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EDSA

Magazine



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European Dental
Students' Association



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From the Editor Team



Dear EDSA Family,

Welcome to the Summer issue of the EDSA Magazine. This edition feels particularly special to me, as it marks the end of my EDSA journey and my last EDSA meeting.

Over the past year, this magazine has been a wonderful platform for sharing ideas, experiences, and perspectives from dental students across Europe. It has been a privilege to be part of that process and to see the enthusiasm and creativity of our community reflected in every edition.

I would like to sincerely thank all of our writers for sharing their knowledge, experiences, and ideas, and my co-editors for their support, creativity, and hard work. Working alongside such a dedicated team has been one of the highlights of my EDSA experience.

Beyond the magazine, EDSA has given me countless unforgettable experiences, wonderful friendships, and memories that I will carry with me long after my time in the organisation comes to an end. I am incredibly grateful for every person I have met and every opportunity this community has given me. Thank you, EDSA, for an unforgettable chapter. Although this is my last meeting, I know I will always feel part of the EDSA family.

Liisbet Jäätma, EE
EDSA Vice President of Public Relations



Dear future dentists,

The past year with this team has been an amazing experience and I am so grateful to have been part of the inner workings of the EDSA magazine.

EDSA is a truly special community and I believe that both the Amsterdam and Budapest editions reflect this perfectly. Thank you to all the writers that have been a part of this!

Dear readers, I sincerely hope that every one of you can find something exciting in this edition to bring back to clinical practice.

Happy reading!

Nora Nõmm, EE
Co-editor



Dear Readers,

Thank you for being such an important part of this journey and for helping create something we can all be proud of. Your work may often happen behind the scenes, but its impact is seen by everyone.

Gabriela Gorodecka, LV
Co-editor



Dear Readers,

We are happy to share this edition with you. This 2026 Summer Edition brings together articles that celebrate curiosity, learning, and the connections that make our community unique. Whether you are looking for the latest developments in dentistry or simply an enjoyable read, we hope there is something here for everyone.

Seeing this magazine come to life through the ideas and dedication of so many students across Europe reminds me why EDSA is such a special community.

Thank you for taking the time to read our magazine and for being part of this journey with us. I look forward to meeting many of you at our future EDSA events.

Furkan Sarp Tavukcuoğlu, TR
Co-editor

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From the President



Dear EDSA Family,

As my term as President of the European Dental Students' Association comes to an end, it is difficult to capture the past year in a few words. It has been a year of responsibility, challenges, growth and, above all, people.

When I began this term, I knew the role would be about more than representing EDSA. It would be about building on what generations before us created, while ensuring that EDSA continues to evolve with the needs of European dental students. Looking back, I am incredibly proud of what we have achieved together.

This year, EDSA strengthened its relationships across European dentistry and health, including with ADEE, CED, FEDCAR, ERO and other professional partners. We worked to ensure that EDSA is not simply invited to the table, but actively contributes to conversations shaping the future of dental education and our profession.

We also continued strengthening the Association from within — improving our structures, reporting and handover processes, while giving greater attention to continuity between Boards. At the 77th General Meeting in Amsterdam, we adopted policy papers on Non-Communicable Diseases and Oral Health and on Artificial Intelligence in Dentistry, further establishing EDSA's voice on issues beyond student life.

But no presidential year is built by a President alone.

To my Board, Officers, Delegates and Representatives: thank you for your commitment, ideas, patience and trust. Every achievement of this year carries the work of many people, and I am grateful to have shared this chapter with you. To our partners, sponsors and every student who contributed to EDSA this year — thank you for believing in what we are building together.

My own EDSA journey began years ago as a dental student from Lithuania. I could never have imagined that I would one day have the privilege of leading this Association. Being the first Lithuanian EDSA President makes this chapter particularly meaningful, but this role has never been about one country or one person. It has always been about all of us.

As I hand over the Presidency, I do so with confidence in EDSA's future. I hope the next Board will not simply continue what we started, but challenge it, improve it and make it their own.

The presidency may be coming to an end, but my EDSA story certainly is not.

With gratitude,

Saulė Skinkytė

President 2025-2026

European Dental Students' Association (EDSA)

From the President-Elect



Dear Readers of the EDSA Magazine,

I have finally made it into an Article!

Over the past two years, EDSA has become a place where I have grown both personally and professionally. What began as attending meetings and meeting other dental students from across Europe gradually evolved into taking on greater responsibilities.

I have gone from being a regular participant all the way back in Spring 2024, to being granted the privilege of presenting my Country from 2024-25, serving in the Board of Directors from 2025-26 and now being given the honor of presiding over the Association starting with the term of 2026-27.

Yet, when I look back, it is not the documents, meetings, or resolutions. Nor is it the titles, the prestige and positions that stand out in this association, but the people. The conversations between sessions, the friendships built across borders, and the shared determination to leave EDSA a little better than we found it. They reminded us that while we often believe we are shaping our journey, our journey shapes us in return. Every challenge, every success, every disagreement, and every collaboration leaves us a little different from who we were before.

And as EDSA continues to grow, perhaps you, the person reading this right now, have already begun your own story in EDSA. Who knows? Someday, you might be the one finding yourself on the other side of this magazine, sharing your own story.

I would also like to take this opportunity to thank every member of the 2025-26 Leadership, the Co-Leads and the Active Contributors: thank you. Thank you for your dedication, your passion, your patience, your friendship, and for believing in a shared vision of what EDSA can become. Every achievement this year is a result of our shared efforts and every achievement this year of the association is also your achievement.

But enough of all the governance talk!

Whether this is your very first EDSA General Meeting or your tenth, I hope you make the most of every opportunity this week has to offer. Meet new people, exchange ideas, learn something unexpected, and create memories that will stay with you long after Budapest. After all, the people you meet and the experiences you share are what make EDSA so special.

I wish you all a fantastic stay and an unforgettable experience during the 78th EDSA General Meeting in Budapest. And while you're here, take a moment to enjoy this wonderful issue of the EDSA Magazine, brought to you through the hard work of our Vice-President of Public Relations, Liisbet Jääma and her team.

Happy reading, and see you around Budapest!

Jimmy Le

President-Elect

European Dental Students' Association (EDSA)

DIGITAL TECHNOLOGY AS AN ENABLER OF EQUAL ACCESS TO CARE

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Digital technology is not just a luxury tool, but a way to ease dental protocols for patients with special needs.

Clear aligners are clear orthodontic trays designed to replace traditional braces. The orthodontic appliances are made to fit the patient's mouth coming in sets, designed to gradually correct teeth position, millimeter by millimeter. Clear aligners correct malocclusions, including dental crowding, spacing, overbite, underbite, crossbite, and mild to moderate skeletal discrepancies in selected patients. Beyond their aesthetic appeal, aligners represent a clinically effective orthodontic treatment modality that contributes to improve occlusion, oral function, and long-term oral health while offering enhanced comfort and ease of maintenance. Modern digital workflow – from portable intraoral scanning to transparent aligner systems, ceases to be a simple aesthetic attribute but an indispensable basic tool. This system reduces overstimulation of patients, offers protection against bruxism and helps maintain optimal hygiene without changing the usual routine too much.

Access Through Innovation

Equality of rights should go beyond the democratic sphere, implementing equality in access to oral health services. Although technology advances at the speed of light, most of the time there are patients stuck or captive in a traditional medical system. The traditional dental office for patients with neurodiversity conditions particularly those with Autism Spectrum Disorders (ASD) and polyformative genetic syndromes (Down Syndrome) is not just a medical space, but an environment that causes sensory overstimulation and anxiety. Dental malocclusions come with a number of other problems such as plaque retention, increased risk of gingivitis, periodontal disease, chewing difficulty, impaired speech and can increase discomfort in neurological patients. Correcting occlusal dysfunctions and implicitly improving the quality of life for these people, for whom even just sleeping better is a gain, should be prioritized.

Align Technology, the company that designs and manufactures the Invisalign system and iTero intraoral scanners, has created a vast interdisciplinary space for correcting dento-maxillary anomalies through simplified and rapid protocols, tailored to the needs of the patients. The classic impression is a true challenge for patients with severe vomiting syndrome and motor cognitive deficiencies and intraoral scanner offer an interesting alternative for them. The intraoral scanner allows the registration of arches in an efficient and fast way, more pleasant for the patient. Planning consists of a series of occlusion simulations and previews of the procedures, offering both patient and clinician better precision and better cooperation with the patient.

