



e-ISSN:3049-060X

Journal of Advances in Oral Health

Official Journal of Inderprastha
Dental College and Hospital

Volume 2 Issue 1 January-June 2025



INNOVATIVE PUBLICATION
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Journal of Advances in Oral Health

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Managed and Published by Journal of Advances in Oral Health at **IP Innovative Publication Pvt. Ltd.**, A-2, Gulab Bagh, Nawada, Uttam Nagar, New Delhi – 110059, India.

Printed by Polykam Offset, C-138, Naraina, Industrial Area, Phase -1, New Delhi – 110028, India.

The paper used in this publication meets the requirements and ANSI/NISO Z39.48-1992 (Permanence of Paper).



From the Editor's Desk

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Received: 20-06-2025; **Accepted:** 22-06-2025; **Available Online:** 28-06-2025

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It is with great pride and a deep sense of academic fulfillment that I present to you the second volume of the *Journal of Advances in Oral Health*, the official publication of Inderprastha Dental College & Hospital. This journal, envisioned as a platform for scholarly dialogue and scientific innovation, continues to grow in stature, reflecting our institution's unwavering commitment to excellence in dental education, research, and clinical practice.

This volume showcases a rich amalgamation of rare case reports, innovative rehabilitation techniques, and public health research that collectively mirror the dynamic and evolving landscape of dental science. Each contribution represents meticulous clinical observation, diagnostic depth, and a passion for improving patient care—principles that lie at the heart of our profession.

We open this edition with "*Unveiling the uncommon: Adenomatoid odontogenic tumor linked to an impacted mandibular canine*", a case that brings to light a rare pathology with important clinical implications for early diagnosis and surgical planning. Following this is a timely and profoundly relevant case report titled "*Rehabilitation of maxillectomy in mucormycosis patient by using obturator*", which explores the intricate challenges and creative solutions involved in restoring function and aesthetics in post-COVID mucormycosis survivors.

The article on "*Dentigerous cyst exhibiting focal ameloblastomatous transformation*" adds a valuable histopathological dimension to this issue, underlining the importance of vigilance even in seemingly routine cases. Equally notable is the piece titled "*From atrophy to accuracy: A breakthrough in maxillary reconstruction*", which delves into contemporary reconstructive techniques that bridge the gap between atrophic defects and precise anatomic rehabilitation.

Clinical skill and precision are further exemplified in "*Clinical insights into endodontic management of dilacerated maxillary premolars*", a report that addresses the complexity of root canal therapy in anatomically challenging scenarios. We conclude with a socially impactful original research article—"*Effectiveness of Various Sensory Input Methods in Dental Health Education Among Visually Impaired Children (3–14 years): A Comparative Study*". This study not only advances health education methodology but also speaks to our collective responsibility to ensure equity and accessibility in oral healthcare.

As we celebrate the success of this issue, it is also an opportune moment to look forward. Our future vision for the *Journal of Advances in Oral Health* is guided by the goal of transforming it into a recognized, peer-reviewed, and indexed journal that fosters interdisciplinary research and global academic collaboration. We aim to:

Encourage high-quality submissions from academicians, clinicians, and researchers across India and beyond.

Introduce thematic issues that focus on emerging trends such as digital dentistry, AI in oral health, and regenerative therapies.

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Expand our editorial and peer-review board to include experts from diverse specialities to strengthen the quality and scope of publications.

Create opportunities for undergraduate and postgraduate students to contribute through mentorship-driven writing and research sections.

Organize workshops on scientific writing, research methodology, and publication ethics to build capacity among budding scholars.

This journal is more than a collection of articles—it is a growing movement that reflects our institutional ethos: to educate, to innovate, and to serve. I extend my sincere gratitude to all the contributing authors, reviewers, editorial team members, and staff who have worked diligently to make this issue a reality.

I invite our readers—students, faculty, and practitioners alike—to engage deeply with the content, contribute to future issues, and join us in our mission to advance the frontiers of oral health care and research.

With warm regards and best wishes,

Dr. Rahul Paul

Editor-in-Chief

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Review Article

The T-scan system: A digital approach to occlusal analysis in modern dentistry

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Abstract

Occlusion is fundamental to preserving the functional integrity of the stomatognathic system. Conventional techniques for assessing occlusion primarily depend on subjective patient responses and visual judgment, often lacking measurable data concerning the force and timing of occlusal contacts. Introduced in 1984 and now in its tenth generation of software, the T-Scan system offers a computerized, objective, and dynamic method for occlusal evaluation. Utilizing a pressure-sensitive Mylar sensor, the device records the timing and relative intensity of occlusal forces, helping clinicians identify early contacts, imbalanced force distribution, and potential temporomandibular joint issues. The system delivers real-time two-dimensional and three-dimensional visual outputs under both temporal and force analysis settings. Its versatility extends across various dental disciplines, including prosthodontics, implantology, orthodontics, restorative procedures, and post-operative monitoring. T-Scan enhances diagnostic precision, facilitates patient understanding, and may streamline treatment processes. However, it is not without limitations, such as its inability to measure absolute force, variability in sensor performance, and reduced reliability in certain clinical scenarios. Despite these challenges, the system has shown sufficient sensitivity and specificity to be a reliable tool in clinical practice. By enabling more accurate occlusal adjustments and promoting evidence-based treatment planning, T-Scan plays a significant role in advancing contemporary approaches to occlusal diagnostics and care.

Keywords: Computerized Occlusal analysis, Digital Analysis, Dynamic Mapping, T-Scan.

Received: 02-05-2025; **Accepted:** 05-06-2025; **Available Online:** 28-06-2025

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1. Introduction

Occlusion can be defined as “the act or process of closure or of being closed or shut off,” or more specifically, as “the static relationship between the incising or masticating surfaces of the maxillary and mandibular teeth or their analogues”.¹ For optimal function, occlusal contacts must harmonize with the overall stomatognathic system. The concept of occlusion goes beyond just the morphological interaction between teeth—it encompasses the dynamic, functional interplay of all elements within the masticatory system, including the teeth, periodontal structures, neuromuscular components, temporomandibular joints (TMJs), and craniofacial bones.²⁻⁴

In the context of occlusion, *nearby contacts* are defined as zones with either contact or a gap of up to 0.5 mm between opposing tooth surfaces. In contrast, *non-contacts* refer to

separations ranging from 0.5 to 2 mm. Among the various occlusal theories, Bonwill’s concept of bilateral balanced occlusion is widely accepted.⁵

Occlusal trauma typically results from uneven distribution of forces across the dentition, where opposing teeth may not contact simultaneously. Contributing factors often include premature contacts or excessive cusp height in restorations. Studies have indicated that heightened bite forces or abnormal lateral stresses can lead to damage in dental and periodontal structures, as well as in implants—frequently culminating in bone resorption or implant failure. Additionally, protrusive interferences can negatively affect the TMJs or force the mandible into a pathologic position, resulting in muscular discomfort or myalgia. Undetected occlusal discrepancies or interferences during mastication can generate harmful forces that may provoke clenching, facial and cervical muscle soreness, and even impinge upon

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nerves within the TMJ, contributing to various temporomandibular disorders (TMDs).⁶ Hence, a thorough occlusal evaluation is crucial to prevent and manage such complications.

Traditionally, clinicians have relied on various occlusal indicators such as articulation paper, silk strips, impression waxes, elastomeric materials, and shimstock foil to detect contact points during adjustments. These conventional methods, however, depend heavily on patient perception and fail to measure occlusal force quantitatively. In response to these limitations, advanced technologies such as the T-Scan system have emerged for digital occlusal analysis. The T-Scan offers notable advantages, including high sensitivity, reproducibility, and the ability to record the sequence of occlusal contacts, the timing, and the distribution of relative forces. The most recent iteration in use is the T-Scan III system.⁷

2. Historical Development & Clinical Utility

The T-Scan system was initially introduced in 1984 by Maness and colleagues, making it the first computerized device to analyze occlusal contact using both force and timing metrics. It marked a shift toward grid-based occlusal analysis technology. By 1987, the system was made commercially available through Tekscan. The early model utilized epoxy-based sensors embedded with conductive ink, capable of recording occlusal contact timing and intensity.⁸

In 1991, Kerstein RB and Wright N utilized the first-generation T-Scan to study disocclusion time in patients with myofascial pain, emphasizing the system’s diagnostic potential.⁹ Later, in 2010, Bernd Koos and associates conducted a clinical evaluation involving 45 patients and validated the T-Scan's accuracy and repeatability.¹⁰

Table 1: Evolution of the T-scan system (Kerstein, 2020)¹¹

T-Scan Version	Year	Key Features	Contact Timing (seconds)
T-Scan I	1984	Epoxy-based, ink grid, intraoral force recording	0.01
T-Scan II	1995	Windows interface, 2D/3D views, trajectory, customizable dental arches	0.01
T-Scan III	2004-2006	Synchronized EMG, zoom features, detailed force-time graphs	0.03
T-Scan III (Software 5-7)	2004	Patient data storage, EMG sync, 2D/3D visualization	0.03
T-Scan 8	2012	Simplified graphics for learning purposes	0.03
T-Scan 9	–	Introduction of ergonomic Novus handle	0.03
T-Scan 10	2018	Enhanced interface, digital impression overlay, implant safety alerts	0.03

3. Sensor Generations Overview

Across its development, five generations of T-Scan sensors have been introduced (Kerstein, 2020) - 1st Generation (1984): Consisted of a pressure-sensitive epoxy matrix with Mylar laminations and conductive ink.2nd Generation (1992): Featured urethane-based dielectric within Mylar casing, enhancing flexibility and resistance to cracking.3rd Generation (1997): Utilized a dual-layer Mylar construction with pressure-sensitive ink grid, offering better thermal stability and reduced drift.4th Generation (2002): Included HD capabilities, increased the recording zone by 33%, and minimized non-recording area by 50%.5th Generation (2018): Combined dual-layer Mylar and Novus handle, offering larger HD sensors for improved data precision.¹¹

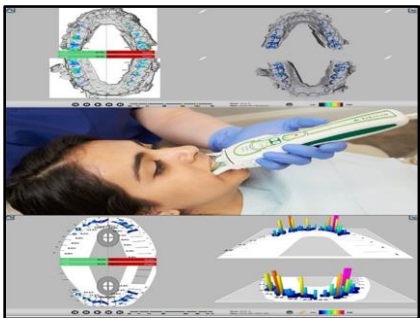


Figure 1: Occlusal force analysis using T-scan system

4. Components and Working Modes

The T-Scan system comprises a pressure-sensitive sensor (U-shaped), a handle, sensor holder, system unit, computer software, USB connection, and a calibration unit. It functions in two primary modes:

- 1. Time Mode: Visualizes occlusal contacts in 3D, highlighting the first three contact points with corresponding time values.
- 2. Force Mode: Analyzes contact location and intensity in both 2D and 3D, with output displayed as an animated sequence.

The patient, seated upright, bites in centric relation on the sensor. The system registers occlusal dynamics, showcasing data such as relative force, contact sequence, and bite timing in both 2D and 3D formats.¹²

5. Working Mechanism

Occlusal contact alters the sensor's electrical resistance, converting pressure data into visual imagery. Two analyses are provided: Time Analysis: Highlights the sequence of contacts using color-coded indicators. Force Analysis: Visualizes occlusal force intensity and location using varying colour shades.

Force mode subtypes:

1. Instantaneous: Captures a single force snapshot at a specific mandibular position.
2. Sequential: Monitors occlusal contacts throughout the jaw's movement, generating a continuous movie-like visualization.

Instead of measuring absolute occlusal forces, the system tracks relative force values, which ensures consistent and comparative evaluation across different sessions, independent of muscle activity variation.¹³

6. Clinical Applications

Diagnostics: Early detection of occlusal imbalances and dysfunctions. Prosthodontics: Helps in identifying high points on restorations and ensuring occlusal stability. Implant Dentistry: Assists in assessing force distribution to prevent overload and implant failure. TMJ Disorders: Combined with EMG, helps in analyzing mandibular movement and muscular activity. Orthodontics: Aids in pre- and post-treatment occlusal assessments to ensure proper bite alignment. Restorative Dentistry: Detects occlusal discrepancies in restorations, reducing failure and discomfort. Surgical Evaluation: Useful post-operatively to assess occlusal harmony after procedures such as orthognathic surgery.¹⁴

6.1. Advantages

1. Provides 3D visualization of occlusal contact timing and location.
2. Enables early detection of occlusal interferences during functional movements.
3. Facilitates precise force analysis across dental arches.
4. Enhances patient understanding and compliance with treatment plans.
5. Reduces treatment time and risk of implant complications or prosthetic failures.
6. Records can be stored for longitudinal monitoring.

6.2. Limitations

1. Sensor sensitivity is not uniform and requires calibration before use.

2. Sensor thickness may interfere with proprioception and occlusal accuracy.¹⁵
3. Sharp occlusal contacts may distort sensor output, creating recording artifacts.
4. It cannot reliably detect interferences smaller than 0.6 mm.
5. Time and force analysis modes may show slight inconsistencies in occlusal contact representation.
6. Absolute bite force measurement is not possible; only relative forces are recorded.
7. Manual recording techniques (e.g., handheld loading) can introduce variability between trials, though increasing the sample size can help mitigate random errors.¹⁶

7. Discussion

The T-Scan system represents a significant advancement in computerized occlusal analysis, offering a dynamic, quantifiable method to assess occlusal contact timing and relative force distribution. This technology addresses many limitations of traditional occlusal assessment tools such as articulating paper and shim stock, which are inherently subjective and limited to static, visual evaluations. With the incorporation of high-definition sensors and updated software, the T-Scan system allows for real-time recording and visualization of occlusal contacts in both 2D and 3D formats, enabling clinicians to make precise and evidence-based occlusal adjustments.¹⁷

The ability to correlate the sequence and magnitude of contacts with their specific intraoral locations enhances the clinical relevance of occlusal adjustments. This is particularly beneficial when managing prosthetic restorations, implant-supported prostheses, and occlusal imbalances. The system facilitates the establishment of bilateral simultaneous occlusal contacts, ensuring that no region of the arch is subjected to excessive early force or delayed loading. Achieving such balance is critical for promoting functional harmony and preventing undue stress on restorative materials or biological structures.

