographic techniques. The image quality was of good resolution, with clear and detailed visualization of the oral structures.(figure1)

The CBCT coronal slice at the anterior maxillary region reveals an insufficient bone width at the site of the tooth N°21.(figure2)

The treatment plan consisted of enucleating the incisive canal, followed by implant placement and filling the canal with xenograft particles.

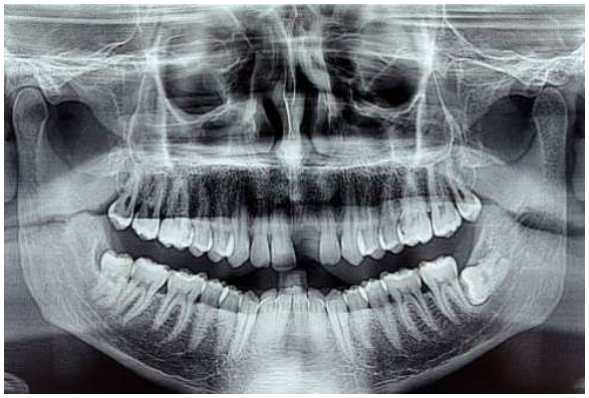

Figure 1 Panoramic X-Ray

Figure 2 CBCT coronal slice

Surgical procedure

The mouth was disinfected with 0.12% chlorhexidine rinses, the skin around the mouth was disinfected with polyvidone iodine solution, and the surgical area was isolated using sterile surgical scrubs.

Under local anesthesia (buccal and palatal) with mepivacaine 2% containing a vasoconstrictor 1:100,000 (medicine 2%, Médis, Tunisia), we started by performing two intra-sulcular incisions around the teeth n11 and 22,continued by a mid-crestal incision with a scalpel blade n° 15 in the alveolar crest of the central incisor area. (figure4)

The flap was carefully detached using a Molt periosteal elevator, followed by total subperiosteal detachment up to the bony margin, allowing adequate flap elevation and optimal visibility and access to the implant site. All soft tissue remnants were removed from the bone to obtain a clear surgical field.(figure5)

The incisive canal and its contents were clearly identified. Enucleation of the incisive neurovascular

bundle was subsequently performed under continuous irrigation using a periodontal curette. (figure 6). The implant site was then prepared by passing successive drills with increasing diameters to the depth of the final preparation until the final drill was reached whose diameter corresponds to that of the implant.

The implant (Biotech/Kontact®/ø3.6/L:12 mm) was then placed with a rotation speed of 50 rpm and an insertion torque of 35 Ncm. (figure7)

Before the final placement of the healing abutment, the implant cover screw was provisionally placed and the canal was filled with xenograft particles. (figure8)

After finishing, the healing abutment was screwed on and the flap was repositioned and sutured using 4-0 resorbable sutures.(figure9)

A periapical X-ray was taken on the day of the surgery, showing correct implant axis. (figure10)

*The patient had post-surgery instructions and a medical prescription. Then he was scheduled to remove the sutures 10 days after surgery.

Figure 3 Endo-buccal view

Figure 4 Anesthesia

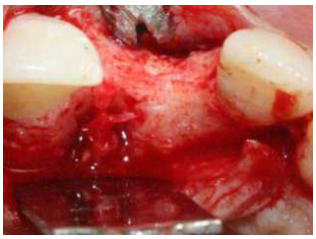

Figure 5 Incisive canal content

Figure 6 Enucleation of the incisive canal content

Figure 7 Osteotomy trajectory for implant placement

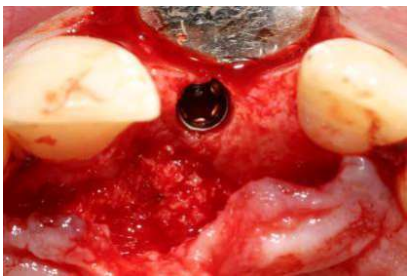

Figure 8 Filling the incisive canal with xenograft bone and Implant placement

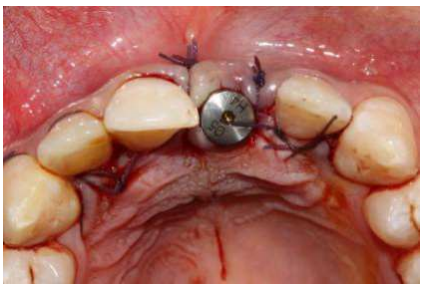

Figure 9 Stitches

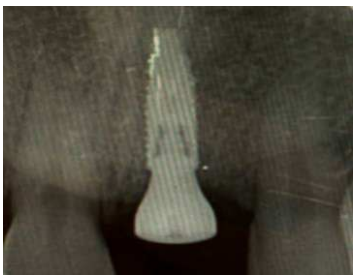

Figure 10 Post-operative X-Ray

DISCUSSION

A thorough understanding of the anatomy of the incisive canal is essential when evaluating its role in anterior maxillary implant procedures. The canal occupies the midline of the premaxilla and extends between the nasal cavity and the anterior palate. It contains the incisive nerve , a continuation of the nasopalatine nerve that changes name as it enters the canal, along with the incisive artery, both of which provide sensory innervation and vascular supply to the palatal mucosa spanning the canine region(1). Anatomically, the canal displays considerable variability: it may be present as cylindrical, funnel-shaped, hourglass-shaped, or

