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CASE REPORT

INTERRUPTION OF CANALIS SINUOSUS BY DENTAL IMPLANT PLACEMENT: REPORT OF TWO CASES

Interrupción del conducto sinuoso por colocación de implantes dentales: informe de dos casos

Sergey Kabak,[1] Yuliya Melnichenko,[1] Ruslan Mekhtiev,[2] Nina Savrasova.[3]

1. Human Morphology Department, Belarusian State Medical University, Minsk, Belarus.
2. Department of Prosthetic Dentistry and Orthodontics, Belarusian State Medical University, Minsk, Belarus.
3. Dental clinic "Elegiya", Minsk, Belarus.

ABSTRACT

Case Report: The Canalis Sinuosus (CS) represents a critical anatomical consideration in anterior maxillary implantation, with its perforation potentially leading to either neuropathic complications or significant hemorrhage. This report details two clinically distinct cases of CS-related injuries during upper incisor implant placement.

In the first case, a 60-year-old male developed persistent neuropathic pain following terminal CS branch perforation, with symptoms enduring at 1-year follow-up despite implant retention. The second case involved a 35-year-old female who experienced 5-day postoperative bleeding from accessory canal (0.9 mm diameter) disruption, successfully managed through conservative measures.

These outcomes underscore three critical findings: first, accessory canals pose substantial hemorrhage risks even with proper implant positioning; second, injuries of terminal branch CS may necessitate extended pain management protocols; and third, cone beam computed tomography evaluation should be considered mandatory for anterior maxillary implant planning.

As the first comparative analysis of neurological *versus* vascular CS complications, this report provides clinicians with clear guidelines for complication prevention and management, while highlighting underrecognized anatomical risks in implant dentistry.

Keywords: *Canalis Sinuosus; Anterior superior alveolar nerve; Dental implants; Postoperative complications; Facial nerve injury; Hemorrhage.*

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Corresponding Author: Yuliya Michailovna Melnichenko. Human Morphology Department, Belarusian State Medical University, Dzerzhinskogo Avenue 83, Minsk, Belarus. Phone: (+375) 2916 378 67, **E-mail: mjm1980@yandex.ru**

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RESUMEN

Reporte de caso: El canalis sinuosus (CS) representa una consideración anatómica crítica en la implantación maxilar anterior, con su perforación potencialmente llevando a complicaciones neuropáticas o hemorragias significativas. Este informe detalla dos casos clínicamente distintos de lesiones relacionadas con el CS durante la colocación de implantes en incisivos superiores.

En el primer caso, un hombre de 60 años desarrolló dolor neuropático persistente después de la perforación de la rama terminal del CS, con síntomas que perduraron en el seguimiento de 1 año a pesar de la retención del implante. El segundo caso involucró a una mujer de 35 años que experimentó sangrado postoperatorio a los 5 días por la interrupción del canal accesorio (0,9 mm de diámetro), manejado exitosamente con medidas conservadoras.

Estos resultados subrayan tres hallazgos críticos: primero, los canales accesorios presentan riesgos sustanciales de hemorragia incluso con la colocación correcta del implante; segundo, las lesiones de la rama terminal del CS pueden requerir protocolos extendidos de manejo del dolor; y tercero, la evaluación de la tomografía computarizada de haz cónico debe considerarse obligatoria para la planificación de implantes maxilares anteriores.

Como primer análisis comparativo de las complicaciones neurológicas y vasculares de la CS, este informe proporciona a los médicos pautas claras para la prevención y el tratamiento de las complicaciones, al tiempo que destaca los riesgos anatómicos poco reconocidos en la implantología dental.