The objectivity provided by T-Scan technology eliminates the guesswork often associated with traditional methods. Operators can measure and control both force and timing with precision. For instance, ideal occlusal endpoints—where all teeth contact within 0.2 seconds and posterior disclusion occurs within 0.4 seconds of initiating an excursive movement—can be reliably attained with the aid of T-Scan-guided corrections. Additionally, the system enables clinicians to achieve a symmetrical distribution of occlusal force (50% right and 50% left), which is essential for long-term stability of the occlusion.¹⁸

Despite these advantages, several studies have highlighted limitations of the T-Scan system. Moini et al., 1991 reported that its accuracy was lower than that of traditional silk ribbon methods.¹⁹ Hsu et al., 1992 found that sensor sensitivity was not uniform across the sensor surface,

potentially affecting the reliability of recordings.²⁰ Throckmorton et al., 2009 emphasized that the system is not suitable for measuring absolute bite forces without the use of additional aids like shim stock or bite guards.²¹ Furthermore, although T-Scan sensors are available in multiple sizes to accommodate varying dental arch dimensions, there is limited evidence regarding their effectiveness in pediatric populations or individuals with restricted mouth opening.

Koos et al., 2010 however, demonstrated that the system maintains a satisfactory level of accuracy and that the replacement of sensors or repeated measurements did not introduce significant variation.²² Moreover, the evolution of the software—now in its tenth version—has led to improvements in the graphical representation of the dental arch, making occlusal analysis more anatomically accurate and clinically useful.

An important feature of the T-Scan system is its capacity to separately analyze contact timing and force distribution, offering a comprehensive overview of occlusal function and muscular coordination. This dual analysis allows clinicians to make a definitive diagnosis of occlusal imbalances, facilitating better treatment planning in various disciplines such as prosthodontics, implantology, restorative dentistry, and orthodontics.²³

The T-Scan system has undergone notable improvements; newer sensors are thinner and more adaptable, enhancing patient comfort and allowing for more precise detection of bite forces and contact timing. T-Scan v10 software is the latest release in digital occlusion technology, which reveals the force, timing, balance, and location of contacts in the mouth in real-time. Incorporate occlusion as part of the intraoral workflow, integrate biometric data, and work more efficiently with improved chairside functionality. NEW features and enhancements to simplify digital occlusion, T-Scan v10 boasts improvements to the database, security, and patient files and reports. Design and functionality features allow for capturing bite data more efficiently.²⁴

In conclusion, while the T-Scan system is not without limitations, it provides a significant enhancement over traditional occlusal assessment tools. Its ability to objectively measure contact timing and relative force distribution contributes to improved diagnostic accuracy and more predictable treatment outcomes. Future developments should aim to improve sensor sensitivity and adapt the technology for broader applications, including use in pediatric and special-needs populations.²⁵

8. Conclusion

Accurate assessment and correction of occlusion remains a complex clinical challenge. The T-Scan system, functioning as a computerized occlusal mapping tool, offers a valuable solution by enabling precise analysis of occlusal contact

patterns. It is increasingly adopted in clinical dentistry due to its ability to provide objective data on occlusal function. The system allows for comprehensive evaluation in three key aspects: (a) it displays the timing and relative intensity of all tooth contacts, (b) it detects excessive occlusal loads and brief impact forces on individual teeth, and (c) it reveals active contacts within the functional mandibular range, including the relationship between working and non-working interferences. T-Scan has demonstrated strong sensitivity and specificity in clinical diagnostics, and it performs reliably under intraoral conditions, even in the presence of moisture such as saliva. By eliminating the reliance on subjective interpretation, it allows for the registration and evaluation of dynamic occlusal data with high precision. Despite the high cost associated with this technology, it proves to be a valuable asset in both clinical practice and dental education. It enhances the clinician's ability to diagnose occlusal imbalances accurately, monitor treatment outcomes, and improve patient care through data-driven decisions. Thus, the T-Scan system stands as an important tool for advancing the understanding and management of occlusal dynamics in contemporary dentistry.

9. Source of Funding

None.

10. Conflict of Interest

None.

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Cite this article: Goyal MK, Paul G, Chauhan S, Sharma S, Bajaj AS, Dua M. The T-scan system: A digital approach to occlusal analysis in modern dentistry. *Journal Advances in Oral Health* 2025;2(1):1–5.



Original Research Article

Effectiveness of various sensory input methods in dental health education among visually impaired children of age group between 3-14 years- A comparative study

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Abstract

Introduction: Oral health education is essential for all, but it poses unique challenges for visually impaired children who rely on senses other than sight to learn. Customizing educational methods using sensory inputs like touch and sound can significantly enhance their understanding and practice of oral hygiene. This study aims to evaluate the effectiveness of various sensory input methods in improving oral health awareness among visually impaired children.

Aim & Objectives: The objective of the research is to assess the success of different sensory input techniques in oral training program for visually impaired child. The dental health condition was evaluated by measuring plaque scores both prior to and following the oral health education.

Materials and Methods: The research included 50 child with low vision aged between 3 and 14 years, representing both genders, from a single institution for the blind. The overall study population (n=50) was randomized and separated into two groups, each consisting of 25 children.

Results: Following the intervention, the average scores exhibited statistical significance in both study groups when contrasted with the baseline scores.

Conclusion: The research indicates that visually impaired children can achieve a satisfactory level of oral hygiene when instructed using specialized, tailored methods such as a multisensory approach, which has proven to be more effective than a unisensory method.

Keywords: Health education, Oral Health, Oral hygiene

Received: 20-05-2025; **Accepted:** 23-06-2025; **Available Online:** 28-06-2025

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1. Introduction

Dental care is a crucial aspect of overall, influencing not only aesthetics and interaction but also having significant physical, emotional, and social implications. Nation like India, where health awareness is generally low and poor oral hygiene is widespread, along with limited access to oral health professionals, providing comprehensive treatment for the entire community seems impractical. Consequently, there is a clear necessity to explore the success of promoting oral health through dental training.¹

Wellness promotion concerning the sustainability of good oral health is vital for all individuals, including those with special need. These patient who have additional needs, often receive less dental care compared to the general children, despite experiencing a higher prevalence of oral diseases.² The dental health status of these disabled groups should be enhanced through increased awareness facilitated by

pediatricians, health visitors, and community and primary care teams.³ Dental training involves briefing the importance of dental hygiene and demonstrating brushing and interdental cleaning, typically using visual aids such as disclosing agents and models. Nonetheless, there are situations in which such demonstrations and visual aids may not be appropriate, especially for children who are blind or have visual impairments.⁴ It is crucial for these children to grasp not only the origins of oral diseases but also the preventive strategies to reduce them.⁵ The absence of visual stimuli poses a challenge for dentists in motivating these individuals to uphold proper oral hygiene. Providing thorough dental care for blind children is not only rewarding but also constitutes a significant community service that pediatric dentists ought to endeavor to offer.⁶

In contrast to sighted children, a blind child depends considerably more on alternative senses, such as touch and

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hearing, for their learning process.⁷ This prompts an inquiry into the methods that can be utilized to instruct blind children regarding their oral care, considering that vision—the primary sense for acquiring knowledge—is unavailable. Educational strategies and techniques must be customized to address the unique requirements of the patients, while also integrating essential principles.⁸ A multitude of studies have been recorded in dental literature concerning the delivery of oral health education (OHI) to blind children, which includes the implementation of self-educational manuals, audio recordings, and dental models, among other resources. This research evaluated a modified teaching approach, rather than a fundamental change in oral hygiene practices. The objective of the study is to provide dental health education to blind children through various sensory input methods and to evaluate the effectiveness of each technique both prior to and following the oral health education intervention.⁹

2. Materials and Methods

Research were carried in visually disable children's school in the region of Delhi NCR. The study was conducted upon 50 visually disable children of age group 3-14 years after proper consent was given by their parents or caregiver. The children were separated into two groups, each consisting of 25 individuals. Inclusion criteria for study children whose parents or guardian or caregivers are willing to give consent. Children who are completely blind. Children age between 3-14years. Exclusion criteria for study children with underlying systemic disease. Children undergoing orthodontic treatment. Uncooperative children. Children above the age group of 14.

The data was collected in 3 phases.

Phase 1: The clinical examination took place with the children seated comfortably in chairs, and the plaque index value was documented under sun light at education campus. The plaque index served to record the scores for all the children.

Phase 2: Both groups obtained dental education from a one source trained evaluator utilize various methods. This education covered various issue such as the significance of dental care, brushing demonstration, the significance of tooth brushing, interdental cleaning, the cause of oral caries and periodontal health, as well as protective methods, including the role of fluorides in maintaining healthy teeth.

Group I (Verbal): This sample was provided with oral health education, which included a single information session, and the dental health training was delivered through verbal sensory input.

Group II (Braille): This sample was provided with oral health education through distribution of leaflets that were printed in Braille script.

Phase 3: After 4 week interval the plaque score was again recorded and the difference was studied.

2.1. Statistical analysis

All collected data was input into the Microsoft Excel Sheet 2007 Version, and the acquired data will be analyzed using the (SPSS) Version 27 for detailed analysis and testing for significance. mean, standard deviation, and proportion will be computed for each clinical parameter, and a statistical t-test will be employed for the mean proportion.

3. Result

The result of the study is summarize in the tables below. (Table 1, Table 2)

Table 1: Efficacy of verbal sensory input and braille script sensory input in oral health promotion

Variable	Before instructions DMFT score	After instructions DMFT score
Verbal Instructions	3.20 ± 1.683	2.6 ± 1.000
Braille Instructions	4.44 ± 2.468	2.32 ± 0.627

$p \leq 0.05$ – Significant, CI = 95 %

Table 2: Comparison of efficacy of verbal sensory input and braille script sensory input in oral health promotion before and after instructions

Variable	$\bar{x}$	σ	t	p, S/NS
Before and After Verbal Instructions DMFT score	0.600	1.354	2.216	0.036, S
Before and After Braille Instructions DMFT score	2.120	2.147	4.937	0.000, S

$p \leq 0.05$ – Significant, CI = 95 %

4. Discussion

Dental education is a broadly recognized strategy for preventing oral diseases. It involves the dissemination of expertise and technique essential for enhancing the well-being. Recently, there has been a noticeable change in dental health education in India. The initiation of community based health service not only fosters fresh behaviors but also reinforces and sustains healthy practices designed to advance health outcomes across individuals and communities.⁴ It has been informed that health care represents the most significant unmet need among individuals, particularly among the visually impaired, who experience dental health issues comparable to or exceeding those found in the population. Visually impaired child are entitled to the same opportunities for dental health and hygiene as their sighted counterparts. It is crucial to highlight the significance of health care for these child, as they are unable to visually assess their dental hygiene maintenance. In this current research, we observe in Table 1 a reduction in plaque scores after a 4-week interval.

We have also noted a marked inter-group difference noted between participants using Braille and those using verbal methods, indicating that the braille method is superior, as demonstrated in (Table 2). As evidenced by the research conducted by Yalcinkaya and Atalay,⁵ braille is more effective than the verbal sensory method for promoting oral health. Similarly, a study by chowdary et. al. (2016)⁷ categorized child without vision into 3 distinct groups based on various educational tools (verbal, braille text, and a mix of both) and assessed plaque and gingival index calculated at the end of three months, revealing reductions in both plaque and gingival scores across all criteria. Enhancing the dental health status of individuals with impairment is a challenging endeavor; however, this can be accomplished if guardian or caregivers receive proper health education, that is crucial to enhance and maintaining the oral health and, consequently, the overall general health of these student.

Organizations that offer specialized education for low vision child can assist children in enhancing their dental health practices by incorporating dental health maintenance into the curriculum. An substitute to a dental learning program could involve arranging regular visits for these children to dental hospitals, where they can consult with dental practitioners regarding to maintain hygiene.

5. Conclusion

The present research demonstrated that blind children are capable of maintaining an oral hygiene when showed to them using specialized technique, such as a multimodal approach, that has proven to be more superior to unisensory methods in promoting learning. It is advisable to maintain communication with guardian and caregivers, educating them on the importance of dietary modifications, improvements in hygiene, and the necessity of frequent dental visits for their child. Furthermore, oral health authorities should focus more on establishing dental health care programs in institutions for visually impaired children.

6. Ethical No:

IPDC/317

7. Source of Funding

None.

8. Conflict of Interest

None.

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Cite this article: Goswami AC, Mithesh SS, Nanda J, Mehlaawat R. Effectiveness of various sensory input methods in dental health education among visually impaired children of age group between 3-14 years- A comparative study. *Journal Advances in Oral Health* 2025;2(1):6-8.



Case Report

Unveiling the uncommon: Adenomatoid odontogenic tumor linked to an impacted mandibular canine

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Abstract

Adenomatoid odontogenic tumor (AOT) is an uncommon tumor that arises from the epithelial cells, accounting for only 3-7 % of all odontogenic tumors. It is a harmless, painless, non-invasive, and slow-growing benign lesion, with a frequency of and frequently mistaken for an odontogenic cyst during clinical examination. AOT primarily affects young people, with a higher occurrence in females, and commonly occurs around the crown of unerupted teeth in the second decade of life. This lesion is typically found in the maxillary jaw and is quite rare in the mandibular jaw. It is commonly linked to an impacted canine. AOT often resembles lesions similar to dentigerous cyst or ameloblastoma. AOT has three different types, follicular, extrafollicular, and peripheral. Follicular type is associated with the crown of an unerupted or impacted tooth, and the extrafollicular type, not associated with a tooth. Approximately 73% of central lesions are the follicular type.

Keyword: Admantinoma, Adenomatoid, Dentinoid, Amyloid, Liesegang rings.

Received: 27-04-2025; **Accepted:** 31-05-2025; **Available Online:** 28-06-2025

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1. Introduction

Adenomatoid odontogenic tumor (AOT) is rare tumor that arises from the epithelial cells, accounting for only 3-7 % of all odontogenic tumors.¹ In 1905, Steensland first described a lesion that is now recognized as AOT.¹ Later, in 1948, Stafne referred to similar tumor as an “adamantinoma”. In 1953, Dreyblatt described it as an “adenomatoid odontogenic tumor.” highlighting its gland-like (adenomatoid) structures.¹ Philipsen and Birn (1969) further refined its understanding, introducing the term Adenomatoid Odontogenic Tumor (AOT) and distinguishing it from other odontogenic tumors.¹⁻² In 1971 World Health Organization (WHO) officially recognized AOT as a distinct benign epithelial odontogenic tumor. Max and Stern, in 2003, coined the name ‘adenomatoid odontogenic cyst’.¹⁻² The terms like adamantinoma, adenoameloblastoma, ameloblastic adenomatoid tumor, epithelioma adamantinum, and teratomatous odontoma were used before term AOT being used.¹⁻²

Adenomatoid odontogenic tumor (AOT) is uncommon, benign, slow growing, non-aggressive odontogenic tumor derived from odontogenic epithelium.¹⁻² Cells of AOT originated from enamel organ epithelium.¹⁻² It contains connective tissue elements and sometimes calcification as dentin or enamel-like structure.¹⁻² On clinical examination AOT is often misdiagnosed as odontogenic cyst. It occurs in a wide range of 5 to 50 years, develop in second decade of life, with an average age of 16 years. AOT has 2:1 female predilection with two-third cases is associated with an unerupted tooth, and two-third affected teeth are impacted canines.¹⁻²

2. A Case Report

A 13-year-old male patient visited to the Department of Oral Medicine and Radiology with a chief complaint of swelling in lower front region of jaw since 6 month. Initially the swelling was small, painless, localized and gradually increased to present size. There was no anesthesia or paresthesia of the lower lip, chin, or jaw, and there was no history of trauma.