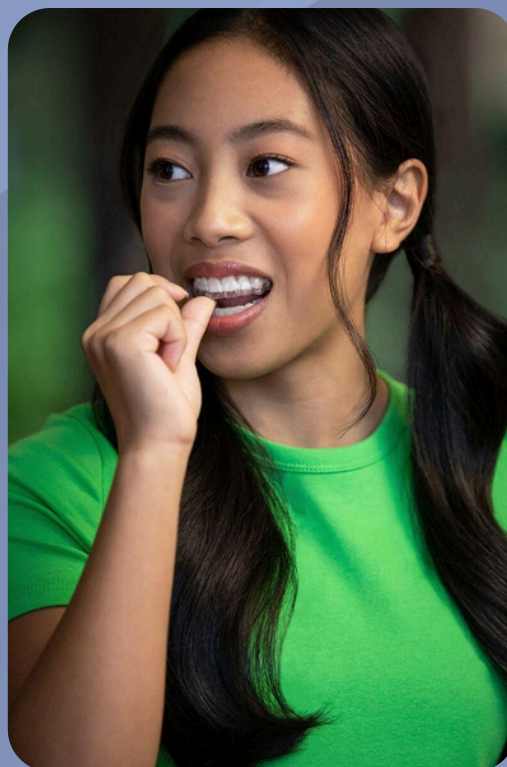
Traditional braces may, in some cases, be an active reservoir of bacteria that could favor the appearance of cavities followed by plaque gingivitis or even periodontitis (especially in patients with Down Syndrome who have a high susceptibility to developing periodontal pockets). Invisalign clear aligners are made of SmartTrack material, designed exclusively for the Invisalign system, to optimally deliver the desired force systems to more predictably move teeth. Emergency visits with Invisalign clear aligners occur almost 80% less frequently than with braces and patients require, on average, on average fewer doctor visits than fixed appliances.

The special needs patient

New technologies mean breaking new borders, where digital dentistry is not only about innovation but also about understanding each patient's individual needs and adapting treatment approaches to achieve better clinical outcomes. Improving our skills in digital workflows and patient-centered care is essential for delivering equitable, accessible, and high-quality dental treatment.

The special needs patients become a challenge to the clinician. The difficulty does not necessarily come from the complexity of the occlusal imbalance, but from the combination of several neurological, cognitive or motor disorders that limit cooperation and movement, making the classic treatment difficult, modifying the biomechanics of the dento-maxillary apparatus. Once discovered, the underlying disease comes with a baggage of problems, including occlusal dysfunctions, – as a direct consequence of muscular and skeletal imbalances. Occlusal imbalance manifests itself much more aggressively in patients with special needs than in the general population due to the accumulation of systemic problems.

For the treatment of patients in the field of neurodiversity, their sensory profiles must be understood. Sensory hyperstimulation (tactile, auditory and visual) transforms incipient stimuli in the office into triggers of crises or episodes of high anxiety.



For example, Down syndrome is a chromosomal genetic disease, due to the presence of an extra chromosome 21, characterized by certain physical, mental and medical changes. In the dental field, they may present a series of severe occlusal pathologies including pseudoprognathism, open occlusion, severe dental crowding midfacial abnormality, narrow palate, macroglossia as well as delayed teeth eruption, missing and malformation in tooth morphology. In addition, individuals with oro-facial disorders may have a high risk of developing oral health problems such as periodontal disease, malocclusion, and dental caries.

Likewise, Autism spectrum disorder (ASD) is a lifelong and complex developmental condition linked to atypical neurodevelopment, usually diagnosed between the ages of one and six years depending on access to healthcare services. In these patients, bruxism represents a self-stimulation mechanism, frequently correlated with psycho-emotional stress or minor occlusal dysfunctions. In the case of ASD, the contraction of the masseter and temporal muscles serves as a neurological self-regulation valve in the face of sensory overstimulation. This type of bruxism can manifest itself both during the day and at night, generating forces much stronger than physiological ones.

Correcting malocclusion matters in special needs patients because oral hygiene becomes easier and more effective, plaque accumulation decreases, periodontal inflammation is reduced, chewing efficiency and speech improves, oral comfort increases and also caregivers can perform oral hygiene more easily.

They need simplified procedures, - in which treatment takes into account the need for a functional, stable and non-traumatic occlusion rather than an ideal, gnathological occlusion.



Why digital technologies matters

Understanding digital orthodontics and aligner therapy is becoming increasingly important as dentistry continues to evolve toward digital workflows, minimally invasive treatment, personalized care, and evidence-based clinical decision-making. Learning digital technologies is now a key factor for increasing predictability, diagnostic accuracy, better interdisciplinary communication, reduced chair time and improved patient cooperation.

The most common obstacle in treating patients with special needs is the diagnostic and impression - taking stage. The classic impression, with metal trays and viscous materials (alginate, silicones), is a challenge for patients with neuronal pathology.

Portable digital technology: intraoral scanners (such as iTero intraoral scanner) eliminate this sensory aggression, allowing the clinician to record the dental arches in a fast and more pleasant way for the patient. It allows the interruption of the work at any time and its resumption when the patient is ready. Also, the scan can be performed without the need for a dental chair, reducing the anxiety associated with the dental office.

Monitoring the evolution and assessing the degrees of tooth wear can be done using digital overlay techniques via the TimeLapse function. This 3D visual evidence is essential for informing and raising the awareness of the owners, providing an objective basis for the therapeutic decision.

In order to rehabilitate the occlusion, traditional orthodontic appliances are a contraindication for patients with ASD. They introduce the idea of a foreign body, sharp and stimulating object for the mucous membranes, difficult to maintain oral hygiene for patients suffering from motor impairment. The Invisalign system works as an occlusal shield, evenly distributing chewing forces and dental wear caused by bruxism. Patients benefit from digital planning through the ClinCheck software, offering precision of the order of millimeters. The biocompatible materials used and the removable aligners do not change the hygiene times of the patient, nor do they damage the soft tissues.

From an ethical and public health point of view, the use of digital technology facilitates equal access to oral health care, reducing the rate of General Anesthesia/deep sedation. Traditionally, due to the lack of patient compliance, sedation methods were used.

Although, sedation methods was an effective method at the time, this approach involves biological risks, high financial costs for the family/insurance system and does not offer a solution for monitoring and dynamic adjustment of occlusion over time.

Digitalization breaks these barriers by using 3D scanning techniques, and the use of removable aligners could increase the predictability of treatments, so that a significant proportion of patients with ASD can be treated consciously. This opens up the frontiers: offering the same quality of treatment for both patients without neuropathy and those suffering from it.

Conclusion

In the era of digitalization, clinical success does not only mean aesthetic restorations or gnathological precision, but a functional occlusion for vulnerable patients. Digital technology through intraoral scanning, alignment, planning and results analysis is revolutionizing dental treatment for patients with neurological spectrum disorders. The wide-scale integration of these protocols is an imperative step towards a dentistry that offers inclusion and human equity. Learning about new technologies emerging in the field of oral health is the path to easily accessible oral health for any patient who arrives at the clinic.



SEEING DENTISTRY DIFFERENTLY WITH THE ALIGN ORAL HEALTH SUITE

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Digital dentistry is changing not only how treatment is planned, but also how it is explained (1).

In contemporary practice, connected workflows can bring diagnosis, visualisation and patient discussion into the same clinical moment, making consultations more structured and easier to follow.

Several digital ecosystems have been developed to support this approach. Among them, the Align Oral Health Suite exemplifies this approach. Described as a digital suite of visualisation and assessment tools within the iTero ecosystem, it is designed to help clinicians explain findings through visual information rather than relying solely on verbal descriptions. To facilitate seamless integration, it connects smoothly with common practice management systems and existing workflows, helping practices overcome potential barriers to adoption and ensuring a smooth transition to digital workflows.