Palabras clave: *Canalis sinuosus; Nervio maxilar; Implantes dentales; Complicaciones posoperatorias; Traumatismos del nervio facial; Hemorragia.*

INTRODUCTION

The neurovascular bundle consisting of the anterior superior alveolar branch of the infraorbital nerve and anterior superior alveolar arteries/veins arises from the infraorbital nerve via tortuous canal (canalis sinuosus, CS). It passes through the anterior wall of the maxillary sinus along the lateral wall of the nasal cavity to the anterior alveolar process.[1] The terminal part of the CS is located in the projection of the incisors and canines close to the palate.[2]

The term canalis sinuosus was first proposed by Jones,[3] who demonstrated that—contrary to the previously prevailing view of multiple small intraosseous canaliculi containing separate branches of the anterior superior alveolar neurovascular bundle—this structure instead exists as a single, larger-diameter canal with a double-curved trajectory within the maxillary sinus wall.

The anterior superior alveolar nerve provides sensory innervation to the maxillary incisors, canines, and the adjacent soft tissues.[4] Possible anatomical variants of CS include the presence of one or more aberrant extensions of the terminal portion of CS towards the palate or anterior alveolar process (the so-called accessory canals).[5] According to the literature, the prevalence of accessory CS canals varies between 15.7% and 100%.[6]

The location of the CS and its accessory canals, which pass through the alveolar process, determines the risk of intraoperative bleeding as well as temporary or permanent sensory disturbances during various surgical

procedures, including dental implant placement in the anterior maxilla.[7] Several case reports have shown that damage to the canalis sinuosus during dental implant placement in the anterior maxilla can lead to persistent pain, which was only relieved after the implant was removed.[8,9] Additionally, perforation of the CS or its accessory branches can lead to disruption of the osseointegration of the implant.[10] This report presents two new clinical cases involving perforation of the canalis sinuosus and/or its accessory canals during dental implant placement.

MATERIALS AND METHODS

Pre- and postoperative cone-beam computed tomography (CBCT) scans of dental patients of outpatient clinics of Minsk, Belarus, with dental implants in anterior maxilla affecting CS for the years 2023-2024 were analyzed in this article.

Publication of these case reports was approved by the Ethics Committee of Belarusian State Medical University, Minsk. Informed consent for information release, image or other clinical information publication was obtained from both participants.