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There was no h/o any pus discharge. Swelling became painful since 1 month. Then he visited to local hospital from where he got referred to this hospital. Now he reported to the hospital with present complaint of persistent pain and swelling.



Figure 1: Extraoral photographs



Figure 2: Intra Oral

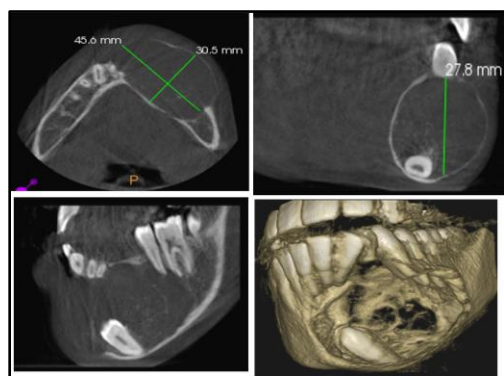


Figure 3: CBCT Photographs



Figure 4: Post-operative photographs



Figure 5; Excised specimen

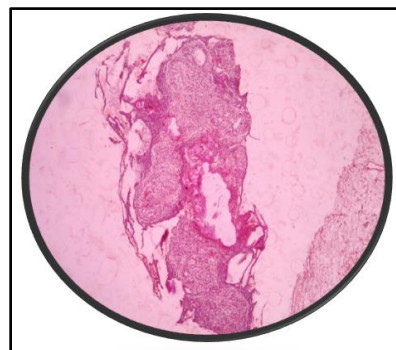


Figure 6: Histopathology slide



Figure 7: Follow Up Photographs

3. Extra Oral Examination-(Figure 1,Figure 2,Figure 3)

3.1. On inspection

Facial asymmetry was present with a single, large, well defined, localized swelling noted at left parasymphysis region of mandible. The swelling extending anteroposteriorly from midline to 1 cm lateral to left corner of mouth and supero inferiorly from vermilion border of lip to inferior border of mandible. The size of swelling approximately AP x SI is 4-4.5 cm x 3.5-4 cm. No ulceration or pus discharge present.

3.2. On palpation

The swelling appears afebrile, non-tender, bony hard and fixed

4. Intra Oral examination

4.1. Soft tissue examination: (Figure 4)

Maxillary jaw was normal while mandibular jaw shows a well-defined intraoral swelling of approx. 4 x 3.7 cm present on the left side of lower buccal vestibule. Antero-posteriorly, swelling extends from distal surface of 42 to distal surface of 34. Supero-inferiorly, swelling present near to attached gingiva of 42,41,31,32,73,34 to the buccal vestibule. Medio-laterally, swelling has obliterated buccal vestibule opposite to 42, 41, 31, 32,73,34. Expansion of buccal and lingual cortices present. Surface of the swelling is slightly blanched, white in

colour compared to the adjacent mucosa. No ulceration or sinus tract present over the surface of the swelling. On palpation the swelling was non-tender, non-compressible, bony hard in consistency.

Hard tissue examination:

All permanent teeth were present with

1. Missing teeth 33
2. Retained deciduous teeth – 73
3. Mesial tipping of 31, 32
4. Mobility-
 - a) Grade I mobility wrt -31,32,41,42
 - b) Grade II mobility wrt - 34,35
 - c) Grade III mobility wrt – 73

5. Radiographic Investigation

CBCT Findings – (Figure 5, Figure 6,

Figure 7).

Location -A well-defined radiolucency of approx. 45.6x30.5x27.8 mm seen on the left body of mandible at the periapical region of 41,31,32,73,34,35,36. The radiolucency is found attached to obliquely placed impacted 33 at the inferior border of mandible. Antero-posteriorly the radiolucency is extending from mesial surface of 42 to mesial root of 36. Supero-inferiorly the radiolucency is extending from the alveolar crest to lower border of mandible. Medio-laterally the radiolucency showed the expansion of buccal and lingual cortical plates adjacent to of 41,31,32,73,34,35,36.

6. Periphery

The periphery of the lesion is well defined, radiopaque, thin corticated margins surrounding the lesion.

7. Internal Structure

The internal structure of the lesion is multilocular with thin wispy septae divides the lesion. The multilocular appearance is similar to soap bubbles. The septae originates at the right angle to the periphery.

8. Effect on the Surrounding Structures

Diffuse osteopenia present. Thinning and expansion of buccal cortical plate with 41,31,32,73,34,35,36 region. Thinning and erosion of lingual cortical plate with 32,73,34,35,36 region. Inferior alveolar nerve canal displaced inferiorly.

9. Effect on Adjacent Teeth

There is localized complete loss of lamina dura seen with 32,73,34,35. There is thinning and partial disruption of lamina dura seen with 31,36. Root resorption and blunting of root apex of 31,32,83,34,35.

A radiographic diagnosis of adenomatoid odontogenic tumor (AOT) was given by considering the multiple scattered

radiopaque flecks in the lesion associated with an unerupted impacted canine 33 and a soft tissue capsule. But a multilocular appearance with large size of an AOT is unusual. Hence, a differential diagnosis of other multilocular mixed lesions such as calcifying odontogenic cyst and calcifying epithelial odontogenic tumor was also considered.

The lesion was surgically enucleated with removal of tumor mass, impacted canine and over retained deciduous tooth 73. The tumor mass was then send for histopathological investigation. Patient was kept on regular follow up.

10. Histopathological Examination

1. The H/E stained section of single soft tissue bit exhibits cystic lining with non-keratinized odontogenic epithelium which is 2-3 cells layers thin, proliferating in the form of solid nests, whorled nodules, rosettes, ductal and stream pattern, cuboidal to low columnar cells with hyperchromatic polarized nuclei form single layer duct- like structures and double layered rosettes.
2. Few duct-like structures show an eosinophilic rim suggestive of dentinoid or amyloid like material at the periphery of the lumen.
3. Focal area of tumor cells is spindle and polygonal shaped with sparse connective tissue.
4. Anastomosing strands of basaloid cells are present in plexiform pattern focally and cribriform pattern at the periphery.
5. Focal areas of calcification are also seen. Thick fibrous capsules is evident at the periphery with parallelly arranged collagen fibers.
6. Overall features suggestive of “Adenomatoid odontogenic tumor”

So, summarizing all the investigation, the final diagnosis was given as Adenomatoid odontogenic tumor associated with impacted 33. After eight months of follow-up, clinical examination revealed complete resolution of the swelling. Follow up OPG shows complete healing and new bone formation.

11. Discussion

Adenomatoid odontogenic tumor (AOT) is an uncommon benign epithelial lesion of odontogenic origin, comprising approximately 3–7% of all odontogenic tumors.¹⁻² It was historically misclassified due to its varied histological presentation, but the World Health Organization (WHO) recognized it as a distinct entity in 1971³ AOT is often referred to as the “two-thirds tumor” due to its occurrence in females (2/3 of cases), its predilection for the maxilla (2/3 of cases), and its association with unerupted canines (2/3 of cases).⁴

The presented case is atypical in multiple respects. Firstly, it was located in the mandible, a less common site for AOT. The maxilla is involved in 65–75% of cases, with the anterior region being the most frequent location.⁵ Mandibular

involvement, particularly in the parasymphysis region as seen here, is rare, representing only about 13–25% of AOT cases.⁶

Secondly, the lesion was associated with an impacted mandibular canine, which is unusual, given the lesion's known predilection for the maxillary canine. A study by Philipsen and Reichart found that only a minority of follicular AOTs involve the mandibular canine.⁷ The radiographic appearance of this case also presents an atypical multilocular radiolucency, whereas classic AOTs are usually unilocular and may contain fine calcifications or snowflake-like radiopacities.⁸

The clinical presentation in this case—a slowly enlarging, initially painless swelling in a young adolescent—is consistent with the behavior of AOT. Typically, these tumors are asymptomatic, slow-growing, and often discovered incidentally or during the investigation of delayed tooth eruption.⁹ However, the presence of pain in this patient during the later stages of growth is somewhat atypical, though it may be attributed to secondary infection or cortical expansion with nerve impingement, which is rare in AOT.¹⁰

Radiographically, AOT may mimic other odontogenic cysts and tumors. In this case, the initial differential diagnosis included calcifying epithelial odontogenic tumor (CEOT), and calcifying odontogenic cyst (COC). The multilocular appearance and significant size deviate from classical AOT radiology. Although most AOTs are unilocular, multilocular radiolucencies have occasionally been reported, particularly in larger lesions.¹¹ The presence of radiopaque flecks, however, along with a well-demarcated corticated border and association with an unerupted tooth, strongly favored AOT.¹²

Histopathologically, the hallmark of AOT is the presence of duct-like structures, rosette-like formations, spindle-shaped epithelial cells, and focal calcifications, all of which were present in this case.¹³ The presence of eosinophilic material resembles amyloid or dentinoid, and basaloid cells arranged in plexiform and cribriform patterns, further confirmed the diagnosis. These features help distinguish AOT from ameloblastoma, which lacks duct-like structures, and from CEOT, which often shows Liesegang rings and prominent amyloid deposits.¹⁴

The treatment of choice for AOT is conservative surgical enucleation, with removal of the associated impacted tooth if present. Due to the tumor's benign and encapsulated nature, recurrence is extremely rare.¹⁵ In this case, complete enucleation along with extraction of the impacted mandibular canine was performed successfully, with no signs of recurrence at follow-up.

This case contributes to the limited pool of mandibular AOTs associated with impacted canines and underscores the importance of considering AOT in the differential diagnosis of mixed radiolucent lesions in young individuals, even in uncommon locations. Accurate diagnosis through clinical,

radiological, and histopathological correlation is essential to avoid overtreatment or misdiagnosis.

12. Conclusion

Adenomatoid odontogenic tumor (AOT) is a rare, benign lesion typically seen in the anterior maxilla and associated with unerupted teeth, most commonly maxillary canines. This case highlights an unusual presentation of AOT in the mandibular parasymphysis region, associated with an impacted mandibular canine and displaying a multilocular radiographic appearance.¹⁵ Despite its rare site and atypical imaging features, the lesion was successfully diagnosed through comprehensive clinical, radiographic, and histopathological analysis. Timely surgical enucleation led to favorable outcomes without recurrence. This report emphasizes the need for clinicians to include AOT in the differential diagnosis of jaw swellings in adolescents, especially when associated with impacted teeth, regardless of location.

13. Source of Funding

None.

14. Conflict of Interest

None.

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Cite this article: Pagare J, Garad M I, Ghorpade P. Unveiling the uncommon: Adenomatoid odontogenic tumor linked to an impacted mandibular canine, *Journal Advances in Oral Health* 2025;2(2):9–13



Case Report

Rehabilitation of maxillectomy in mucormycosis patient by using obturator: A case report

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Abstract

To rehabilitate the patients with maxillary defect prosthetically is a very daunting task. It is not easy to obtain proper retention while half of the dentition along with supporting bone is lost, so for productive prosthesis proper understanding of utilization of remaining structure is important factor. A multidisciplinary approach, incorporating the expertise of maxillofacial surgeons, prosthodontists, speech therapists, and psychologists is essential. Patient-centered care, including education, support, and regular follow-up is vital for successful rehabilitation. Mucormycosis, a potentially fatal fungal infection, has seen a recent surge, especially among COVID-19 patients, with those having weakened immune systems being most vulnerable. Surgical removal of infected tissue often leaves significant defects in the upper jaw, severely affecting patients' ability to speak, eat, and maintain facial aesthetics. This case report underscores the importance of a comprehensive, collaborative approach in achieving effective prosthodontic rehabilitation post-hemimaxillectomy.

Keywords: Maxillary defect, Mucormycosis, Hemimaxillectom

Received: 14-04-2025; **Accepted:** 03-06-2025; **Available Online:** 28-06-2025

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1. Introduction

The facial features that are both practical and aesthetically pleasing are attributed to the maxilla. It is a crucial structure for swallowing, mastication, phonation, face shape aesthetics. A maxillary deficiency can congenital, traumatic, and pathological. The most common causes of acquired maxillary defects are trauma or surgery.¹ Almost majority acquired maxillary abnormalities result from the excision of an oral tumour. Congenital defects comprising 54.7%, followed by traumatic defects at 25.3%, and surgical defects at 20%.²

With the exception of those with minor oronasal and oro-antral flaws, which could be surgically closed, individuals with these anomalies are restored using prosthodontic techniques. Palatal abnormalities have long been treated with prosthodontic therapy.³

Artificial defect closure and sufficient maintenance of the artificial closure were the first treatment goals. One of the main goals of prosthodontic treatment is to provide a

comfortable, aesthetically pleasing prosthesis that recovers the compromised physiologic functions of speech, deglutition, and mastication. An obturator prosthesis that is comfortable, restores appropriate speech, deglutition, and mastication, and is acceptable cosmetically should be given to a patient with an acquired maxillary deformity.⁴

The achievement of these objectives will be influenced greatly by the size and location of the acquired defect and the quantity and integrity of the remaining structures. According to Aramany, maxillectomy defects are divided into six classes. These are; Class I: The midline resection of the maxilla; the teeth are maintained on one side of the arch. Class II: The unilateral defect, retaining the anterior teeth on the contralateral side up to 2nd premolar. Class III: The defect occurs in the central portion of the hard palate and may involve part of the soft palate. Class IV: The defect crosses the midline and involves both sides of the maxillae up to 2nd pre-molar on contralateral side. Class V: The bilateral defect and lies posterior to the remaining abutment teeth. Class VI:

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The bilateral defect and lies anterior to the remaining abutment teeth.⁵

The purpose of an obturator is to seal a defect or opening in the maxilla caused by trauma, cleft palate, or removal of the maxilla owing to pathologic mass. Obturator prosthesis can restore oro-nasal separation, which can enhance speech, mastication, swallowing, and aesthetics. Patients with acquired surgical deformities of the maxilla might get one of three types of obturators: surgical, interim, or final.⁶

2. Case Report

A fifty-year-old male patient reported to the Department of Prosthodontics for the repair of a maxillary defect. The patient's main complaint was that he was having trouble breathing, speaking with a hyper nasal accent, and having discharge come out of his nose while he was eating or drinking liquids. The patient had a history of mucormycosis of the left palate and maxillary antrum. Left maxillectomy and later radiotherapy was performed. He was rehabilitated with a definitive acrylic maxillary obturator.