Figure 1. iTero Lumina Pro. (2,3)

A connected clinical workflow

A digital workflow is valuable because it reduces fragmentation and minimises the risk of errors. Rather than moving between separate records, explanations and treatment plans, the clinician can use a single digital environment to review findings, discuss options, and document the conversation more clearly. This integrated approach enhances treatment accuracy and consistency, ultimately supporting better patient outcomes.

For students and young clinicians, this matters because clear visual communication can boost their confidence and help them feel more competent in clinical care (5,6). A patient may not understand terms such as crowding, attachment loss, occlusal wear, or restorative prognosis, but they can usually understand what they see on a scan (5,6).

Making communication clearer for clinicians and students

For dental professionals, integrated digital tools may improve consistency in case presentation. When images, scans and treatment simulations are available together, diagnosis can be reviewed more systematically, and treatment discussions can become more coherent for both the operator and the wider team (5,6).

This kind of organisation can help busy practices and teaching clinics operate more smoothly, making staff and clinicians feel more in control and less stressed, as immediate visual records simplify explanations and strengthen documentation, thereby reducing stress (4).

Helping patients understand their oral health

From the patient's perspective, the main benefit is feeling reassured through clarity. Visual explanations can help patients feel more confident about their oral health, especially when treatment is complex or emotionally challenging (7).

Better understanding can also strengthen informed consent (5,6). When patients can see their current condition and the proposed treatment pathway more clearly, they are in a stronger position to ask questions, reflect on options and participate meaningfully in decision-making.

Digital communication in complex clinical conversations: the SPIKES framework

Digital tools may be particularly useful when difficult news has to be communicated. Using structured frameworks such as SPIKES (Setting, Perception, Invitation, Knowledge, Emotions and Strategy or Summary) can help clinicians and staff feel more prepared and less anxious, thereby supporting a stepwise, patient-centred approach (8).

The SPIKES protocol is widely used for breaking bad news and provides a structured six-step approach to guide these conversations. (8) In dental practice, this is particularly relevant when discussing prognosis, loss of function or complex rehabilitative needs.

Digital workflows can support this process by making it easier to present information gradually, check understanding, and revisit key findings during the consultation. Visual material can be used to support explanation, which is especially beneficial for anxious patients, helping to acknowledge emotional responses and foster a more comfortable, patient-centred experience.

Beyond orthodontics: Align Oral Health Suite across dentistry

Although orthodontics is the most obvious context for this kind of platform, the same logic extends to many other branches of dentistry. Broader digital transformation in dentistry reflects an ongoing shift towards integrated, data-driven care (4,12).

Integration of the SPIKES Protocol with Digital Workflows in Dentistry

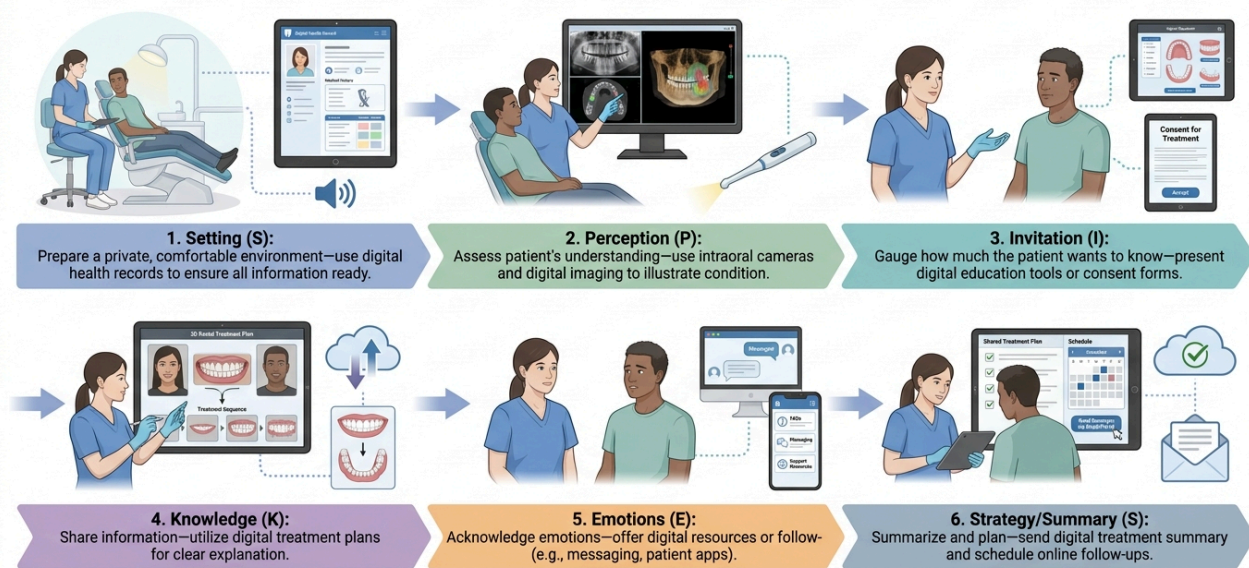


Figure 2. Integration of the SPIKES protocol with digital workflows in dentistry. Adapted from DOI: 10.1634/theoncologist. (8)

In prosthodontics, smile design and CAD/CAM mock-ups help patients compare restorative options and visualise outcomes more clearly. Augmented and virtual reality approaches further enhance treatment planning and simulation (10).

In periodontology, serial digital records and risk charts enable more objective tracking of attachment loss and peri-implant changes over time.

In oral diagnosis and radiology, combining CBCT, clinical photographs and structured reporting improves diagnostic transparency and treatment planning, particularly in implant dentistry (11).

Artificial intelligence is also increasingly integrated into diagnostic and planning pathways, supporting image interpretation and decision-making, although it does not replace clinical judgement (12).

Overall, digital dentistry increasingly reflects a shared model of care in which problems, options and outcomes are visualised collaboratively across disciplines.

Limitations and future perspectives

Despite its advantages, digital communication tools have limitations. Screens may reduce direct eye contact and active listening, and not all patients are equally comfortable with technology-based consultations (4,9).

Concerns also include data security, privacy, and the risk of over-reliance on software in place of clinical reasoning. For this reason, digital systems such as the Align Oral Health Suite should be viewed as supportive tools rather than substitutes for clinical expertise (12). It is important to consider how these tools comply with data protection regulations and how they complement, rather than replace, clinical judgment to ensure safe and effective use.

Conclusion

Used appropriately, integrated digital platforms can make dental consultations more visual, structured and comprehensible for patients. Their value lies not in the technology itself, but in how they support clearer communication, more informed consent and a more connected model of care (4,5).

As digital dentistry continues to evolve, its most meaningful contribution may be improving how clinicians and patients understand each other, rather than simply how treatment is delivered.

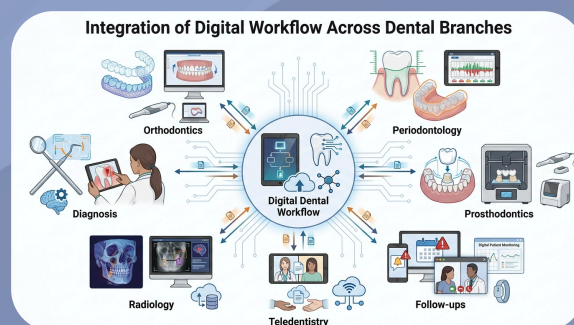


Figure 3. Integration of a digital dental workflow across orthodontics, prosthodontics, periodontology, diagnosis, radiology, tele-dentistry and follow-ups. (1,4,10, 11, 12)



For References

BEYOND ORAL SWELLING

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4th grade



A small, asymptomatic swelling in the mandibular or buccal region may appear clinically harmless at first glance. Nevertheless, salivary gland tumours represent a diverse group of conditions, ranging from benign growths to aggressive malignancies that require difficult management. Although relatively uncommon among head and neck lesions, their clinical relevance lies in how they look deceptively benign.

Salivary gland tumours develop from the major salivary glands (parotid, submandibular, and sublingual) as well as the numerous minor salivary glands distributed throughout the oral cavity. According to the World Health Organization (WHO) classification, these tumours are categorised as benign and malignant. Pleomorphic adenoma is the most common benign salivary gland tumour, and mucoepidermoid carcinoma is among the most common malignant salivary gland tumours [1].