even as multiple parallel canals (2,3). Its dimensions are influenced by age, sex, and dental status, with studies showing that tooth loss in the anterior maxilla often leads to enlargement or forward displacement of the canal due to post-extraction remodeling (4,5,6). This variability directly affects the available bone volume and the feasibility of implant placement in the central incisor region. Historically, these anatomical features contributed to the perception of the incisive canal as a potential "trap" in implantology. The presence of a neurovascular bundle raised concerns regarding hypoesthesia, hyperesthesia, bleeding, and compromised osseointegration if the canal was violated during implant placement (7). Moreover, the canal's position often reduces the thickness of the premaxillary bone, making implant placement difficult without additional grafting procedures. Early reports highlighting postsurgical neuro-sensory disturbances reinforced the belief that the incisive canal was a structure to be avoided whenever possible (8,9). However, with the advent of high-resolution CBCT and improved anatomical knowledge, this perspective has evolved. Studies have shown that the incisive nerve has significant collateral innervation from the greater palatine and superior alveolar nerves, providing overlapping sensory coverage, which may explain the low incidence of long-term sensory complications following canal manipulation (1,10). Emerging clinical evidence demonstrates that the incisive canal can be safely modified, grafted, or partially occupied by an implant under selected conditions (11,12,13).

Techniques such as neurovascular bundle lateralization or canal grafting have allowed clinicians to create a stable implant bed without compromising prosthetic positioning.

In many cases, the dense palatal bone surrounding the canal provides useful anchorage when buccal bone is insufficient, transforming the canal from an obstacle into a strategic asset (12).

In this context, the incisive canal is increasingly recognized not only as a structure to avoid but as a potential anatomical advantage. Its controlled use can reduce the need for extensive augmentation, improve implant trajectory, and support prosthetically guided placement. The present case exemplifies this shift, demonstrating that with careful planning and respect for anatomical boundaries, the incisive canal can be integrated into the surgical strategy to achieve predictable esthetic and functional outcomes.

Simonpieri and colleagues introduced an innovative approach in which the incisive canal is not treated as an obstacle but rather as a natural anatomical guide for implant placement (14). The Simonpieri technique involves the careful curettage or partial debridement of the canal contents, followed by guided implant placement using the canal's trajectory as a reference. This concept aligns with the principles of minimally invasive implantology, aiming to optimize available bone while respecting anatomical landmarks.

From a biomechanical perspective, using the incisive canal as a guide may allow for improved implant alignment along the long axis of the alveolar ridge, particularly in severely resorbed maxillae (15). This approach can help maintain implant placement within the prosthetically driven envelope, thereby enhancing load distribution and long-term stability. Moreover, several clinical reports have suggested that controlled manipulation of the canal does not necessarily result in permanent sensory disturbances, provided that atraumatic techniques are employed and excessive compression of the nasopalatine nerve is avoided (16). Another advantage of this approach is the potential reduction in the need for complex grafting procedures. Traditional management of the anterior maxilla often relies on guided bone regeneration or block grafts to compensate for insufficient bone volume around the incisive canal (17). By contrast, the Simonpieri technique may reduce surgical morbidity, treatment time, and overall costs, while still achieving predictable functional and esthetic outcomes. Nevertheless, this strategy is not without limitations. Careful case selection is paramount, as enlarged incisive canals, high esthetic risk patients, or those with pre-existing neurosensory symptoms may not be ideal candidates (18). Additionally, thorough preoperative CBCT assessment is mandatory to evaluate canal morphology, proximity to adjacent structures, and available bone volume. Long-term, well-designed clinical studies are still needed to validate the safety and predictability of this technique compared with conventional approaches. Overall, reconsidering the role of the incisive canal in implant dentistry reflects a broader evolution toward anatomy-driven and patient-specific treatment planning. When properly assessed and cautiously integrated into the surgical protocol, the incisive canal can serve not only as a structure to respect but also as a valuable anatomical guide, as proposed in the Simonpieri technique, contributing to more conservative and prosthetically optimized implant rehabilitation in the anterior maxilla.

CONCLUSION

In conclusion, the incisive canal, long considered a limitation in anterior maxillary implantology, can, under careful planning and appropriate surgical techniques, serve as a strategic anatomical advantage. A thorough understanding of its morphology, contents, and variations is essential to minimize the risk of neurosensory complications and to optimize implant stability and prosthetic outcomes.

This case illustrates that, rather than being a mere obstacle, the incisive canal can be integrated into the surgical plan to expand reconstructive possibilities in the central incisor region. Future studies with larger patient cohorts are warranted to further define the long-term success, safety, and clinical guidelines for strategic use of the incisive canal in implantology.

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