CASE REPORT

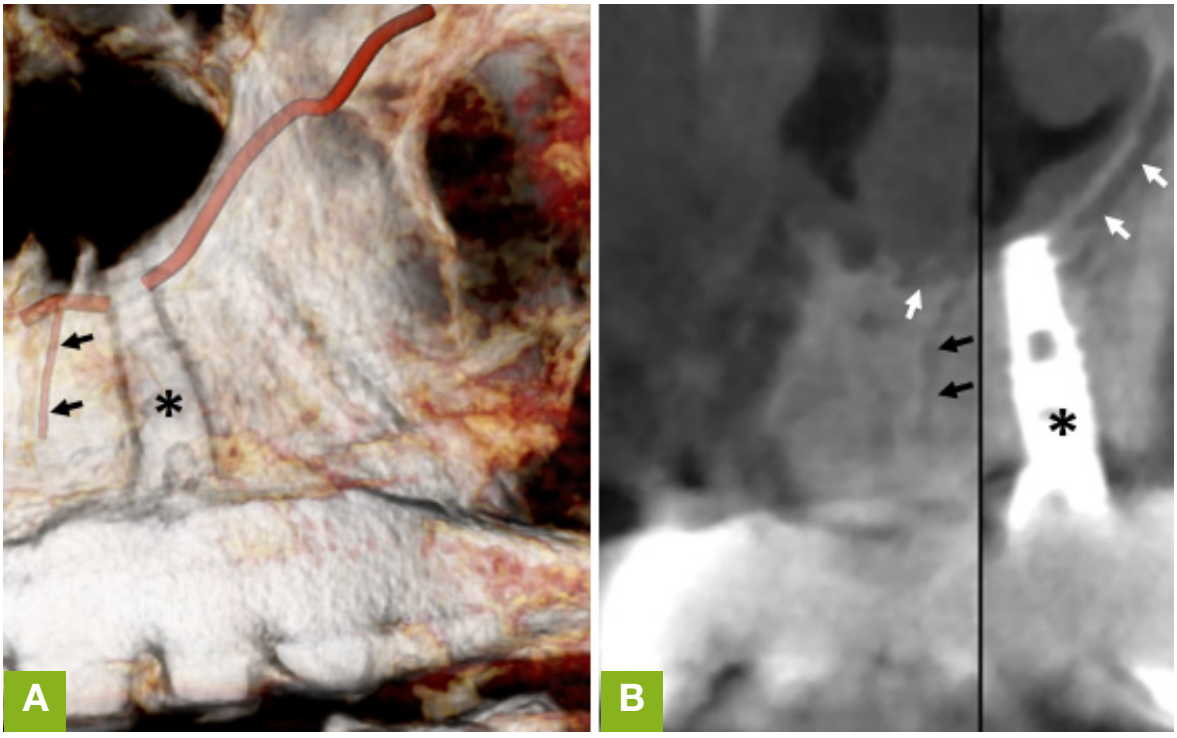
Case 1 Presentation

A 60-year-old male patient underwent installation of a 4 mm wide and 13 mm long implant in the area of the missing maxillary left lateral incisor 6 months after tooth extraction.

Implant placement was not accompanied

Figure 1.

Cone-beam computed tomography images, demonstrating dental implant 2.2(*) perforating the canalis sinuosus (white arrows)



A: Volume-rendered reconstruction. **B:** Corrected coronal scans. **Note:** The accessory canal of Canalis sinuosus (black arrows) extending toward the alveolar ridge at the left maxillary central incisor region.

by any significant perioperative bleeding. After the local anesthetic wore off, aching pain intensifying by palpation of the skin at the apex of the implant appeared.

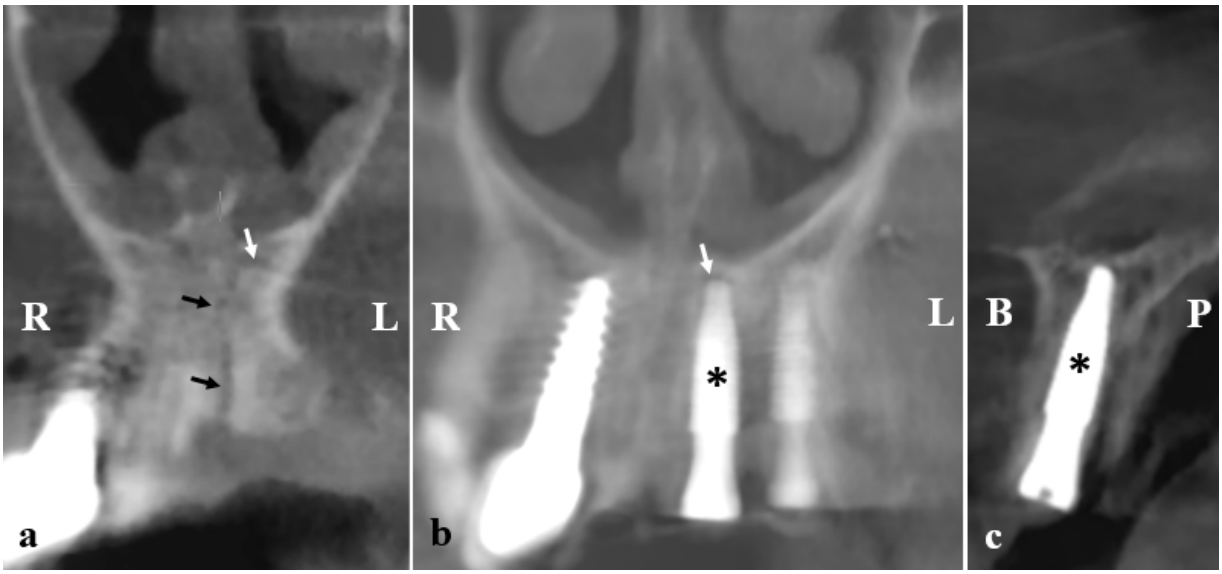
Postoperative management included 200 mg ibuprofen every 4–6 hours as needed for symptom relief, amoxicillin/clavulanate potassium (875 mg/125 mg) every 12 hours, and 25 mg chloropyramine hydrochloride at night. A year later, pain of varying intensity remained in the area of the maxillary left lateral incisor.