Salivary gland tumours are of clinical importance because patients commonly present to dental practitioners before referral to specialist assessment. Dentists play an essential role in early diagnosis of such lesions, where salivary gland tumours range from benign to malignant neoplasm. Early and accurate evaluation is crucial for improving treatment outcomes and prognosis

For dental students and newly qualified dentists, recognizing these harmless appearing lesions is an important clinical skill that leads to early referral and improving patient outcomes.

When a Swelling Is Not Just a Swelling

Most salivary gland tumours appear as small enlarging mass. Especially pleomorphic adenomas, benign lesions are asymptomatic and well-defined, may lead to delayed clinical recognition and diagnosis [5].

Clinical concerns start when the lesion shifts from benign presentation, revealing features that raise suspicion of malignancy. Malignant tumours may display differently, they may grow more rapidly, feel firmly attached to surrounding tissues, or cause pain or discomfort. One of the most alarming signs is weakness or asymmetry of facial movement due to involvement of the facial nerve within the parotid gland. This is a concerning sign that the lesion may be aggressive [5]

Minor salivary glands tumours, particularly on the palate, can be subtle, and appear as small submucosal swellings, that mimic benign mucosal changes at the beginning, but dentists should never ignore progressive enlargement, firmness and ulceration features. [5]

Relying on symptoms alone is potentially misleading because both benign and malignant lesions can be painless in early stages, which is why pain alone is not a reliable differentiator. The key consideration is the overall lesion behaviour over time.

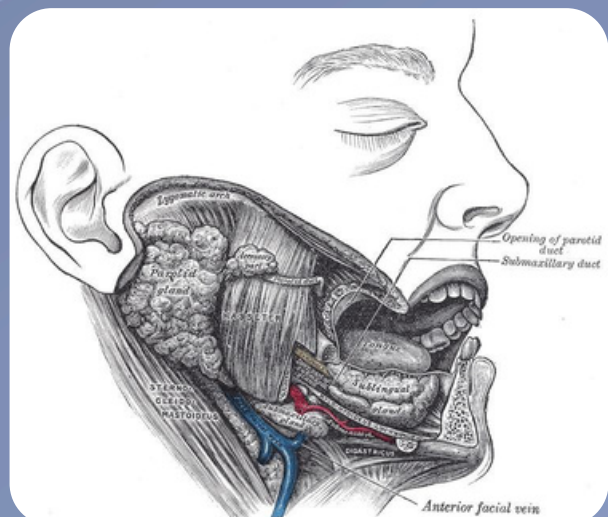
Making The Diagnosis

Correct diagnosis is based on combining clinical assessment with imaging and tissues sampling. Careful clinical assessment comes as first step of reaching accurate diagnosis, leading to further investigation: how long the lesion has been present, is it quickly growing and how quickly, and whether any neurological symptoms are present. (2,5)

Then imaging is used to look deeper. Starting by ultrasound which is quick, non-invasive, and distinguishes solid from cystic masses is used for superficial lesions. especially in parotid region. But, MRI and CT are more beneficial when lesions are deeper and more suspicious. MRI becomes essential when lesion extends to deeper surrounding tissues, it may possibly involve and spread along nerves. (2,3)

Tissue sampling is essential, to establish diagnosis. because, FNAC, Fine-needle aspiration cytology, is simple, minimally invasive, and helps differentiate whether a lesion is benign or malignant, that is why it is widely used. However, it is not perfect, and results must be interpreted alongside clinical and imaging findings. (2,3)

FNAC may yield non-diagnostic results in some cases. in such cases, a biopsy or surgical excision may be needed. Therefore, histopathological examination remains the gold standard for diagnosis and tumour classification (1,2)



Anatomy of the major salivary glands showing the parotid, submandibular, and sublingual glands.

Treatment: Simple Idea, Complex Reality

Salivary gland tumours management depends on its type, location and whether they are benign or malignant but surgery is the foundation of treatment for most cases (3). Complete surgical excision is needed for benign tumours such as pleomorphic adenoma. The key goal is to remove the lesion completely to prevent its recurrence (5).

Malignant tumours require a more complex and coordinated approach. However, surgery remains the primary treatment, but it is often combined with radiotherapy depending on stage, grade and whether a clear margin have been achieved. If there is evidence of regional spread, lymph node dissection is necessary in some cases (3).

Tumour type, extent of disease and patient characteristics all are factors that affect the treatment plan. While surgery remains the cornerstone of treatment. In selected cases, radiotherapy plays an important role in reducing the risk of tumour recurrence. Particularly when nerve is involved or complete resection wasn't achieved (3).

The future of salivary gland tumours may lie in the idea of personalised treatment approaches. Molecular research is evolving, so better understanding of tumour biology may allow treatment to be customised to each patient (4).

Why Early Recognition?

Behaviour of salivary gland tumours differs based on timing of recognition where it has an excellent prognosis when benign lesion is completely removed. But late diagnosis may complicate management. On the other hand, malignant tumours also depend on early detection for better outcomes (3,5).

For dental practitioners, the most important skill is early recognition of lesions that require further investigation. A persistent swelling, change in facial nerve function, or any lesion that behaves unexpectedly should never be ignored. Timing is very important to make significant outcome.

Salivary gland tumours demand clinical vigilance. Swellings that appear harmless may be of significant condition, making careful assessment and early referral are essential.

Conclusion

Salivary gland tumours are of significant clinical importance because of their unpredictable nature though they may be uncommon. What starts as a small, painless swelling can range from harmless benign growth to an aggressive malignancy requiring complex care.

A structured diagnostic approach that combines clinical assessment, imaging, and histopathological examination remains essential. Although management is usually surgical, outcomes strongly depend on early recognition and appropriate referral. Persistent salivary gland swellings should never be underestimated.

Careful observation, early suspicion, and timely action are critical, and may ultimately determine patient outcomes.

DIAGNOSTIC PATHWAY FOR SALIVARY GLAND TUMOURS



Key Points

- ✓ Combine clinical, imaging and cytology/histology for accurate diagnosis.
- ✓ Early detection improves treatment outcomes.
- ✓ Refer early if malignancy is suspected.



For References

SAVING THE SOCKET

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For many patients, the day a tooth is extracted feels like the end of treatment. In reality, however, it marks the beginning of a remarkable healing process that can shape future treatment options. From the moment a tooth is removed, the alveolar bone begins to remodel, often resulting in around 4 mm of horizontal and 2 mm of vertical bone loss. Although this is a natural part of healing, it can complicate future implant, bridge or denture treatment by compromising both function and aesthetics.

As dental students, every extraction presents a decision. Is allowing the socket to heal naturally enough, or could preserving the ridge provide a better outcome for the patient's future? More importantly, should socket preservation become routine practice, or is selective use the better approach?

The Biology Behind Bone Loss

Healing does not stop once a tooth has been removed. While the socket repairs itself, the surrounding bone undergoes changes that are often overlooked. Understanding why bone is lost after extraction helps explain why socket preservation has become such an important part of modern dentistry.

Following extraction, a blood clot forms inside the socket and is gradually replaced by granulation tissue, woven bone and eventually mature lamellar bone. Although the socket itself heals well, the surrounding alveolar bone continues to remodel.

Unlike most bones in the body, the alveolar bone is a tooth-dependent structure. Once the tooth is removed, the bundle bone lining the socket loses its function and begins to resorb. As a result, the ridge gradually shrinks in both width and height, with most of the changes happening within the first few months after extraction.

Why does this matter? For patients hoping to replace a missing tooth with an implant, bridge or denture, losing bone can make treatment much more difficult. Ridge collapse can affect implant placement, compromise aesthetics and, in some cases, mean that additional bone grafting is needed before treatment can even begin. In fact, a 2020 randomised controlled trial found that almost half of untreated sockets required further grafting before implant placement, compared with only 11.5% of sockets that had been preserved.

Most of this remodelling occurs at the buccal plate surrounding the tooth. Because it is made up largely of bundle bone with very little cancellous support, it resorbs rapidly after extraction. As this happens, the ridge gradually collapses towards the palate or tongue, changing the natural contour that supports the surrounding soft tissues. This is especially important in patients with a thin periodontal phenotype or a high smile line, where even small changes can have a noticeable impact

on the final aesthetic outcome. Research has shown that thinner buccal plate is associated with greater the amount of post-extraction bone loss, reinforcing the importance of recognising high-risk patients before the tooth is even removed.