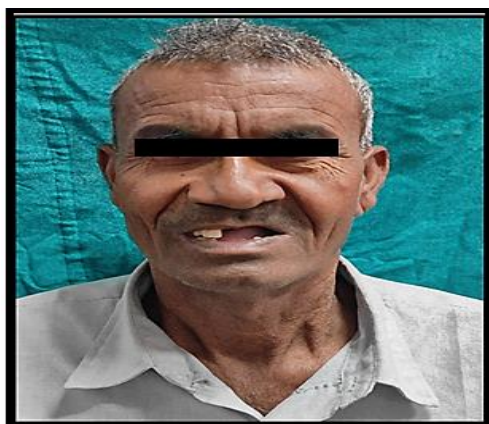


Figure 1: Pre-operative frontal view



Figure 2: Pre-operative lateral view



Figure 3: Pre-operative intra-oral view



Figure 4: Maxillary impression



Figure 5: Flasking of obturator



Figure 6: Mould after de-waxing



Figure 7: Final prosthesis



Figure 8: Post-operative intraoral view in occlusion



Figure 9: Post-operative intraoral occlusal view



Figure 10: Post-operative frontal view

A preliminary impression of the patient's maxillary arch was made using an irreversible impression material (Zhermack, Italy). A cast was poured from the primary impression to create a model of the patient's oral anatomy. A custom tray was fabricated based on the primary cast to ensure an accurate final impression using cold cure acrylic

resin (DPI RR Powder). The custom tray was loaded with a low-fusing compound green stick (DPI) and placed in the patient's mouth. The compound manipulated to mold the borders of the defect area, ensuring the final impression captures all the necessary details. A final impression was made using a medium-body silicone material (Zhermack, Italy) to capture the detailed anatomy of the defect area and surrounding tissues.

A master cast was poured with type III dental stone (Neelkanth, India) from the final impression, which will be used to create the obturator. Plan the design of the prosthesis, considering factors like retention, stability, aesthetics, and functionality. For removable prostheses, create a framework that will support the prosthetic components.

Rims were constructed on the master cast, allowing the patient to try it in their mouth to check for fit and comfort jaw relation was recorded and mount it on the articulator. Arrange artificial teeth (Premadent, India) in wax to simulate the final prosthesis. Wax setup was placed in the patient's mouth to check for fit, occlusion (bite), aesthetics, and patient comfort. Make any necessary adjustments to the wax setup based on feedback from the trial fitting. Once the wax try-in is approved, the denture was processed using heat-cured acrylic resin to create the final obturator.

Place the wax pattern in a flask and encase it in dental stone or plaster (Neelkanth, Dentico, India). Heat the flask to remove the wax, leaving a mold for the prosthetic material. Fill the mold with the chosen prosthetic material, such as heat cure acrylic resin (Pyrex, France). The flask is then closed and placed in a hydraulic press of about 100kg/cm² to eliminate any voids and improve the density of the acrylic. The closed flask is placed in a water bath or oven to cure the acrylic resin heated to 74⁰ C for 8hrs.

The curing process typically involves both heat and pressure to ensure a strong and durable prosthesis. After curing, the flask is allowed to cool before it is opened and the investment material is removed. The obturator is trimmed and polished by using carbide burs, rubber wheels acrylic stone burs and sand paper to remove any rough edges and ensure a smooth surface that is comfortable for the patient.

Place the finished prosthesis in the patient's mouth and check for proper fit and function. Make any necessary final adjustments to ensure comfort and functionality. Provide detailed instructions on how to care for the prosthesis, including cleaning and maintenance tips. Like clean atleast twice per day by using soft bristle toothbrush, cleaning of defect with long cotton buds, take obturator out during bed time and put in cold water. Arrange regular follow-up appointments to monitor the prosthesis and make any needed adjustments over time.

3. Discussion

Handling the various issues that crop up while making a complicated maxillofacial prosthesis necessitates thoughtful consideration and evaluation. In this instance, ensuring sufficient retention for the prosthesis was the primary problem. The patient must practise good oral hygiene and carefully follow post-operative instructions for the obturator prosthesis to function well in the long run.

It is important to emphasise the significance of occlusion in order to support maxillary obturator prosthesis. The prosthetic teeth's occlusal plane that connects to the jaw flange ought to be encouraged. In order to minimise or eliminate occlusal imbalances for the maxillary prosthesis repairing a maxillary defect, the mandibular dentition should be corrected as best as feasible. If the forces of occlusion during mastication directed the prosthesis upward, inward, and posteriorly in bilateral simultaneous posterior tooth contact, the stability of the maxillary prosthesis would be improved. The patient is also reminded of the need for routine review visits in order to replace it.⁷

The treatment of a patient who has undergone a hemimaxillectomy (surgical removal of one side of the upper jaw) typically involves the use of an obturator, a prosthesis designed to close the defect. This process is typically managed in three stages:

Immediate Surgical Obturator: This obturator is placed immediately after surgery. Its primary functions are to provide support to the surgical site, control bleeding, and protect the wound. It also helps the patient maintain some function for speaking and swallowing. Made prior to the surgery based on pre-operative impressions. It's typically made of clear acrylic to allow for post-operative observation of the wound.

Interim (Temporary) Obturator: This is fitted after the initial healing phase, usually a few weeks post-surgery. It provides better function and aesthetics compared to the immediate surgical obturator and aids in the patient's adaptation to changes in oral structure. The interim obturator is more refined and comfortable than the immediate one. Adjustments are made as the healing process continues and the tissue changes.

Definitive (Permanent) Obturator: This is the final stage, typically undertaken several months after surgery, once healing is complete and tissue changes have stabilized. The definitive obturator is designed to provide optimal function and aesthetics. Custom-made for the patient, it offers the best fit, comfort, and functionality. It is often made from durable materials and can be adjusted over time if needed. These stages ensure that the patient receives the necessary support and functionality immediately after surgery and continues to improve their quality of life as healing progresses.⁸

Patients who wear obturators for extended periods of time report nasal reflux and hypernasal speech due to air leakage. The primary cause of this is the ongoing fibrosis of the tissues around the prosthesis.⁹

A maxillary obturator prosthesis's mechanics can be affected by a variety of conditions, which may lead to prosthetic failure. Clinical scenarios that are appropriate for prosthetic success may not be presented by defects of greater size or defect topologies that impair prosthetic stability, retention, and support. Furthermore, a poor patient result might be expected if the maxillary defect has poor overlying tissue quality, making the remaining gingiva or mucosa friable or readily irritated.¹⁰

4. Conclusion

Obturator prosthesis fabrication does not necessitate the use of particular skills to build a prosthesis extension into a defect or to arbitrarily extend a prosthesis into a defect.¹¹

In order to fabricate an obturator prosthesis, patients without maxillary abnormalities must be treated using fundamental prosthodontic principles. Because of the type and placement of the remaining structures, several concepts need to be adjusted. To provide stability, retention, and support for an obturator prosthesis, the defect must be utilised in concert with the remaining structures. Applying fundamental prosthodontic principles will determine the obturator's size and extension, minimising the wide range in obturators that is frequently observed. In order to offer comfort, function, cosmetics, and little alteration to the weakened residual components, conservative prosthesis design in conjunction with routine maintenance treatment constitute acceptable prosthodontic therapy for patients with tile-acquired maxillary defects.¹²

5. Source of Funding

None.

6. Conflict of Interest

None.

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Cite this article: Kaur J, Kumar S, Aggarwal R, Yadav K, Singh AR. Rehabilitation of maxillectomy in mucormycosis patient by using obturator: A case report. *Journal Advances in Oral Health* 2025;2(1):14–18.



Case Report

Dentigerous cyst exhibiting focal ameloblastomatous transformation: Histopathological insights from an unusual case

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Abstract

A dentigerous cyst is a type of developing odontogenic cyst that surrounds an unerupted tooth's crown. Dentigerous cysts, which make up 20% of all developmental cysts of the jaws, are the most prevalent in the oral cavity. They are caused by fluid buildup between the tooth crown and reduced enamel epithelium. Hence, it is usually associated with an unerupted or impacted tooth. Ameloblastoma, squamous cell carcinoma, and mucoepidermoid carcinoma are among the neoplastic transformations that can occur in the lining of dentigerous cysts. Ameloblastoma is a type of odontogenic tumour that is aggressive locally and makes up around 10% of all jaw tumours. This report describes a 47-year-old male patient who was diagnosed with ameloblastoma that developed in the dentigerous cyst wall.

Keywords: Ameloblastomatous transformation, Ameloblastoma, Dentigerous cyst, Neoplastic transformation, Odontogenic cyst, Odontogenic tumor

Received: 10-05-2025; **Accepted:** 12-06-2025; **Available Online:** 28-06-2025

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1. Introduction

Dentigerous cysts (DC), odontogenic keratocysts, calcifying odontogenic cysts, glandular odontogenic cysts, and radicular cysts are among the odontogenic cysts that have the potential to develop into malignancy. The odontogenic keratocyst and dentigerous cyst exhibit the highest rate of neoplastic transformation among the odontogenic cysts.¹

The crown of an unerupted or embedded tooth, typically the maxillary canine tooth or the mandibular third molar, is invariably linked to the dentigerous cyst, which is not uncommon. It is not a neoplastic entity, but it can become aggressive, causing bone destruction and cortical plate expansion, which may contribute to facial deformities.²

Ameloblastomas have been observed to arise from the odontogenic epithelial remnants within the cyst capsules or the cystic lining. Ameloblastoma and other odontogenic or non-odontogenic tumours can develop from the epithelium of dentigerous cysts. 10% of all odontogenic tumours are ameloblastomas, making them the most prevalent type.³ This

is an unusual instance of an ameloblastomatous lesion inside a dentigerous cyst.

2. Case History

A 47 year old, male patient reported to the department complaining of pain and swelling in the mandibular anterior teeth region since 6 months. It had gradually increased in size and there was no history of trauma or pain.

Extra-oral examination revealed facial symmetry with tender on mandibular symphysis region. Oral examination revealed swelling in the mandibular anterior region w.r.t. 33-43. It was pale pink in color and the margins were indistinct. On palpation, the lesion was tender, and no discharge was seen on compression. Orthopantomograph revealed impacted canine w.r.t. 33 and 43 (**Figure 1**).

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Figure 1: The radiographic examination revealed impacted canine w.r.t. 33 and 43.

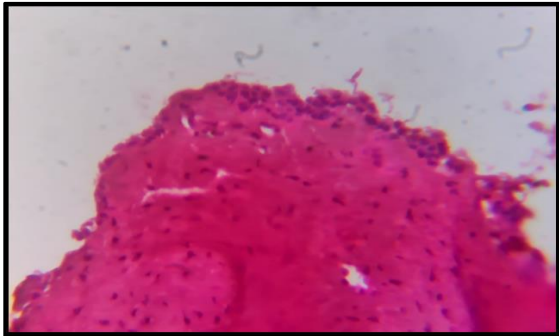


Figure 2: H&E stained section shows non-keratinized stratified squamous epithelial lining overlying a dense fibrocellular connective tissue stroma. (H & E, 40x)

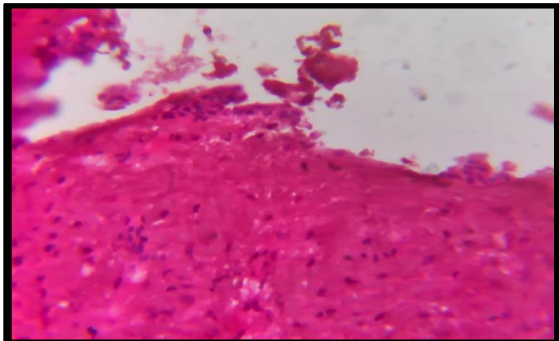


Figure 3: H&E stained section shows 3-4 cell layer thick epithelial lining with cuboidal basal cells and flattened superficial cells resembling reduced enamel epithelium. (H & E, 40x)

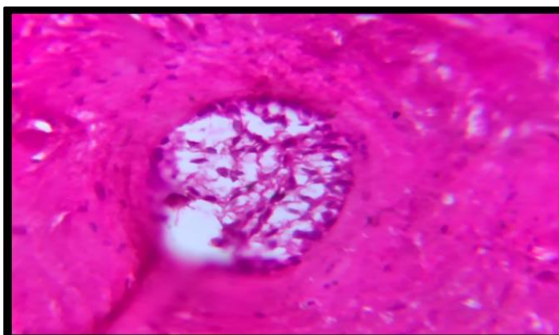


Figure 4; H&E stained section shows a follicle of odontogenic epithelial cells with peripheral cuboidal and central loosely-held stellate reticulum like cells. (H & E, 40x)

Based on the clinical and radiological features, a provisional diagnosis of dentigerous cyst was made. The lesion was enucleated together with the unerupted tooth and the tissue was sent for histopathological examination. The patient was unavailable for follow-up, and no further information could be obtained.

Gross examination of biopsy specimen showed 2 soft tissue specimens, measuring (A1) 15x6x3 mm (A2) 6x3.5x2.5 mm, greyish-brown in color and firm in consistency. The soft-tissue specimens were sectioned, and all the bits were processed following routine tissue processing protocols.

Histopathological examination revealed non-keratinized stratified squamous epithelial lining overlying a dense fibrocellular connective tissue stroma. Collagen fibres were arranged in bundles along with mild inflammatory cell infiltration. Areas of hyalinization and numerous engorged blood vessels were also evident. Areas of calcifications were also seen.

Under high magnification, the epithelium was 3-4 cell layer thick with cuboidal basal cells and flattened superficial cells resembling reduced enamel epithelium (**Figure 2, Figure 3**). The connective tissue showed dense collagen bundles associated with spindle shaped fibroblasts. Areas of hyalinization were evident. Mild chronic inflammatory cell infiltration chiefly consists of lymphocytes, plasma cells and few mast cells. Focal area in one section showed a follicle of Odontogenic epithelial cells with peripheral cuboidal and central loosely-held stellate reticulum like cells (**Figure 4**). Numerous Odontogenic rests were also present within the capsule. Areas of calcifications and osseous metaplasia were also seen. Numerous engorged blood vessels were lined by plump cuboidal endothelial cells. The microscopic characteristics together with clinical findings confirmed it to be dentigerous cyst with focal ameloblastomatous changes.