Figure 2.

Extraoral and intraoral photographs after dental implant placement (2.1 and 2.2) showing facial edema, postoperative bleeding and upper lip hematoma

A AND B: Photographs taken on the 3rd day. **C AND D:** Photographs taken on the 7th day.

Figure 3.
Cone-beam computed tomography (CBCT) images demonstrating the anatomical relationship between dental implants and the canalis sinuosus



A: Preoperative coronal view at tooth #21 showing the canalis sinuosus (white arrows) and its accessory canal (black arrows) extending to the alveolar ridge. **B AND C:** Postoperative coronal and sagittal reconstructions reveal complete effacement of the accessory canal by the implant body (asterisk), confirming iatrogenic disruption of this neurovascular pathway.
Orientation markers: B: Buccal. **P:** Palatal. **L:** Left. **R:** Right.

Postoperative CBCT revealed the presence of CS originating from the lower third of the infraorbital canal and passing towards the anterior nasal spine. The canal's diameter gradually decreased from 1.3 mm to 0.7 mm. The terminal portion of CS was interrupted at the level of the missing tooth 2.2 by the apical part of the dental implant, affecting it over a length of 2.8 mm.

An accessory branch (Ø 0.6 mm) extended further downwards from the CS to the alveolar ridge at the level of the missing tooth 2.1 (Figure 1). The oral surgeon who performed the implant procedure classified the patient's pain as idiopathic facial pain. The implant perforating the canalis sinuosus was retained.

Case 2 Presentation

A 35-year-old female patient received two 3.75×11.5 mm implants in the maxillary left central and lateral incisor sites 12 months post-extraction. The surgical procedure was complicated by significant hemorrhage originating near tooth 2.1, which was controlled through suturing and pressure dressing. Following bleeding control, standard healing abutments were placed.
Immediate postoperative care included 200 mg ibuprofen every 4–6 hours as needed for symptom relief, amoxicillin/clavulanate potassium (875 mg/125 mg) every 12 hours, and 25 mg chloropyramine hydrochloride at night.

On the 3rd postoperative day, after removal of healing abutments for customized temporization, bleeding began in the area of 2.1 implant (Figure 2A, Figure 2B). The surgical site was irrigated with 0.05% chlorhexidine solution, the healing abutments were reinserted, and the patient was referred to an oral surgeon.

Table 1

Comparative analysis of canalis sinuosus-related complications in two clinical cases

Parameter	Case 1	Case 2
Patient Demographics	60-year-old male	35-year-old female
Implant Details	Single implant (tooth #2.2) Dimensions: 4.0 × 13.0 mm	Two implants (teeth #2.1, #2.2) Dimensions: 3.75 × 11.5 mm
Time Since Extraction	6 months	12 months
Intraoperative Findings	No significant bleeding	Profuse bleeding from accessory canal violation (tooth #2.1 region)
Postoperative Symptoms	Delayed-onset neuropathic pain Persistent symptoms at 1-year follow-up	Continuous bleeding for 7 days No neurological deficits
CBCT Findings	CS max diameter 1.3 mm Apical perforation of CS by dental implant Accessory canal (0.6 mm) to tooth #2.1	CS diameter: 1.0–1.5 mm Accessory canal (0.9 mm) perforated byimplant at tooth #2.1
Management	NSAIDs (ibuprofen 200 mg q6-8h PRN) Antibiotics (amoxicillin/clavulanate 875 mg q12h) Antihistamine (chloropyramine hydrochloride 25 mg q24h) Implant retained despite pain	Identical pharmacotherapy Hemostasis: 0.05% chlorhexidine irrigation + pressure dressing + suturing Implants retained
Outcome	Neuropathic pain (classified as idiopathic)	Bleeding resolved by day 7
Key Anatomical Risk	Terminal CS perforation → persistent neurological symptoms →	Accessory canal disruption Acute vascular complications

Note: Patients presented no absolute contraindications for implantation, including absence of maxillofacial radiation history, active periodontal infection, uncontrolled diabetes or other systemic conditions, coagulopathies.