What does Socket Preservation involve?

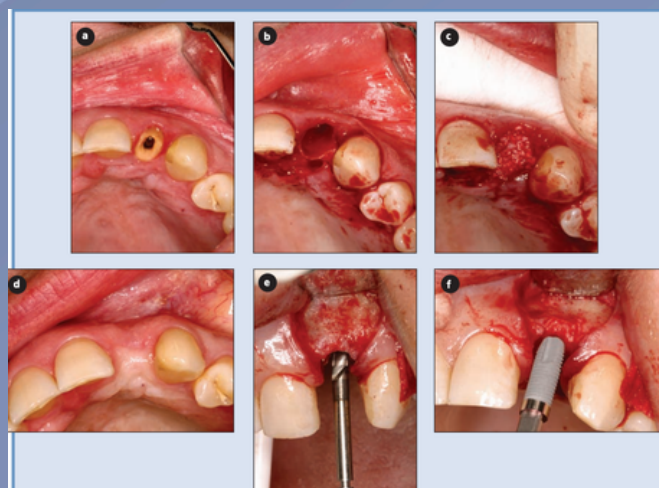
So, if bone loss after extraction is almost inevitable, can we actually do anything to slow it down?

This is where socket preservation, also known as alveolar ridge preservation (ARP), comes in with the aim is to minimise bone loss while the socket heals.

The procedure is carried out immediately after extraction. Once the socket has been cleaned, it is filled with a bone graft or bone substitute before being sealed with a membrane or soft tissue graft. Rather than replacing the bone that has been lost, the graft supports the body's natural healing by providing a framework for new bone to form.

The graft material can come from a variety of sources, including the patient's own bone (autografts), donated human bone (allografts), animal-derived bone, most commonly bovine (xenografts) and synthetic substitutes such as hydroxyapatite or β -tricalcium phosphate (alloplasts). Although each material behaves slightly differently during healing, they all aim to support new bone formation and preserve ridge volume.

With so many options available, it is easy to assume one material must outperform the rest. However, the evidence tells a different story. Recent evidence found that commonly used graft materials reduced ridge resorption compared with unassisted healing, but none completely prevented bone loss.



(a) Upper lateral incisor post extraction socket
(b) and (c) Socket filled with porous bovine bone mineral
(d) to (f) 6 months of healing and successful ridge preservation shown in preparation for placement of a narrow-platform implant.

In other words, preserving the socket appears to matter more than the material used.

Sealing the Socket

Placing a graft is only part of the procedure. It also needs to be protected while the socket heals, and that's where socket sealing comes into play. After the graft is placed, the socket is usually covered with a collagen membrane or soft tissue graft. This helps protect the blood clot, keeps the graft stable and creates the right environment for new bone to form.

Placing a graft is only part of the procedure. It also needs to be protected while the socket heals, and that's where socket sealing comes into play. After the graft is placed, the socket is usually covered with a collagen membrane or soft tissue graft. This helps protect the blood clot, keeps the graft stable and creates the right environment for new bone to form.

There are several techniques to seal a socket, including collagen membranes, free gingival grafts and connective tissue grafts. A 2021 meta-analysis found that while free gingival grafts performed well in preserving buccal bone height, different techniques produced similar overall outcomes when used appropriately. Ultimately, achieving a stable soft tissue seal matters more than the material used to create it.

This is especially important in the aesthetic zone as socket preservation also helps preserve the soft tissue that shapes a patient's smile.

As dental students, our biggest takeaway is that socket preservation protects not only the bone hidden beneath the gums, but also the smile our patients see every day.

When Should We Preserve?

If socket preservation offers so many benefits, should every extraction socket be grafted? The short answer is no.

Socket preservation is not necessary for every patient, and deciding when to use it relies on good clinical judgement. It is most beneficial when future implant placement is planned, when the buccal plate is thin, or when aesthetics are a priority, particularly in the anterior region. Patients with a high smile line or thin periodontal phenotype are also more likely to benefit, as even small amounts of bone loss can affect the final appearance.

On the other hand, socket preservation may not always be appropriate. Active infection, poor oral hygiene, financial considerations or certain medical conditions that affect healing may influence the decision.

Not every patient plans to replace a missing tooth, and in low-risk cases, allowing the socket to heal naturally may be entirely appropriate. Ultimately, treatment should be individualised, balancing the available evidence with the patient's wishes, medical history and long-term restorative goals.

The Take-Home Message

Socket preservation is not simply about filling an empty socket however, thinking about planning ahead for the patient. Every tooth extraction sets off biological changes that can influence future treatment, whether that is an implant, bridge or denture.

Current evidence consistently shows that preserving the socket reduces bone loss and creates a better foundation for future prosthetic rehabilitation regardless of the graft material or sealing technique used.

As dental students, we spend a lot of time learning how to remove teeth. Perhaps we should spend just as much time thinking about what happens after the extraction. Understanding socket preservation means thinking beyond the procedure itself and considering the long-term outcome for every patient. After all, extracting a tooth may take only a few minutes, but the decisions we make that day can shape a patient's smile for years to come.



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PROBIOTICS IN MODERN DENTISTRY

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The oral cavity harbours over seven hundred species of bacteria, ranking second only to the gut for biodiversity (1). Under healthy conditions, these microbes exist in a state of mutual regulation, providing essential metabolic functions and immune support (2,3). If the equilibrium gets disrupted, it results in a state known as dysbiosis, characterised by reduced microbial diversity and overgrowth of pathogenic species, which strongly predisposes the oral cavity to disease (1).

Why Balance Matters

As modern dentistry shifts towards prevention, there is a growing focus on treatments aimed at restoring microbial balance (4,5). Building on their success in gastroenterology, probiotics have transitioned into oral healthcare to satisfy these objectives (4,6,7). Characterised as live microbes that deliver specific health benefits to the host, probiotics operate through dynamic, strain-specific mechanisms (4). Rather than merely eradicating bacteria like broad-spectrum antimicrobials, they remodel the oral environment without the associated adverse effects (8). They inhibit pathogenic overgrowth, degrade disease-causing biofilms, and produce antimicrobial metabolites that prevent pathobiont adhesion (1). Furthermore, probiotics modulate innate and adaptive immunity by regulating cytokine production and boosting immunoglobulin responses (4,7,9). By managing both dysbiosis and inflammation, probiotic therapy represents an exciting alternative and adjunctive strategy for the comprehensive management and prevention of oral diseases (7,10,11).

When the Balance Breaks

Oral health relies on a balanced microbial ecosystem (1,12). When disrupted, highly coordinated networks of periodontopathogens, such as *Porphyromonas gingivalis* (*P. gingivalis*) and *Tannerella forsythia*, establish dominant niches, forming biofilms that drive the chronic inflammation characteristic of periodontitis (4,13,14). Standard mechanical debridement and antibiotic therapy effectively reduce microbial loads, yet the oral microbiome is not restored, and subgingival pockets remain vulnerable to rapid recolonisation by pathobionts (1,4,15,16). Moreover, prolonged antibiotic reliance has caused a rise in antimicrobial resistance (17–19).

Similarly, dental caries arises when this microbial balance shifts into dysbiosis, favouring acid-producing, Gram-positive bacteria (4,20). Current preventive measures, such as fluoride, successfully remineralise enamel yet fail to stop biofilm formation or resolve the underlying dysbiosis (21). Furthermore, as seen with periodontitis, using broad-spectrum antibiotics presents

significant drawbacks. Protective biofilm structures limit drug efficacy, while the broad action indiscriminately destroys healthy microbiota, driving the ecosystem into a deeper state of dysbiosis and contributing to the aforementioned crisis of antimicrobial resistance (17,19,22).

Another significant outcome of imbalance is halitosis, commonly referred to as oral malodour (1,23). Bacteria, such as *Fusobacterium nucleatum* (*F. nucleatum*) and *P. gingivalis*, produce volatile sulphur compounds (VSCs) by breaking down amino acids derived from secretions and dietary debris (4,23,24). Historically, managing halitosis has relied heavily on antimicrobial approaches, including topical metronidazole. However, because antibiotics fail to address the root ecological cause of dysbiosis and carry the risk of inducing drug resistance, the field is increasingly pivoting towards alternative therapies.