3. Discussion

Dentigerous cysts (DCs) are among the most prevalent kinds of cysts occurring in the jaws. A common clinical presentation for a dentigerous cyst is an asymptomatic unilocular radiolucency that surrounds the crown of an impacted or unerupted tooth. Dentigerous cysts predominantly present throughout the second and third decades of life, with maximal occurrence in adolescence. A dentigerous cyst is usually easy to identify, although even on radiography, a "typical" dentigerous cyst may be mistaken for something else, including a dental follicle, a hyperplastic dental follicle, an odontogenic keratocyst, or a unicystic ameloblastoma based on histological investigation.⁴ Therefore, the histopathological diagnosis of these lesions is crucial. The fluid's soluble protein and cholesterol levels indicate the possibility of an ameloblastoma, radicular, dentigerous, or fissural cyst.⁵

In 1965, Gorlin et al. initially reported the prevalence of malignancies arising from odontogenic cysts, describing ameloblastomatous changes of cysts in nevoid basal cell carcinoma syndrome.⁶ An ameloblastoma is a locally aggressive benign epithelial odontogenic tumor, commonly arising from the mandible. However, in the present case, lesion was observed in the mandibular anterior region. Ameloblastoma primarily affects people aged 20 to 40, with nearly similar odds of occurrence in both genders. Ameloblastomas are aggressive locally and rarely metastasise. Huang, I. Y et al examined the expression of osteopontin and CD10 in ameloblastoma and dentigerous cysts in order to correlate its expression with neoplastic potentiality. It was determined that elevated expression of osteopontin and CD10 may suggest the neoplastic potential in certain areas.⁷

Shear states that the most probable causes are that an ameloblastoma shares clinical and radiographic characteristics with DC, and the microscopic features indicate that the ameloblastoma is originating from DC. Next reason reveals that a biopsy from an enlarged locule might be an ameloblastoma growing in the epithelial lining of DC. The last explanation states that the cyst wall contains isolated ameloblastomatous epithelium islets or follicles that are situated at a distance from the epithelial lining.⁸ In the present case, the development of cystic lining away from the unerupted tooth and neoplastic epithelium indicates that DC is developing into ameloblastoma.

In the connective tissue associated with odontogenic cysts, odontogenic cell nests are commonly observed. Other hallmarks of true ameloblastic differentiation, including basal cell hyperchromatism, polarisation of the basal cell nuclei, or vacuolation of the basal cell cytoplasm, may be absent in some of them, while palisading of basaloid cells at the outer circumference may be present in others.³ These nests have the potential to multiply and alter the stroma, which is essential to the pathophysiology of odontogenic tumours, according to Jayanandan M et al. Therefore, it indicates that long-term follow-up is advised even in cases of dentigerous cysts.⁹

Varshney A et al. examined the expression of calretinin and observed positive calretinin staining in the lining of unicystic ameloblastoma. It is an immunohistochemical marker specific to the neoplastic ameloblastic epithelium and plays a role in the change from odontogenic cyst epithelial lining to ameloblastomatous epithelium.¹⁰

Various etiologic factors have been proposed for the ameloblastomas arising from odontogenic cysts, including nonspecific irritational factors (extraction, trauma, infection, inflammation, unerupted tooth), nutritional deficit disorders, and viral infection. Ameloblastoma and other neoplastic tumours, as well as odontogenic cysts, like DC, may arise as a result of increased cell proliferation, according to a number of proliferative studies and

immunohistochemically demonstrations of proliferative markers. Oncogene mutations, tumour suppressor gene alterations, or cell cycle disruption can all lead to this increased cell proliferation.¹¹

In the present case, it was evident that the lesion was a dentigerous cyst, and histological analysis showed characteristics of a follicular ameloblastoma that originated from the cyst's lining. However, there were no neoplastic cells in the cyst capsule. According to our understanding, this lesion began as a dentigerous cyst and developed into ameloblastoma with the passage of time and in the presence of a definite stimulus.

4. Conclusion

The ameloblastoma that developed from a DC in the present case is an uncommon occurrence that reveals the histogenesis of ameloblastoma. The malignant potential of DCs and the significance of a thorough histological investigation of the entire specimen via multiple sectioning are highlighted in this case. One potential method for diagnosing odontogenic cystic transformation to tumours in the future may be the application of particular immunohistochemistry markers for neoplastic ameloblastic epithelium.

5. Source of Funding

None.

6. Conflict of Interest

None.

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Cite this article: Saigal C, Bhargava K, Paul M, Bhandari S, Huidrom D. Dentigerous cyst exhibiting focal ameloblastomatous transformation: Histopathological insights from an unusual case. *Journal Advances in Oral Health* 2025;2(1):19–22.



Case Report

From atrophy to accuracy: A breakthrough in maxillary reconstruction

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Abstract

Bone resorption with age presents challenges in treating edentulous patients, as even perfectly crafted Removable Partial Dentures (RPD) often fail over time. Prefabricated dental implants, while preferred, fall short of addressing significant bone loss and individual needs in cases like hypoplastic or edentulous maxillae. Patient-specific implants (PSIs) overcome these limitations, offering zero-nil accuracy and unmatched precision. This case report explores our experience using PSIs in a hypoplastic and edentulous maxilla, focusing on detailed preoperative diagnosis, precise surgical techniques, and evaluating postoperative outcomes, including patient satisfaction.

Keywords: Maxillary atrophy, Edentulous maxilla, Bone loss, Patient-specific implants, Osseointegration, Maxillary reconstruction, Implant rehabilitation

Received: 05-05-2025; **Accepted:** 09-06-2025; **Available Online:** 28-06-2025

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1. Introduction

An atrophic maxilla results from bone loss in the upper jaw due to factors like aging, tooth loss, periodontal disease, and sinus enlargement, complicating implant placement.

Traditional techniques like bone grafting, sinus lifting, and ridge augmentation rely on a two-stage surgical protocol, which is intricate and prone to complications. Prefabricated implants often lack stability, demand extensive adjustments, and perform poorly in severe atrophy, trauma, or post-tumour cases, emphasizing the need for customized solutions.

Patient-specific implants (PSI) in maxillofacial surgery are meticulously custom-designed implants relative to the unique and specific anatomical variation of each patient. These are different from prefabricated conventional implants in providing an unequivocally ideal fit, distinctive to each patient, and are considered to be very useful in complex cases with bone loss and structural deficiencies that cannot be successfully addressed with conventional implant techniques.¹

This case report features a patient with an atrophic maxilla, which was successfully managed using Patient-Specific Implants (PSI), leveraging advanced imaging and customization to address the unique anatomical challenges, ensuring optimal functional and aesthetic outcomes.

2. Case Presentation

A 46-year-old male patient presented to the Oral and Maxillofacial Surgery (OMFS) Outpatient Department (OPD) with a chief complaint of missing teeth in relation to the maxillary right posterior region for the past 1.5 years. The patient had no relevant possibly complicating medical history, any known allergies, or bleeding disorders. The patient had undergone a therapeutic extraction a year ago in relation to the right upper posterior region.

On general examination, the patient appeared conscious and coherent and well-oriented with time and place, vitals appeared to be stable.

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Figure 1: Intraoral view highlighting adequate mouth opening, poor oral hygiene, and gingival recession. Partial edentulism in relation to the maxillary right posterior region is encircled



Figure 2: Preoperative Orthopantomogram (OPG) highlighting the region of severe maxillary atrophy with partial edentulism in the right maxillary posterior region.

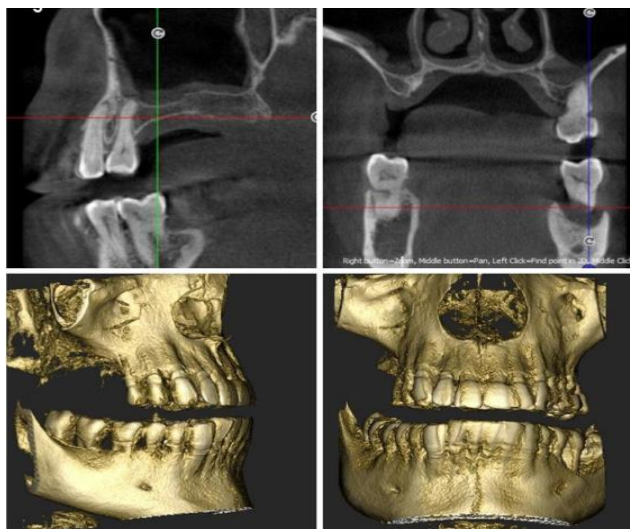


Figure 3: High-resolution computed tomography (HRCT) in coronal and sagittal sections (highlighted in yellow) along with a 3D-reconstructed HRCT image (highlighted in red), depicting extensive bone resorption and anatomical constraints for conventional implant placement.

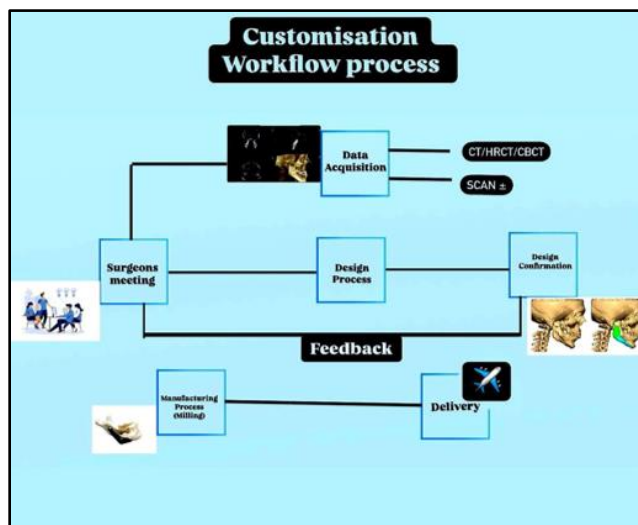


Figure 4: Depicts workflow for the digital planning and fabrication of patient-specific implants using CTARS technology.



Figure 5: Titanium PSI design with endosseous support (a) Isolated view, (b) Trial fit on stereolithographic maxillary model.

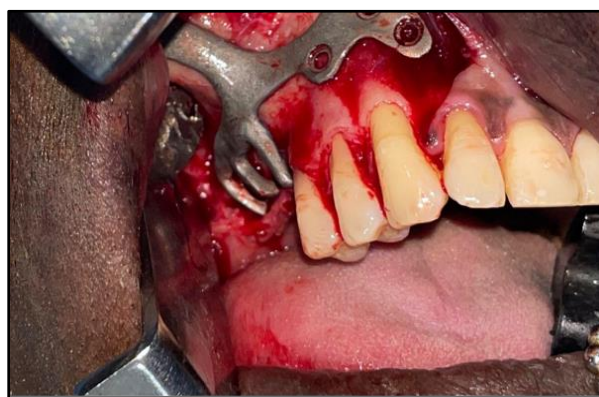


Figure 6: Depicts bone trimming performed in the right posterior maxillary region, using an alveolar platform guide.

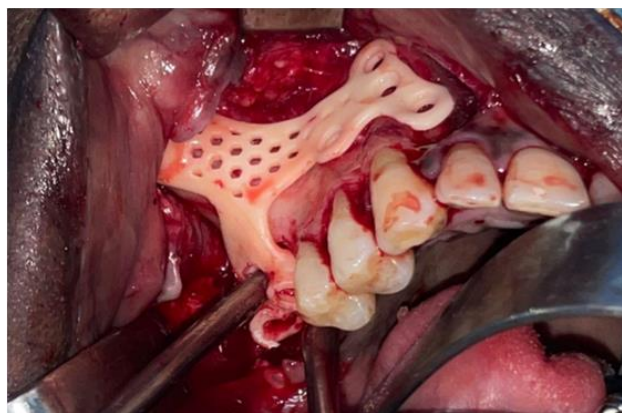


Figure 7: Shows the placement of the patient-specific implant (PSI) template following position verification in the right posterior maxillary region.

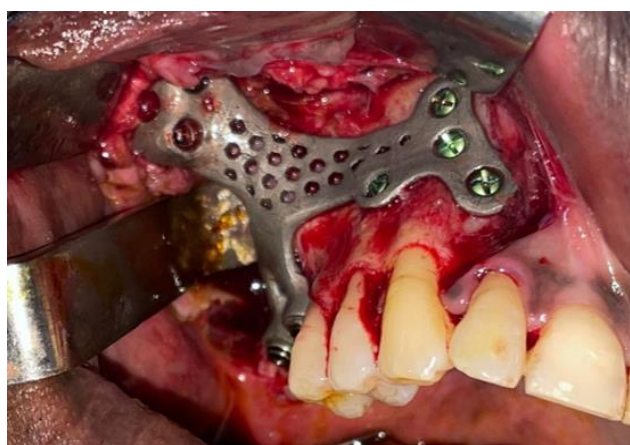


Figure 8: Visualises the patient-specific implant (PSI) positioned in the right posterior maxilla and stabilized using titanium screws



Figure 9: Depicts the final stabilization of the patient-specific implant (PSI) with a healing abutment in the right posterior maxilla.



Figure 10: Postoperative orthopantomogram (OPG) highlighting successful osseointegration of the patient-specific implant (PSI) in the right posterior maxillary region.



Figure 11: Postoperative intraoral picture depicts successful prosthetic rehabilitation in the posterior maxillary region after the patient-specific implant (PSI) placement.

Extraoral evaluation revealed no evident facial asymmetry, with bilateral temporomandibular joint functions appearing normal. On intraoral examination, the patient demonstrated adequate mouth opening; however, oral hygiene maintenance was significantly compromised. Generalized gingival recession was observed, along with partial edentulism in relation to the 16, 17 regions. The mandibular occlusal plane and dentition appeared intact and properly aligned. (**Figure 1**)

Soft tissue examination revealed no ulceration or erythema. The patient was subjected to thorough radiological investigations, including Orthopantomogram (OPG) (**Figure 2**) and High-Resolution Computed Tomography (HRCT). (**Figure 3**) All routine blood and biochemical tests were performed concurrently, yielding results within the normal range. The patient was thoroughly informed about treatment options, including Conventional Dental Implants, Zygomatic Implants, and Patient-Specific Implants (PSIs). After consideration, the patient opted to go with PSIs.