A conservative approach was adopted, prioritizing implant preservation. The bleeding resolved spontaneously by day 7 without further intervention (Figure 2B, Figure 2C)

Preoperative CBCT revealed the presence of CS measuring 1.0-1.5 mm in diameter, with an accessory canal (0.9 mm diameter) extending from its terminal portion at the level of the missing tooth 2.1 to the alveolar ridge (Figure 3).

DISCUSSION

The canalis sinuosus is now recognized as a distinct anatomical structure rather than an anatomical variation, with prevalence rates ranging from 88% to 100% across populations.[6,11,12] Despite its clinical significance, only 11 cases of iatrogenic CS injury have been documented in *PubMed*-indexed literature,[10,13] with 10 involving dental implants and one attributed to denture pressure.

Our report contributes two scenarios to this limited body of evidence:
(1) neuropathic pain arising from terminal CS penetration, and;
(2) recurrent hemorrhage secondary to accessory canal violation. These findings challenge several clinical assumptions.

Our first case (Table 1) demonstrates that CS terminal branch involvement can induce persistent neuropathic symptoms, as confirmed by CBCT evidence of implant-induced canal wall destruction. Notably, conservative management with pharmacotherapy was successfully employed without implant removal—a departure from the explantation approach described in six prior cases. This suggests that implant retention maybe viable when osseointegration is established, provided symptoms remain controllable.

The second case represents the first reported instance of clinically significant hemorrhage linked to accessory canal damage, expanding the known spectrum of CS-related surgical risks. The transient yet recurrent nature of this bleeding underscores the need for heightened awareness of vascularized accessory canals during preoperative planning.

Collectively, these observations advocate for mandatory CBCT evaluation prior to anterior maxillary implant placement, with particular attention to both terminal CS branches and their accessory canals due to their association with hemorrhage risk and potential neuropathic pain development.

Furthermore, they highlight the value of individualized therapeutic decisions—retaining osseointegrated implants when neurologically feasible while maintaining vigilance for vascular complications. Given that 15.7-100% of CS exhibit accessory canals,[6] our findings carry immediate relevance for refining surgical protocols in implant dentistry.

CONCLUSIONS

The presence of CS constitutes a significant risk factor for both intraoperative hemorrhage and postoperative neurosensory complications during dental implant placement in the maxillary anterior region.

Our findings emphasize the critical importance of CBCT evaluation prior to surgical intervention, as this imaging modality allows for precise identification of the CS anatomy and its accessory canals while enabling determination of safe zones for implant placement. These results strongly support the routine incorporation of CBCT assessment into standard preoperative planning protocols for implant procedures in the anterior maxilla to minimize neurovascular complications and optimize surgical outcomes.

CONFLICT OF INTERESTS

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

ETHICS APPROVAL

This research was approved by the Ethics Committee of Belarusian State Medical University and informed consents were obtained from all patients for the purpose of publication of case details and images (protocol#1 from 1 August 2023).

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AUTHORS' CONTRIBUTIONS

Sergey Kabak: Conceptualization, Data curation, Methodology, Project administration, Writing – review & editing.

Yuliya Melnichenko: Conceptualization, Project administration, Data curation, Investigation, Methodology, Writing – original draft.

Ruslan Mekhtiev: Investigation, Project administration, Writing – review & editing.

Nina Savrasova: Data curation, Investigation, Methodology, Visualization, Writing – review & editing.

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ORCID

Sergey Kabak
0000-0002-7173-1818
Yuliya Melnichenko
0000-0002-8742-6973
Ruslan Mekhtiev
0000-0003-0146-6841
Nina Savrasova
0000-0003-1297-0226

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