Beyond these oral diseases, dysbiosis extends its reach to creating opportunistic breeding grounds for fungal infections like oral candidiasis while being further implicated in the progression of squamous cell carcinoma (4,25). Ultimately, the collective failure of traditional treatments highlights a need for treatments that protect and restore the oral ecosystem.

Restoring the Oral Microbiome

Probiotic therapy offers a comprehensive strategy to resolve the underlying dysbiosis. Clinically, probiotics serve as powerful adjuvants in the management of periodontal disease by improving bleeding on probing and reducing pocket depth; specific strains, such as *Lactobacillus reuteri* (*L. reuteri*), have even been shown to promote bone regeneration (4,17,26–28). Beyond clinical improvements, probiotics offer significant immunomodulatory and microbial benefits. *Bifidobacterium animalis* (*B. animalis*) subsp. *lactis* HN019, for example, limits periodontal destruction by downregulating inflammatory signals that drive the breakdown (1,29). Other strains like *Lactobacillus paracasei* aid recovery from gingivitis, while *Lactobacillus fermentum* (*L. fermentum*) releases antimicrobial compounds that suppress major periodopathobionts (30,31).

The therapeutic benefits of probiotics extend well beyond periodontal applications. In the context of dental caries, evidence suggests that they yield the greatest efficacy when implemented prophylactically (32). For instance, long-term daily administration of *L. reuteri* has been shown to significantly reduce caries indices in children (7). This works by disrupting multispecies cariogenic biofilms. Strains like *Lactobacillus plantarum* (*L. plantarum*) 14917 structurally degrade the pathogen matrix by lowering the microenvironmental pH, while *L. fermentum* actively suppresses glucan production by *Streptococcus mutans*, weakening the biofilm's structural integrity (1,4,33). Remarkably, certain strains, including *L. plantarum* CCFM8724 and *Lactobacillus casei*, demonstrate efficacy comparable to traditional chlorhexidine treatments (27).

Extending their therapeutic reach, probiotics also neutralise the metabolic compounds responsible for halitosis. *Streptococcus salivarius*, for instance, produces salivarin, which inhibits the protein synthesis of VSC-producing bacteria (34). Other probiotics, including strains of *B. animalis* and *Lactobacillus salivarius*, reduce malodorous compounds such as hydrogen sulphide while also preventing pathogens from adhering and forming biofilms. Furthermore, *Weissella cibaria* actively reduces halitosis by targeting VSC-producing pathogens like *F. nucleatum*, and offers the added clinical advantage of high tolerance to pH and temperature changes in the dynamic oral environment (4,24).

Finally, the restorative capacity of probiotic therapy extends to the management of fungal infections and mucosal lesions. Several *Lactobacillus* species have proven effective in alleviating the symptoms of oral candidiasis, and when administered concomitantly with traditional antifungal treatments like fluconazole, these probiotics exert a synergistic effect of enhancing antibiofilm activity and expediting the return to microbial equilibrium (35). Notably, *L. plantarum* 14917 exhibits direct antibiofilm activity against *Candida albicans*, disrupting biofilm formation even within complex multispecies communities (1).

Optimising Probiotic Therapy

The clinical success of probiotic therapy relies heavily on the selection of appropriate delivery methods. As the primary objective is local colonisation, vehicles must focus on in-mouth disintegration rather than immediate swallowing (4,7,10,11). While traditional tablets and lozenges have proven effective for sustained microbiome regulation, dairy-based formulations offer low efficacy for oral applications. Therefore, the field is pivoting towards highly localised topical delivery methods. Probiotic mouthwashes, toothpastes, and, notably, orodispersible films are alternatives that provide direct and concentrated contact with tissues, demonstrating promising clinical efficacy by immediately remodelling the dysbiotic microenvironment (1,36,37). When evaluating these commercial vehicles, it is worth noting that a 2020 reclassification moved many of these strains out of the genus *Lactobacillus*, so the same organism may appear under different nomenclature across labels and scientific literature.

Besides choosing the proper product, strict adherence to application parameters is required to achieve optimal therapeutic outcomes. To achieve their full preventative potential, administration should ideally begin before the onset of major clinical signs of inflammation or structural tissue destruction (4,32). Moreover, unlike acute courses of traditional antimicrobials, probiotics do not function as transient treatments. They necessitate continuous, daily administration over extended timelines to successfully reduce established pathogen loads and maintain long-term homeostasis for the duration of therapy (6,10,11).

As microbial adherence in the fluctuating oral cavity can be transient, optimising this continuous therapy often requires synergistic strategies. Co-administration of prebiotics and dietary ingredients that selectively promote probiotic growth is encouraged to enhance and sustain their colonisation and metabolic activity (4–6,21).

What This Means for Us

While traditional treatments will undoubtedly remain necessary cornerstones of acute dental care, they are no longer the only tools at our disposal. These microbiome-directed therapies represent a shift from eradication to ecological management. However, inherent limitations still require careful chairside management. Clinicians must consider the oral-gut axis, as introducing competitive strains to the mouth may inadvertently alter downstream gastrointestinal microbial communities (1). More importantly, live microbes are highly vulnerable to degradation during manufacturing, storage, and mucosal delivery (1,4).

To bypass this fragility, the field is also exploring postbiotics, such as inactivated microbial metabolites, cell fragments, and bacteriocins, which deliver antimicrobial effects without the risks of live-cell degradation or antibiotic resistance transfer (4). As dental professionals, understanding and embracing these biological delivery systems will become a critical competency. Ultimately, by integrating probiotics into our clinical repertoire, we can move beyond simply treating the symptoms of dysbiosis to actively protecting and restoring the oral ecosystem for patients.



BIOLOGICALLY ORIENTED PREPARATION TECHNIQUE (BOPT) FOR TOOTH PREPARATION

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The biologically oriented preparation technique (BOPT) represents a contemporary approach in prosthodontics aimed at optimising the relationship between fixed restorations and periodontal tissues (1). Unlike conventional preparation designs, BOPT is characterized by a vertical tooth preparation performed without a defined finish line. A central aspect of this technique is the provisional restoration, which plays an important role in shaping the gingival tissues by guiding the emergence profile and influencing the subsequent healing response.

Through this controlled interaction, the periodontal tissues adapt and mature around the restoration, leading to a more stable gingival contour that is later replicated in the definitive prosthesis. Clinically, BOPT has been associated with improved long-term gingival stability, more favorable emergence profiles, simplified oral hygiene maintenance, and enhanced aesthetic outcomes (2). Since its introduction, it has attracted considerable attention due to its ability to modulate soft tissue behaviour, including the potential for coronal migration of the gingival margin when required.

Historical background

The abutment tooth is conventionally prepared with a horizontal preparation technique that results in the formation of a shoulder or chamfer finish line. The margins of the preparation can be supragingival, equigingival or subgingival. The Supragingival finish line exhibits lower Gingival Index scores yet has an unaesthetic appearance. Equigingival restorations are associated with gingivitis because equigingival margin lines are prone to accumulating plaque and thus are not preferred for tooth preparation. Subgingival margins are associated with periodontal diseases despite improving aesthetic appearance (3). To address these problems, vertical preparations were introduced. They demonstrate similar periodontal health status to natural teeth.

A modified vertical preparation known as Biologically Oriented Preparation Technique (BOPT) was introduced by Dr. Loi in 2013 (1). Unlike conventional horizontal preparations, BOPT focuses on managing and shaping the peri-coronal soft tissues rather than relying on a fixed prosthetic finish line. Dr. Loi introduced two modifications to the vertical preparation concept: tooth preparation without flap elevation and immediate placement of a provisional crown on the day of preparation. A central concept of BOPT is the "biological polygon," defined as the space between the tangent of the prepared tooth surface and the tangent of the final crown's emergence profile (4). By modifying the crown emergence angle, clinicians can influence the morphology of the surrounding soft tissues. A greater emergence angle creates more space for connective tissue development, promoting the thickening of soft tissues and improved stability of the gingiva (1), (3).