The patient was then educated about the suitability and advantages of patient-specific implants (PSIs), highlighting their precision and ease of application, particularly for addressing the atrophic maxilla as in his case. Following a comprehensive evaluation of all relevant factors, a treatment plan was designed to incorporate patient-specific implants for the rehabilitation of the right posterior maxilla. The patient was advised oral prophylaxis and had undergone procedural oral prophylaxis prior to the treatment. After rigorous radiological analysis using OPG and HRCT, patient-specific implants were customized for the patient's atrophic posterior maxilla. These implants were fabricated using titanium—a

material renowned for its exceptional biocompatibility and durability, making it a cornerstone in prosthetic development since its early use enabling precision and customization for both medical and dental applications. The manufacturing process was supported by advanced technology and specialized software from the Centre for Technology-Assisted Reconstructive Surgery (CTARS), enabling precision and customization. (**Figure 5**)

Considering the protocols for the fabrication of Patient-Specific Implants, we proposed custom-designed maxillary implants featuring an innovative design that incorporates endosseous support zones to facilitate optimal osseointegration and enhance implant stability. (**Figure 5**)

2.1. Surgical procedure

Routine investigations were completed, and the reports were obtained. Anaesthesia fitness was assessed, and the patient was classified as ASA II (American Society of Anaesthesiologists Physical Status Classification System), making him suitable for surgery under general anaesthesia.

Under aseptic conditions, right naso-endotracheal intubation was performed, and general anaesthesia was successfully induced and maintained. The patient was prepared, following standard surgical painting and draping protocols. Local anaesthesia was administered by infiltrating 2% lignocaine with adrenaline into the right buccal vestibule.

A crevicular incision was performed with a No. 15 blade, from the 12-15 region and was extended as an anterior releasing incision distal to 12. The mucoperiosteal flap was elevated using a No. 9 Molt's periosteal elevator, providing a clear view of the right pyriform rim, the right zygomatic body, and the right zygomatic buttress region.

Using a guide for alveolar platform creation, bone trimming was performed with a 701 bur. (**Figure 6**) After verifying its position, a patient-specific implant (PSI) template was placed (**Figure 7**) The implant was inserted into the right posterior maxilla and secured with titanium screws for stable fixation. Specifically, two screws (2.0 mm x 6 mm) and four screws (2.0 mm x 8 mm) were placed in the posterior maxillary region. (**Figure 8**)

Throughout the procedure, thorough irrigation with betadine and saline was performed. Periosteum scoring was completed to enhance tissue adaptation. Cover screws were removed, and healing abutments were placed into the implant slots. (**Figure 9**) The site was irrigated again to ensure optimal cleanliness before securely closing the surgical area with 3-0 monocryl sutures. This marked the successful completion of the surgery.

The patient was prescribed routine postoperative analgesics and antibiotics for five days and advised to follow up at the OMFS Outpatient Department after one week.

During the follow-up visit, the healing abutments were reviewed and removed, and the prosthetic phase was initiated. (**Figure 10**)

Soft tissue adaptation and implant platform integrity were verified. Following initial healing, the patient-specific implant (PSI) framework was placed, and the abutment was separately connected to ensure precise fit and optimal load distribution, a practice that enhances biomechanical efficiency. A custom impression was taken to accurately capture peri-implant soft tissue contours, facilitating the fabrication of a cement-retained metal ceramic crown. Although PSIs are compatible with both cement- and screw-retained restorations, a cement-retained option was chosen in this case due to favorable implant angulation and the high esthetic demands of the region, as it eliminates visible screw access holes. The crown was luted using a Resin-Modified Glass Ionomer Cement (RMGIC), and excess cement was carefully removed to prevent peri-implantitis, as residual cement is a known risk factor for such complications. This approach optimized passive fit, esthetics, and functional stability.³ This marked the successful completion of the PSI-based rehabilitation, restoring both function and aesthetics. (**Figure 11**)

3. Discussion

The atrophic maxilla, characterized by significant bone loss, poses challenges for traditional implant placement. Alexandre Amir Aalam et al. emphasize that multiple factors must be evaluated to determine appropriate treatment options for atrophic maxillae.⁴

Ramninder Bawa et al. have elaborated on the significance and versatility of Maxillofacial Patient-Specific Implants and how PSIs address both reconstructive and aesthetic needs. These implants correct volume loss, deformities, and asymmetries while supporting procedures such as trauma reconstruction, osteotomies, orthognathic surgeries, and Temporomandibular Joint (TMJ) replacements. PSIs are particularly advantageous for patients with unsatisfactory outcomes from conventional implants or unique contour defects.⁵

Even though titanium implants have been used solemnly as a trustworthy novel source, newer materials have also come to stabilize the PSI field as preference for PSIs increases from day to day. Secondary to Ti, cobalt-chromium (Co-Cr) are used owing to their increased wear resistance but are evidently less biocompatibility appealing. Zirconia (Zr), which is highly preferred for radiolucent dental prostheses, is used but as an optional material since it's very brittle and cannot sustain load-bearing stress. PEEK is also a radiolucent synthetic material biocompatibility similar to bone but not commonly used in dentistry. Other bioresorbable materials like polycaprolactone are used as temporary implants and their strength is lower and are not indicated for complex cases. Bioactive glass is a recent one which integrates with

the natural bone and is also of use in low stress-bearing areas.⁶

Designed with advanced imaging technologies like 3D imaging, high-resolution computed tomography (HRCT), or cone-beam computed tomography (CBCT), PSIs achieve a precise fit customized to individual anatomy. This precision enhances stability, reduces grafting requirements, and facilitates the rehabilitation of complex cases, marking a significant advancement in implantology.⁷

CAD/CAM technology has further improved PSIs by enabling rapid, customized implant design and fabrication. These advancements allow for single-stage reconstruction, minimize donor site morbidity, and bring implantology closer to providing ideal patient-specific solutions.⁸

Esposito et al. highlights the potential of PSIs in treating the atrophic maxilla. Their work explores immediate or early loading protocols to reduce treatment time and stresses the importance of long-term follow-up to identify complications such as sinusitis. Similarly, Jehn et al. report favourable therapeutic outcomes with PSIs, noting their comparable effectiveness to conventional implants in improving Oral Health-Related Quality Of Life (OHRQoL).⁹⁻¹⁰

Since PSIs have been introduced recently, long-term clinical data remains limited, highlighting the need for further research. Comparative trials should assess their efficacy, particularly in cases of severely atrophic maxillae and as retainers for obturators in maxillectomy patients. Such studies will be crucial in establishing PSIs as a viable alternative to traditional bone augmentation techniques.¹¹

By eliminating intraoperative modifications, enhancing accuracy, and accelerating recovery, PSIs revolutionize implantology. Their customization, functionality, and aesthetic integration offer superior support, retention, and durability, making them an advanced alternative to conventional implants.

4. Conclusion

Edentulism, whether partial or complete, poses a significant challenge, especially in an era where both aesthetics and functionality are prioritized. As demand for personalized treatments rises, Patient-Specific Implants (PSIs) offer a precise solution in surgical implantology. Unlike traditional implants, PSIs address issues like poor bone quality and density, providing a precise fit for patients with bone loss. Utilizing advanced imaging technologies like CBCT/HRCT and 3D printing, PSIs are custom-designed for optimal biomechanical integration, enhancing both functionality and aesthetics. This innovative approach represents a major advancement in surgical implantology.

5. Conflict of Interest Statement

None.

6. Funding Statement

None.

7. Ethical Approval & Patient Consent

All clinical images included in this report are fully anonymized and do not reveal the patient's identity. However, informed patient consent was obtained, ensuring compliance with ethical standards.

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Cite this article: Senthilkumar S, Lakshmi Rathan AC, Narayanan V, Abinaya Subramaniam A, Raj N. From atrophy to accuracy: A breakthrough in maxillary reconstruction. *Journal Advances in Oral Health* 2025;2(1):23–27



Case Report

Clinical insights into endodontic management of dilacerated maxillary premolars: A report of two cases

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Abstract

Effective endodontic therapy treatment necessitates by shaping and thorough cleaning of root canal's structure, which often presents multiple curvatures that complicate instrumentation. In both the cases discussed in the case report, there was sudden sharp pain on consumption of hot and cold food stuffs. On clinical examination, deep proximal caries in maxillary second premolar was seen in both the cases. Teeth were tender on percussion. Radiographic evaluation showed caries involving pulp, with periodontal ligament widening and sharp curvature in apical third region of the roots. These curvatures can lead to procedural errors like ledges and obstructions. This case report highlights the challenges in treatment of moderately to severely bent root canals (tooth number 15 and 25 respectively), emphasizing the importance of understanding root and canal morphology and use of appropriate instruments like pre-curved Ni-Ti files during canal shaping.

Keywords: Bayonet canal, Curved root canal management, Dilacerations; Endodontic treatment, Maxillary Premolar, Root canal treatment.

Received: 15-03-2025; **Accepted:** 29-05-2025; **Available Online:** 28-06-2025

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1. Introduction

Effective endodontic therapy includes comprehensive shaping as well as cleaning of root canal system. Numerous curvatures occur in the majority of root canals, making canal instrumentation challenging. Because majority of the teeth have some bends or curves in the roots, straight root canals are less common than typical. Furthermore, the length of root canals may exhibit many planes of curvature. A dilacerated canal, a Bayonet or S-shaped canal, a progressive root curvature, or a sharp bend in the apical part of the root can all have different canal curvatures.¹ In 1848, John Tomes referred to these types of curves as "dilacerations."¹ It describes a variation or bend in straight line connection between tooth's coronal structure and root, as well as an angulation, acute bending, or curvature in tooth's radicular or coronal structure. Sever mechanical trauma to main precursor teeth may result in dilatation of underneath growing tooth bud and may lead to dilacerations.

The permanent tooth germ's calcified portion is moved such that the remaining, non-calcified portion creates an angle.² While displacements are common in both permanent and deciduous dentitions, but they are less in primary teeth as compared to permanent.

Both maxillary and mandibular jaws are equally affected. The incidence of dilacerations in teeth are as follows: mandibular second molar (1.6%), mandibular first molar (0.6%), and maxillary first molar (1.3%) are the teeth most commonly affected. The occurrence is rare in mandibular lateral incisor, canine, first premolar, maxillary canine, and second premolar. The complicated structure of root canal is a challenge for endodontic treatment since it requires complete shaping and cleaning, especially given the varied anatomical variations.³

Curvatures frequently result in ledge formations, obstructions, perforations, and apical transportation, among other procedural errors.⁴ The elaborate and effective

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treatment of two cases with moderately to severely curved root canals is presented in this case report.

1.1. Case report 1

35-years old women reported to the department of Conservative Dentistry and Endodontics complaining of pain in maxillary right posterior region from past 2 months. The patient gave history of sensation to hot and cold. Diffuse pain for the past 2 months, which worsened over the last 3–4 days and also began during sleep, subsiding with medication. The intraoral examination revealed proximal caries with respect to 15,16. Tooth 15 was tender on percussion. The radiographic examination revealed a radiolucency spreading into the pulpal area without periapical pathological symptoms in relation to 15 and mesial Class II caries w.r.t 16. Regarding 15, vitality testing (cold and electrical) produced a strong, persistent discomfort following the removal of the stimulus. Radiographic examination revealed proximal caries involving pulpal, based on these findings, the diagnosis was symptomatic irreversible pulpitis with apical periodontitis in relation to 15. In addition to these observations, the tooth displayed a dilacerated root. Root canal treatment followed by crown rehabilitation was suggested to the patient and informed consent was taken from before initiating the treatment.

1.2. Case report 2

28 years old male patient came to Department of Conservative and Endodontics with complaint of pain in relation to maxillary left back tooth region. Pain was spontaneous and sharp, and intensified with the consumption of hot food and beverages. Clinical evaluation showed deep disto-proximal caries in upper left second bicuspid. Tooth was tender on percussion. While performing pulp sensibility tests (electric pulp test and heat test) tooth was vital. The radiographic evaluation showed deep caries involving pulp, along with periodontal ligament widening. Apart from these findings, a sharp curvature in apical third area of the tooth was seen on the radiograph. The diagnosis of chronic irreversible pulpitis was made and endodontic therapy was planned following full coverage restoration of the tooth. Informed consent was taken from the patient before initiating the treatment.

1.3. Clinical management

Before the initiation of endodontic treatment, pre-operative radiographs (**Figure 1a** and **Figure 2 a**) were taken and the degree of curvature was determined with the help of Schneider method that showed severely curved canals in first case and moderately curved canals in relation to second case.⁵ The tooth was anesthetized with 2% lignocaine (1:80,000). Under rubber-dam isolation, a traditional endodontic access cavity was created utilizing round carbide (ISO 014) and Endo-Z bur (Dentsply Maillefer, Ballaigues, Switzerland). Two canals, buccal as well as palatal were found. Once sufficient access was gained, initial inspection of the root

canal was completed using K-files number 6 and 8 (Mani, Inc., Japan) after pre-curving them and patency was attained.

Working length was ascertained with the help of electronic apex locator (Propex; Dentsply Maillefer) and verified using periapical radiograph (EZ Sensor Classic IOS, Vatech, India) (**Figure 1b** and **Figure 2 b**). At first the pathfinder files made of stainless steel (Sybron Endo, Orange, CA, USA) in-between sizes, i.e., number 12 as well as 17 were utilized and filing was carried out using 17% EDTA following irrigation using saline as well as 5.25% sodium hypochlorite (NaOCl). Lastly root canal preparation was done with Hy-Flex CM rotary files (Coltene-Whaledent, Switzerland) till size 25-4% taper of the instrument in both the cases. The canals were flushed using EDTA 17% and 5.25% sodium hypochlorite (NaOCl) followed by final flush with saline, then dried with the help of 25-4% paper points prior to obturation. Obturation done using single cone obturation technique with 25-4% taper gutta-percha (**Figure 1c** and **Figure 2 c**) with AH Plus sealer (Dentsply, USA), followed by composite resin restoration (Filtek Z350XT, 3M, Germany) and porcelain fused metal crown (**Figure 1d** and **Figure 2 d**).