Clinical principles

1.Pre Cutting stage

The pre cutting stage includes the fabrication of an interim crown position at, or in contact with, the gingival margin. The surface of this interim crown will be later adjusted. In addition to this, an intersulcular mapping is performed to locate the cemento- enamel junction (CEJ) (4). The location of the CEJ is important because it will be eliminated during the cutting stage to be replaced by a new prosthetic CEJ. The interim prosthesis serves to establish a new prosthetic CEJ and to shape the desired emergence profile.

Cutting stage

The preparation of the abutment tooth consists of two stages: supragingival and subgingival preparation (1). As BOPT is a marginless technique, the preparation is confined to the axial surfaces, and careful control of bur angulation is essential to avoid the formation of a transmucosal step (5). Following supragingival preparation, the bur is extended intrasulcularly to shape the tooth surface and eliminate the cemento-enamel junction (CEJ). Removal of the CEJ eliminates the natural anatomical landmark that could otherwise promote apical displacement of the gingival margin after the soft tissues have been initially shaped by the provisional restoration.

Simultaneously, the action of the bur induces controlled epithelial injury, resulting in indirect tissue de-epithelialization. The aim of this process is to stabilize the blood clot within the gingival sulcus through the provisional restoration, thereby promoting the formation of new connective tissue around the modified emergence profile (6).

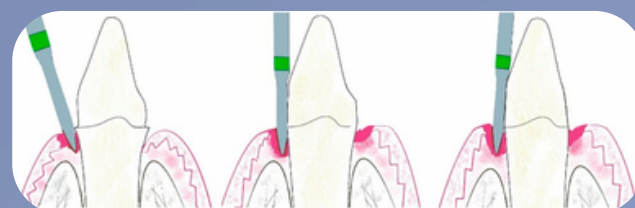


Figure 1. The bur is initially positioned at a 10–15° angle to the tooth's long axis, then aligned parallel to remove the existing finish line, and finally inclined at 3–6° to achieve the required preparation convergence.

Interim restoration

The provisional shell is relined with acrylic resin and seated intraorally to record the tooth preparation, gingival margin, and surrounding soft tissues, creating a negative impression of the peri-coronal tissues, a distinctive feature of BOPT (4).

After polymerization, a cervical concavity is observed on the internal surface, reflecting the gingival and sulcular anatomy. This concavity is filled with acrylic resin during rebasing, and the cervical portion is reshaped toward the emergence zone to create a new emergence profile aimed at guiding soft tissue maturation (1).

The provisional restoration is then repositioned, and the gingival margin is checked to ensure a maximum subgingival extension of 0.5 mm, defining the final finish line. The cervical contour is refined into a smooth, convex profile to support clot stabilization and controlled soft tissue healing.

Definitive restoration

The interim crown remains in place for 4 weeks to enable the gingiva to heal and adapt to the new emergence profile. After 6–8 weeks, soft tissue stabilisation is complete and the interim restoration is replaced by the definitive restoration. The definitive restoration will reproduce the emergence profile and the perigingival architecture that was developed during the provisional phase (3). After placing the definitive restoration it is possible that the tissues continue to mature and adapt to their shape.

Effects on periodontal tissues

Unlike other preparation designs, restorations fabricated using BOPT do not result in thin gingival margin profiles. Compared with other preparation types, increased gingival thickness has been reported and appears to be maintained over time. Digital volumetric analysis has further demonstrated that increasing the provisional emergence profile angle results in greater buccal gingival thickness and controlled apical displacement of the gingival margin (5). Specifically, according to the literature, buccal and lingual gingival thickness increase by approximately 0.5 mm and 0.4 mm, respectively (2). The greater increase in buccal gingival thickness is desirable, as the buccal gingiva is more susceptible to gingival recession (4). At the same time, long-term esthetic outcomes are improved. The increase in gingival thickness appears to be more pronounced in patients without signs of inflammation.

A relationship has been reported between gingival thickness and the Gingival Index (GI). The Gingival Index scores tend to be lower in patients with thicker gingival tissues, while its values appear to remain stable before and after placement of the definitive restoration.

Apical migration of the marginal gingiva is a common complication associated with fixed dental prostheses. In contrast, the literature reports that patients restored using BOPT did not exhibit gingival recession after a two-year follow-up period, thereby ensuring periodontal stability and superior esthetic outcomes (7).

Probing depth remains stable following placement of the definitive restoration and is generally maintained within the range of 0–3 mm, as long as the patient adheres to appropriate oral hygiene practices (2).

Conclusions

The Biologically Oriented Preparation Technique (BOPT) represents a valuable restorative approach that enables the optimisation of periodontal soft tissue morphology, facilitating the development of a favorable and natural emergence profile. Current evidence suggests that its effects on periodontal tissues are comparable to, and in some cases may surpass, those achieved with conventional horizontal preparation designs. Through the guided adaptation of the gingival tissues, BOPT contributes to enhanced periodontal stability and improved esthetic outcomes (8).

Nevertheless, despite its promising clinical results, BOPT has not yet been widely adopted in clinical practice. Successful implementation requires a thorough understanding of its clinical principles and a competition of an appropriate learning curve (4). The application of BOPT principles in conjunction with no-preparation veneers has been proposed as a minimally invasive treatment approach (9), with the potential to promote both short- and long-term gingival stability while improving restoration emergence profiles.



Figure 2. Relined crown's margin (left) and finished crown (right). The space between the two crown margins created during the relining procedure is filled with resin to increase the thickness of the coronal margin of the re



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ORTHOGNATHIC SURGERY AND MASTICATORY MUSCLES: WHERE SURGERY MEETS ORTHODONTICS

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Orthodontics is a branch of dentistry dedicated to diagnosing and managing irregularities of the teeth, jaws, and facial structures. Dentofacial disharmony not only affects facial aesthetics, but can also disrupt chewing function, speech, occlusal stability, and overall oral health.

In certain individuals, dentofacial irregularities stem from skeletal discrepancies rather than mere tooth position. These imbalances may arise due to genetic factors, abnormal craniofacial growth, congenital anomalies such as cleft lip and palate, trauma, or persistent oral habits during childhood, including thumb sucking and mouth breathing.

When the imbalance involves the skeletal relationship between the maxilla and mandible, conventional orthodontic treatment may prove insufficient. Such discrepancies can disrupt the harmony between the teeth, jaws, and masticatory muscles, resulting in altered chewing patterns, diminished bite strength, muscle imbalance, temporomandibular discomfort, and difficulty achieving a stable occlusion. In these cases, orthognathic surgery becomes necessary to realign the jaws, enhancing both facial balance and masticatory function.(1)

History of Orthognathic Surgery

Orthognathic surgery mainly aims to fix problems with the jaw bones by moving the upper jaw, lower jaw, and sometimes the chin into better positions. The goal isn't just to help people look better, it's also to make sure the bite works well and chewing feels easier and more natural.

The history of mandibular orthognathic surgery can be traced back to 1849, when Hüllihen performed one of the earliest reported mandibular osteotomies to correct prognathism in a patient with mandibular elongation and facial deformity secondary to burn injury. Hüllihen, a general surgeon with dental training, was among the pioneers of maxillofacial surgery. Other surgeons, including von Langenbeck, Cheever, Billroth, and Dufourmentel, also contributed to the early development of craniofacial and maxillofacial surgical procedures.

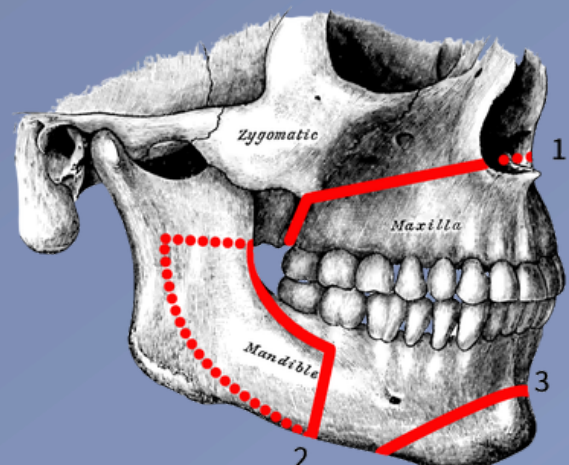
In the early twentieth century, Blair introduced the horizontal ramus osteotomy, which was later described in collaboration with Angle. They also proposed one of the earliest classifications of mandibular deformities. Importantly, they emphasized that ideal occlusion alone does not always guarantee the best facial outcome, a concept that remains relevant in modern orthognathic treatment planning.