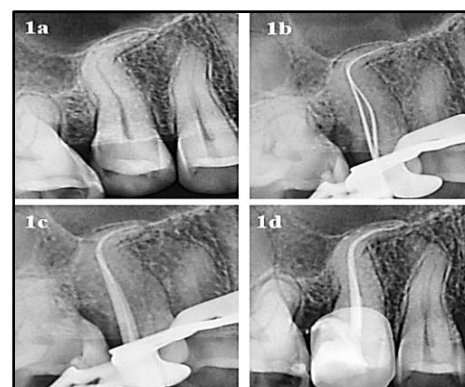


Figure 1: (a) Pre-Operative radiograph (b) Working length (c) Master cone (d) Obturation

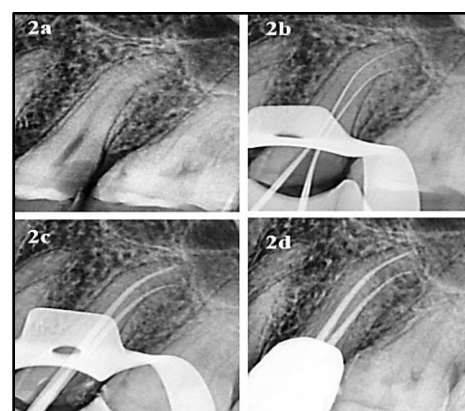


Figure 2: (a) Pre-operative radiograph working length (c) Master cone (d) Obturation

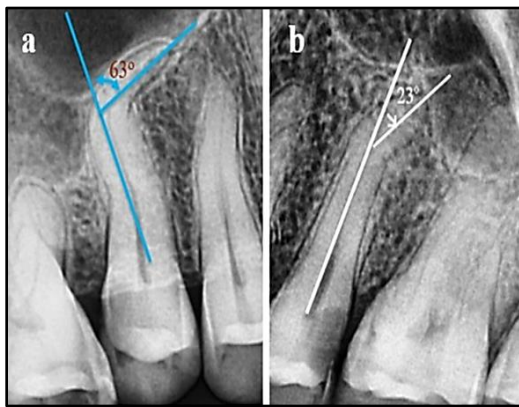


Figure 3: 3 Months follow up (a) Case 1 (b) Case 2



Figure 4: (a) Severe curvature (b) Moderately curved root.

2. Discussion

Precise canal cleaning and shaping are important for successful endodontic treatment; yet, root canal instrumentation can be challenging because to many curvatures present in most canals. In situations where there is atypical canal morphology, endodontic procedures often fail due to procedural errors such as elbow generation, ledge formation, damaged instruments, canal blockage and zipping.¹

Different criteria have been proposed in the literature to identify root dilacerations which include, according to anatomic location (apical third, middle third, coronal third curvature), Shape-based curvature (Apical gradual curve, Sickie shape curve, Bayonet curve), Dobo-Nagy classification (Shape- straight, J-shape (apical curve), C-shape (entirely curve), S-shape (multi-curve)).⁶ Dilaceration has been defined by authors as a deviation of 20 degrees or more from the tooth's normal axis in the apical region of the root. A tooth may show signs of dilatation along its axis, either in the mesial or distal direction, or along its axis at an angle of 90 degrees or more.⁷ The direction of curvature can be used to preserve a constant tapered shape and prevent damage of structure to the endodontic instruments.³

According to a 2005 study by Malčić et al., dilaceration is shown in apical one third of roots of incisors, canines, and

bicuspsids, but middle and cervical thirds of third molars are most frequently afflicted. Additionally, a number of publications found that the overall prevalence of premolars and maxillary anterior teeth (4.6%) is higher than rate affecting comparable region of the mandible (1.3%).⁸ Schneider proposed a technique in which draw a line parallel to the long axis of the canal, within the coronal third; draw another line from the apical foramen till it intersects the point where the primary line leaves the long axis of the canal, this crossing point is the Schneider angle, used to determine the degree of root curvature.⁹ And it falls into one of three categories: Severe: 25–70°, Moderate: 10–20°, and Straight: 5° or less.⁵ (Figure 4)

Procedural errors are the primary reason why endodontic treatment fails in curved canals.¹⁰ Understanding inside root configuration is necessary for endodontic treatment to be successful. In this instance, careful consideration was given to the radiographic evaluation, which aided in determining the canal design and root curvature.

Coronal pre-flaring, according to Guttman, aids in creating a glide path prior to the introduction of rotational NiTi files for biomechanical preparation as well as for tactile command of the whole dilacerated canal. Pre-flaring also improves cleaning since it retains more irrigant.⁵⁵ Exceptional substitutes for number 6 and number 8 K files are Pathfinder files. These files offer the added benefit of stiffness and increased flexibility during canal navigation, making it easier to negotiate narrow and challenging canals.

During preparing curvature of canals, following rules should be considered:

1. Maintaining apical foramen towards its real spatial position.
2. Gaining straight-line access towards area of curvature.
3. Use instrument which closely adapts the original canal shape and its anatomy.

Based on Vertucci upper bicuspsids teeth have most anatomic variations. One such variation which often occurs in maxillary bicuspid is 'S' shaped or bayonet shape canals of root. There are two curves in the S-shaped canal, the most challenging of which is the apical curve. These root canals have a very high risk of strip perforation. Guttman proposed that pre-flaring coronal of one third canal (at expense of tooth) to decrease curvature angle.¹¹ After procedure is finished, it's easier to negotiate the remaining root canal. It is necessary to formulate a customized therapy for the managing curved canals and determining the curvature degree before beginning treatment. In case presented, Schneider method regarding curvature determination is followed, due of its wide acceptance and simplicity.⁵⁵

All hand tools, particularly the Ni-Ti K files, should be pre-curved. Using smaller files (No. 6 or 8) also makes

negotiating curved canals easier and minimizes the transportation amount from dangerous places. Balanced force approach keeps the instrument central in the root canal, reduces apical debris ejection, and has a lower risk of iatrogenic injury.¹² In comparison to stainless steel, Ni-Ti alloys are softer, more robust, and exhibit shape memory and super elasticity (SE). They also have a lower modulus of elasticity. With benefits including less apical debris extrusion, less cervical binding of instruments, and efficient irrigation of apical one-third of canal, rotating files aid in flaring of the cervical third.¹³

HyFlex CM Ni-Ti files are controlled memory files. It has ability to follow the anatomy of canal closely, minimizing the risk of ledge formation risk, zipping and perforation. It can also be pre-bent, similar to the way of stainless-steel files. Therefore, these files were used in this case.

Therefore, after analysis of case, incorporating application of correct straight-line access, coronal pre-flaring, negotiation, as well as glide path, a severe root canal curvature can be safely, predictably and successfully shaped, cleaned and sealed.

3. Conclusion

Success depends on having a solid grasp of the tooth's internal anatomy in addition to a careful evaluation of preoperative radiographs. Curved canal management, problem prevention, and treatment quality improvement can be achieved with the use of appropriate instrumentation techniques and personalized treatment planning.

It is best to use hand files to traverse the canals for a while before switching to rotary files, being sure to irrigate the spaces between each file thoroughly. This approach must be consistently followed in order to successfully handle bent canals, which will eventually enhance treatment results and patient satisfaction.

4. Conflict of Interest

None.

5. Source of Funding

None.

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Cite this article: Jain S, Poonia N, Sinha DJ, Deb A., Clinical insights into endodontic management of dilacerated maxillary premolars: a report of two cases. *Journal Advances in Oral Health* 2025;2(1):28–31.

**Case Report****Integrated management of extraction sites: Socket preservation to final prosthesis: Case report****Kartik Bajaj^{1*}, Preeti Upadhyay¹, Pragya Tripathi¹, Garima Mishra¹, Manpreet Kaur¹**¹Dept. of Periodontology, Inderprastha Dental College and Hospital, Sahibabad, Ghaziabad, Uttar Pradesh, India.**Abstract**

Socket preservation after tooth extraction helps maintain alveolar bone volume, supporting future implant placement and prosthetics. Implant stability is essential for successful osseointegration and is measured by ISQ values, ranging from 1 to 100. Higher ISQ values (above 60) indicate good primary stability, predicting better healing and long-term implant success. This case report aim to evaluate the feasibility of implant placement following socket preservation in sites with reduced bone volume after tooth extraction, by measuring implant stability using ISQ values through resonance frequency analysis (RFA). This case report includes one patient with inadequate bone volume after tooth extraction. Patient underwent socket preservation before implant placement. ISQ values were measured at baseline (implant placement) and again after 3 months (during prosthetic rehabilitation). Case report demonstrated favorable outcomes, with successful implant integration and effective bone preservation following socket preservation before implant placement. ISQ measurements indicated good primary stability at implant placement, with values above 60, and continued stability at prosthetic rehabilitation, with ISQ values exceeding 70. This case report demonstrates that socket preservation in sites with reduced bone volume after tooth extraction can effectively maintain alveolar bone, facilitating successful implant placement. The favorable ISQ values observed at implant placement and after three months indicate good primary stability and sustained Osseo integration, supporting the feasibility of this approach. Thus, socket preservation proves to be a valuable technique to enhance implant stability and improve long-term treatment outcomes in compromised extraction sites.

Keywords: Socket preservation, Implant stability quotient (ISQ), Radio frequency analysis (RFA), Primary stability, Secondary stability**Received:** 21-05-2025; **Accepted:** 23-06-2025; **Available Online:** 28-06-2025

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For reprints contact: reprint@ipinnovative.com**1. Introduction**

The success of implant therapy is now evaluated not only by implant survival but also by the long-term aesthetic and functional outcomes. Currently, implant placement should be prosthetically guided, ensuring precise three-dimensional positioning to provide optimal support and stability for the surrounding hard and soft tissues.

“Alveolar ridge preservation” describes procedures performed at the time of tooth extraction aimed at minimizing external resorption of the alveolar ridge and promoting bone formation within the dental socket. The term was originally introduced by Dr. Robert G. Schallhorn in 1982 as “bone maintenance.”² It is also known by synonyms such as “socket

preservation” (SP), “ridge preservation,” and “socket grafting.”

According to a 2011 consensus, the goal of SP is to support the remaining hard and soft tissues, maintain sufficient bone volume for ideal functional and aesthetic results, and facilitate future treatment.³ This procedure can be carried out using various bone graft materials, barrier membranes, or a combination thereof. SP can be categorized into three types based on the resorption rate of the grafting material used. The first category represents a long-term preservation approach, typically applied when only prosthetic restoration is planned without implant placement. The second category involves medium-duration preservation with slowly resorbing materials that maintain bone volume over an extended period. Implant placement can occur after

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primary healing, even if residual graft particles remain, making it suitable for cases where implant placement is significantly delayed. The third category is short-term preservation, designed to maintain tissue volume during the initial healing stages, with implant placement performed shortly thereafter. While SP and socket augmentation are procedures performed at the time of tooth extraction, guided tissue/bone regeneration and augmentation refer to treatments done prior to or during implant placement.⁴

A major advancement in implant dentistry occurred in the 1960s when P.I. Brånemark and his team introduced the concept of osseointegration — a biological process where the implant surface forms a direct, stable connection with living bone without any intervening fibrous tissue. Osseointegration remains the cornerstone of modern implantology, ensuring long-term implant stability and integration.¹

Implant success is primarily dependent on its stability, which occurs in two distinct phases: primary and secondary stability. Primary stability is achieved immediately upon implant placement through mechanical engagement with the cortical bone. This initial stability is influenced by factors such as bone density, implant design, and surgical technique. However, primary stability alone does not guarantee long-term success, as it typically decreases during early bone remodeling.⁷

Secondary stability develops biologically over time as new bone forms around the implant. The transitional period between these phases, usually within the first two to three weeks after placement, is critical and may show a temporary decline in stability before remodeling strengthens the implant interface.⁷

Factors like bone quality, implant surface modifications, and surgical approach affect the overall implant stability and osseointegration. Several methods have been developed to assess implant stability, including insertion torque analysis, Periotest, and removal torque testing, though these often have limitations in accuracy and reproducibility.

Resonance frequency analysis (RFA), introduced by Meredith et al. in 1996, has become a widely accepted technique for evaluating stability. It uses the Implant Stability Quotient (ISQ), which ranges from 1 to 100.⁶ Higher ISQ values indicate greater stability: readings above 70 generally reflect excellent osseointegration, values between 57 and 60 suggest borderline stability requiring close monitoring, and values below 57 may necessitate longer healing or additional interventions. While primary stability often corresponds with high ISQ values initially, secondary stability is marked by a gradual increase in ISQ as bone remodeling reinforces the implant-bone connection. Tracking ISQ over time provides valuable information on osseointegration and helps clinicians determine the best timing for prosthetic loading.

2. Materials and Methods

This case report involved patient who presented with inadequate bone volume following tooth extraction. Dental implants were placed, and implant stability was evaluated by measuring ISQ values using resonance frequency analysis (RFA).

2.1. Presurgical assessment

Scaling and oral hygiene instructions were given to patient 2 weeks before the surgery root. Patient received a single dose of prophylactic antibiotics 1hour prior to the intervention.

2.2. Surgical procedure

2.2.1. Socket preservation (**Figure 1-Figure 6**)

1. After anesthetizing the surgical site, a sulcular incision was made, and a full-thickness flap was elevated.
2. This was followed by atraumatic extraction of the diseased tooth.
3. After filling the socket with bone graft flaps were repositioned and approximated with interrupted sutures using 3-0 black braided silk.

2.2.2. Implant placement-(**Figure 7-Figure 15**)

1. 4 months after socket preservation implant placement planning was done.
2. After anesthetizing the surgical site, a mid-crestal incision was made, and a full-thickness flap was elevated.
3. This was followed by osteotomy site preparation and implant placement.
4. The flaps were then repositioned and approximated with interrupted sutures using 3-0 black braided silk.

2.3. Postoperative instructions

1. The patient continued the course of antibiotics for next 5-7 days as prescribed prior to the surgery and analgesics to control pain.
2. Patient was recalled at 7-10 days' post-surgery for suture removal.
3. 0.2% chlorhexidine mouthwash was prescribed to be used twice daily, from the day after the surgery is performed, for a period of 10 days.
4. Patient was also educated about reporting any kind of pain and discomfort.

2.3. Post-operative evaluation

ISQ values were measured at the time of implant placement (baseline) and at the time of prosthetic rehabilitation (after 3 months).

3. Case Description

The patient reported to the Department of Periodontology at Inderprastha Dental College and Hospital, Sahibabad, Ghaziabad, with a chief complaint of a dislodged prosthesis

in the upper left posterior region, which has been present for the past three months. The patient was apparently in good health until the prosthesis became dislodged suddenly, without any associated pain or other significant symptoms.



Figure 1: Pre-operative

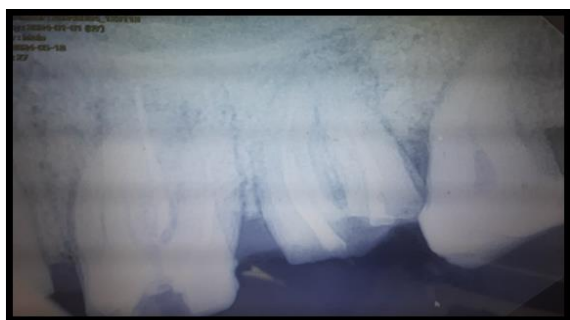


Figure 2: Pre-operative X-ray



Figure 3: After extraction



Figure 4: After grafting and suture

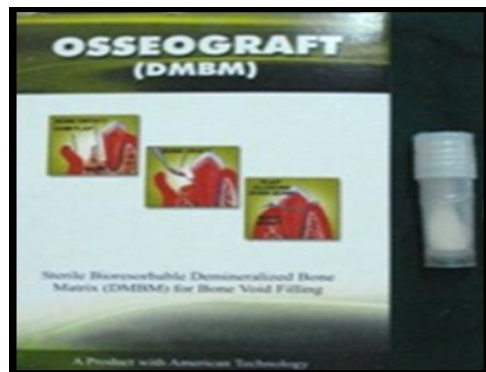


Figure 5: Bone graft



Figure 6: Immediate post-operative x-ray



Figure 7: Post-operative X ray 4 months



Figure 8: Osteotomy preparation



Figure 9: Implant placement



Figure 10: ISQ value at baseline



Figure 11: Implant x-ray



Figure 12: After suturing



Figure 13: ISQ value after 3 months



Figure 14: Final x ray



Figure 15: Final prosthesis

4. Results

Implant stability was assessed using Resonance Frequency Analysis (RFA) at the time of implant placement (baseline) and again after 3 months, prior to prosthetic loading. (Table 1) The measured implant stability quotient (ISQ) values showed an increase over time, indicating successful Osseo integration and improved implant stability.

Table 1: Implant stability using resonance frequency analysis (RFA) at the time of implant placement (baseline) and again after 3 months

Time Point	ISQ Value
Baseline (At Placement)	66
After 3 Months (Loading)	76

The increase in ISQ value from 66 to 76 reflects the transition from primary mechanical stability to enhanced secondary

biological stability. This progression confirms favorable bone healing and integration around the implant, supporting the clinical decision to proceed with prosthetic rehabilitation.

5. Discussion

This case report emphasizes the significance of alveolar ridge preservation (ARP) in achieving successful long-term outcomes in implant dentistry. Tooth extraction often leads to alveolar bone resorption, which can compromise future implant placement both functionally and aesthetically.⁵ In this case, socket preservation was performed immediately after tooth extraction using a bone graft material. This approach aimed to minimize ridge collapse and maintain adequate bone volume for delayed implant placement.

The choice to delay implant placement by four months allowed for primary healing and bone maturation, facilitating optimal implant positioning.⁵ The use of Resonance Frequency Analysis (RFA) to measure Implant Stability Quotient (ISQ) values provided a reliable, non-invasive method to monitor implant stability during the treatment phases. ISQ values recorded at the time of placement and again at prosthetic loading demonstrated increased stability over time, indicating successful Osseo integration.

The transition from primary to secondary stability is a critical period during implant healing. High initial ISQ values reflect good mechanical engagement, while progressive increases in ISQ over time confirm biological integration. This case showed a favorable trend, validating the clinical protocol used.

The patient's compliance with postoperative care, including antibiotic and analgesic therapy, use of chlorhexidine mouthwash, and regular follow-up, further contributed to the positive outcome. Overall, the combination of ARP, delayed implant placement, and ISQ-based stability assessment provided a structured and predictable approach, ensuring the functional and aesthetic success of the implant. This case supports the use of evidence-based protocols in modern implantology for enhanced treatment outcomes.

6. Conclusion

This case report demonstrates the critical role of alveolar ridge preservation in maintaining the structural integrity of the extraction site to support future implant placement. Through careful presurgical planning, timely socket preservation, and delayed implant placement, optimal bone volume was achieved, facilitating successful osseointegration. The use of Resonance Frequency Analysis

(RFA) to monitor Implant Stability Quotient (ISQ) values provided an objective and reliable method for assessing implant stability throughout the healing process. The favorable progression of ISQ values highlighted the effective transition from primary to secondary stability, confirming the biological success of the implant. Additionally, strict adherence to postoperative protocols and patient compliance were key contributors to the positive clinical outcome. This case reinforces the importance of a comprehensive, evidence-based approach in implant therapy to ensure long-term functional and aesthetic success.

7. Source of Funding

None.

8. Conflict of Interest

None.

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Cite this article: Bajaj K, Upadhyay P, Tripathi P, Mishra G, Kaur M. Integrated management of extraction sites: Socket preservation to final prosthesis: Case report. *Journal Advances in Oral Health.* 2025;2(1):32-36



Letter to Editor

Why postoperative care in third molar surgery remains a challenge despite extensive research

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Abstract

Third molar impaction is one of the most studied topics in oral and maxillofacial surgery, with hundreds of research papers published annually. These studies aim to optimize surgical techniques, reduce complications, and improve postoperative outcomes. Despite this wealth of research, postoperative care for patients undergoing third molar extractions continues to present challenges. This article explores the reasons behind this conundrum, focusing on biological variability, procedural complexity, limitations in translating research into practice, and the multifaceted nature of patient care.

Keywords: Third molar surgery, Impaction, Post-operative care

Received: 04-05-2025; **Accepted:** 07-06-2025; **Available Online:** 28-06-2025

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1. Biological and Anatomical Variability

One of the primary reasons for inconsistent postoperative outcomes lies in the inherent biological variability among patients.

1. **Anatomical differences:** The position, angulation, and depth of impaction vary widely among individuals, influencing surgical complexity and postoperative healing. Deep impactions, proximity to the inferior alveolar nerve, or sinus involvement significantly increase complication risks.
2. **Individual healing responses:** Healing is influenced by genetic factors, systemic conditions (e.g., diabetes, smoking), and individual immune responses, making it difficult to standardize postoperative care protocols.
3. **Pain perception and tolerance:** Pain is subjective and varies across patients, complicating the management of this critical postoperative concern.

2. Complexity of the Procedure and Surgical Variations

Third molar surgery ranges from straightforward extractions to highly complex cases.

2.1. Surgical techniques

Despite advancements, there is no one-size-fits-all approach. Techniques such as flap designs, bone removal, or use of piezoelectric surgery reduce complications in some cases but may not apply universally.

1. **Flap designs:** Use of Various types of soft tissue flaps such as triangular flap, envelope flap¹ and flapless incisions²⁻³ show varying degrees of success.
2. **Bone removal:** Degree of bone removal,⁴ use of surgical handpieces⁵ (straight or contralateral), Irrigant temperature⁶ and different solutions⁷ have shown statistically different results in various studies.

Piezosurgery: Use of piezoelectric handpieces has shown improved results but only in deep seated third molar impactions.⁸

2.2. Skill of the operator

Outcomes are closely tied to the experience and technique of the surgeon. Novice surgeons often report higher rates of postoperative complications like swelling, pain, and infection. This could be attributed to increased surgical time,

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Improper technique and improper postoperative instructions and followup.⁹

3. Challenges in Translating Research into Clinical Practice

Research findings often fail to be seamlessly integrated into everyday practice due to various factors:

1. **Diverse study designs:** Research studies often vary in methodologies, populations, and outcome measures, making it difficult to draw universal conclusions.
2. **Limited generalizability:** Many studies are conducted in controlled environments with ideal patient conditions. Real-world scenarios, however, involve patients with comorbidities, non-compliance, or suboptimal oral hygiene, limiting the applicability of research outcomes.
3. **Lack of standardized protocols:** Research findings are sometimes contradictory or do not result in clear consensus guidelines, leaving clinicians to rely on personal judgment or experience.

4. Multifactorial Nature of Postoperative Challenges

The postoperative phase involves managing a range of symptoms, which complicates care:

1. **Pain and inflammation:** The intensity and duration of postoperative pain and swelling vary widely. While NSAIDs, corticosteroids, and analgesics are commonly prescribed, their efficacy is not uniform. Studies have suggested using long-acting anaesthetics or pre-emptive analgesia, but patient responses remain inconsistent.¹⁰
2. **Infections:** Despite prophylactic antibiotics, postoperative infections like alveolar osteitis (dry socket) remain common, occurring in 1–5% of cases. Research on the role of antiseptic rinses¹¹ or medicated dressings shows promise but is not universally adopted.¹²⁻¹³
3. **Psychological factors:** Anxiety and fear about the procedure and recovery can amplify postoperative symptoms, complicating pain management and compliance with care instructions.¹⁴

5. Patient-Related Factors

Patient behaviour significantly affects postoperative recovery.

1. **Non-compliance:** Many patients fail to adhere to postoperative instructions, such as avoiding smoking, maintaining oral hygiene, or following dietary restrictions.
2. **Lifestyle factors:** Smoking, alcohol consumption, and poor nutritional habits delay healing, increasing the risk of complications.
3. **Patient education:** Research shows that well-informed patients experience better outcomes, yet gaps in patient education persist, impacting recovery.

6. Gaps in Research and Innovations

Despite extensive studies, certain gaps persist:

1. **Focus on short-term outcomes:** Most studies emphasize immediate postoperative results (e.g., pain and swelling), with limited focus on long-term complications such as nerve damage or TMJ issues.
2. **Underexplored therapies:** Emerging technologies such as stem cell therapy, advanced biomaterials, and bioactive dressings show potential but require further validation before clinical adoption.
3. **Inconsistent metrics:** Lack of standard metrics for evaluating outcomes (e.g., patient-reported outcomes vs. clinical parameters) creates inconsistencies in assessing the effectiveness of care strategies.

7. Proposed Directions for Improvement

To address these challenges, a multifaceted approach is essential:

1. **Personalized care protocols:** Leveraging predictive tools like AI and machine learning to tailor postoperative care to individual patient profiles, similar to systems developed by Zain et al, 2024.¹⁵
2. **Enhanced surgical training:** Ensuring that surgeons are proficient in advanced techniques to minimize complications. Jerjes et al, 2006, demonstrated that surgeons with greater experience have cases with lesser post-operative complications.⁹
3. **Standardized guidelines:** Developing and disseminating evidence-based guidelines that synthesize the best practices from current research.
4. **Patient education:** Emphasizing the importance of compliance through clear communication and resources. Phone calls have shown to improve patient compliance to post-operative instructions.¹⁶
5. **Future research focus:** Shifting towards real-world studies that include diverse populations and long-term outcomes to improve clinical applicability.

7. Conclusion

The inability to provide universally manageable postoperative care for third molar impaction patients stems from the complexity of the condition and the multifactorial nature of postoperative challenges. While research has provided valuable insights into surgical techniques and postoperative management, the inherent variability in patients and care environments limits the translation of these findings into consistent clinical success. Bridging the gap between research and practice requires a concerted effort to personalize care, enhance training, and focus on patient-centric approaches. Only then can we hope to improve outcomes for this common yet challenging procedure.

8. Source of Funding

None.

9. Conflict of Interest

None.

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Cite this article: Swati Sharma. Why postoperative care in third molar surgery remains a challenge despite extensive research. *Journal Advances in Oral Health* 2025;2(1):37–393



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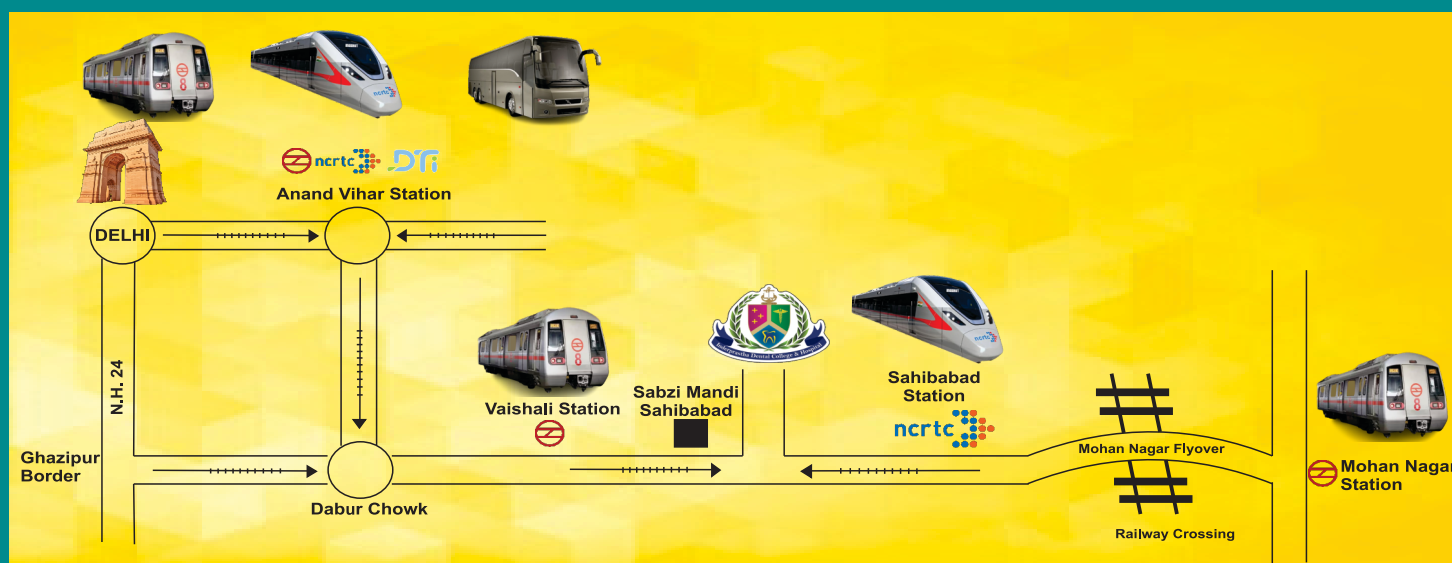
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- Best Dental College in INDIA for Year 2023-24 (Awarded by Times Group)
- Best Dental College in INDIA for Year 2023-24 (Awarded by DASANA FOUNDATION)
- Best Dental College in India for Year 2022-23 (Awarded by Katalyst Research)

Closest Dental College to Delhi

- Only 1 km from Sahibabad RRTS Station
- Only 3 kms from Delhi Metro Station-Vaishali
- Only 3 kms from Delhi Metro Station-Mohan Nagar
- Only 5 kms from New Delhi ISBT Bus Terminal -Anand Vihar
- Only 17 kms from New Delhi Railway Station
- Only 32 kms from New Delhi International Airport



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