During the second half of the twentieth century, orthognathic surgery advanced significantly with the development and refinement of standardized osteotomy techniques. The introduction of the bilateral sagittal split osteotomy (BSSO) by Obwegeser, followed by modifications by Dal Pont and Epker, improved surgical stability and expanded the range of mandibular deformities that could be treated successfully. Similarly, refinements in the Le Fort I osteotomy allowed more predictable repositioning of the maxilla and enabled simultaneous correction of maxillary and mandibular skeletal discrepancies.

These innovations established orthognathic surgery as a more predictable and reliable treatment modality. They also laid the foundation for later technological advances in surgical planning.

In recent years, digital technology has transformed the way orthognathic surgery is planned and performed. Three-dimensional (3D) surgical simulation and virtual surgical planning have increasingly replaced conventional two-dimensional planning methods. These technologies allow more accurate visualization of craniofacial anatomy and planned skeletal movements, especially in patients with complex dentofacial deformities.

More precise jaw repositioning does not only improve facial balance and occlusion. It also supports postoperative adaptation of the masticatory muscles, which is essential for improving chewing efficiency, functional stability, and long-term treatment outcomes.(2)(3)



Three Common Orthognathic Procedures: 1. Le Fort I osteotomy, 2. bilateral sagittal split osteotomy, and 3. genioplasty. author Henry Grey

Postoperative Masticatory Adaptation Following Surgery for Mandibular Prognathism

Among different dentofacial deformities, mandibular prognathism provides a clear example of how skeletal jaw position can influence masticatory muscle function. When the mandible is positioned too far forward, occlusal imbalance may affect chewing efficiency, bite force, and muscle coordination. Therefore, postoperative adaptation of the masticatory system becomes an important part of treatment success.



Mandibular Prognathism Before and After Surgery
Author Jose maria llamas

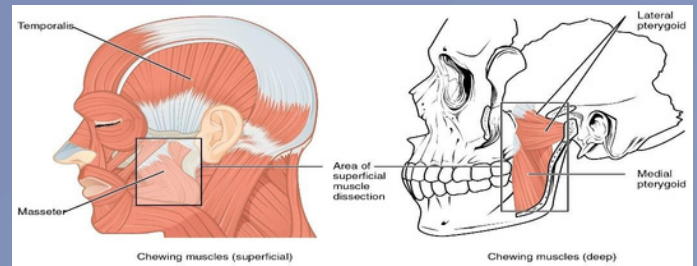
Previous studies have shown that orthognathic surgery can improve masticatory function in patients with mandibular prognathism. However, postoperative masticatory function may still remain lower than that of individuals with normal occlusion. In one study, sixteen patients with mandibular prognathism and eight individuals with normal occlusion were compared. All patients underwent surgical orthodontic treatment, and bilateral sagittal split ramus osteotomy (BSSO) was performed to correct the mandibular deformity. The study reported that functional training, including gum-chewing exercises and patient education, significantly improved masticatory function in patients with mandibular prognathism. This improvement may be related to postoperative neuromuscular adaptation after jaw repositioning. However, only a limited number of studies have investigated effective approaches to improve masticatory function in patients with jaw deformities.

Gum-chewing exercises have been reported to enhance bite force and masticatory performance. In the study, masticatory exercise was started three months after surgery.

This timing is clinically relevant because previous studies have shown a significant reduction in the cross-sectional area of the masseter muscle at three months postoperatively.

Bite force, occlusal contact area, and masticatory efficiency may begin to recover around this period, reaching levels similar to those before surgery. Moreover, the greatest improvement in bite force has been observed between three and six months after surgery.

These findings suggest that postoperative functional training may support the recovery of masticatory function after mandibular prognathism surgery. Gum-chewing exercises, when started at an appropriate stage of healing, may help improve bite force, muscle coordination, and overall masticatory efficiency.⁽⁴⁾



Masticatory Muscles Anatomy, Author OpenStax

Conclusions

Orthognathic surgery plays an important role in the management of severe dentofacial deformities, especially when skeletal discrepancies cannot be corrected by orthodontic treatment alone. Beyond improving facial aesthetics and occlusal relationships, this surgical approach also contributes to the restoration of masticatory function by allowing better coordination between the jaws, teeth, and masticatory muscles.

In patients with mandibular prognathism, postoperative adaptation of the masticatory muscles is an essential part of functional recovery. Although bite force, muscle activity, and chewing efficiency may decrease during the early healing period, these functions can gradually improve through proper healing, orthodontic stabilization, and functional training.

Therefore, careful diagnosis, anamnesis, intraoral examination, treatment planning, and postoperative follow-up are necessary to achieve stable and successful outcomes. Overall, collaboration between orthodontics, oral and maxillofacial surgery, and postoperative functional rehabilitation is crucial in helping patients regain both facial harmony and effective masticatory function after orthognathic surgery.



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THE MOUTH-HEART CONNECTION

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Can bleeding gums say something about the heart? At first glance, the question may seem strange. Dentistry is usually associated with teeth, fillings, implants and scaling. Cardiovascular and cerebrovascular diseases seem to belong to another field, with a different vocabulary: myocardial infarction, stroke, atherosclerosis, hypertension and vascular risk. Yet periodontitis keeps challenging this convenient distinction.

Periodontitis is a chronic inflammatory disease that affects the tissues supporting the teeth. It develops from a dysbiotic bacterial biofilm and a persistent host response, leading to bleeding on probing, periodontal pockets, attachment loss and, in severe cases, tooth loss ¹. Perio-medicine studies how this type of oral inflammation may be related to systemic diseases, including vascular disease ².

This does not mean that periodontitis causes myocardial infarction or stroke. That would be too simple and science is rarely that generous. A more appropriate question is this: can periodontal inflammation place additional biological stress on a patient who is already vascularly fragile?

That is where the story gets interesting.

Is the pocket local?

Dentistry often treats the periodontal pocket as a local problem. Measure it. Record it. Scale it. Re-evaluate it. All of this is necessary. But the pocket is not sealed from the rest of the body.

During chewing, tooth brushing or dental treatment, bacteria and bacterial products may enter the circulation, especially when gingival bleeding is present. In many people, these episodes are short and clinically silent. In a patient with diabetes, smoking habits, hypertension or previous vascular disease, the same repeated exposure may matter more.

The mouth is not floating outside the body. It is part of it. This does not make every bleeding site a medical emergency. It simply means that chronic oral inflammation deserves more respect than it often receives.

Inflammation travels

Atherosclerosis is usually discussed through familiar risk factors: smoking, high blood pressure, diabetes, high cholesterol and low physical activity. These remain central. But atherosclerosis is also an inflammatory process. Blood vessels respond to immune signals, oxidative stress, endothelial injury and thrombotic changes.

Periodontitis may touch some of these pathways. Periodontal bacteria and their products may irritate endothelial cells. Chronic inflammation may increase circulating mediators, including C-reactive protein and interleukin-6. Platelets may become more reactive in an inflammatory setting. These mechanisms give a biological explanation for why periodontitis has often been associated with coronary artery disease, myocardial infarction and ischaemic stroke ^{3,4}.

The American Heart Association has recently placed periodontal disease within the discussion on atherosclerotic cardiovascular disease, while also warning against simple causal claims ³. This is exactly the balance dental students need: the link is biologically plausible and clinically relevant but it should not be oversold.

But there is a trap: association is not proof of causation.

Patients with severe periodontitis often share other vascular risks. They may smoke. They may have diabetes. They may have reduced access to care. They may live with social or behavioural factors that affect both the mouth and the arteries. So the real question is not whether periodontitis alone "causes" cardiovascular disease. The better question is whether it can add inflammatory load to a patient who is already at risk.

Risk factor or risk modifier?

Calling periodontitis a cardiovascular risk factor sounds attractive. It is memorable and easy to communicate. But it may go too far.

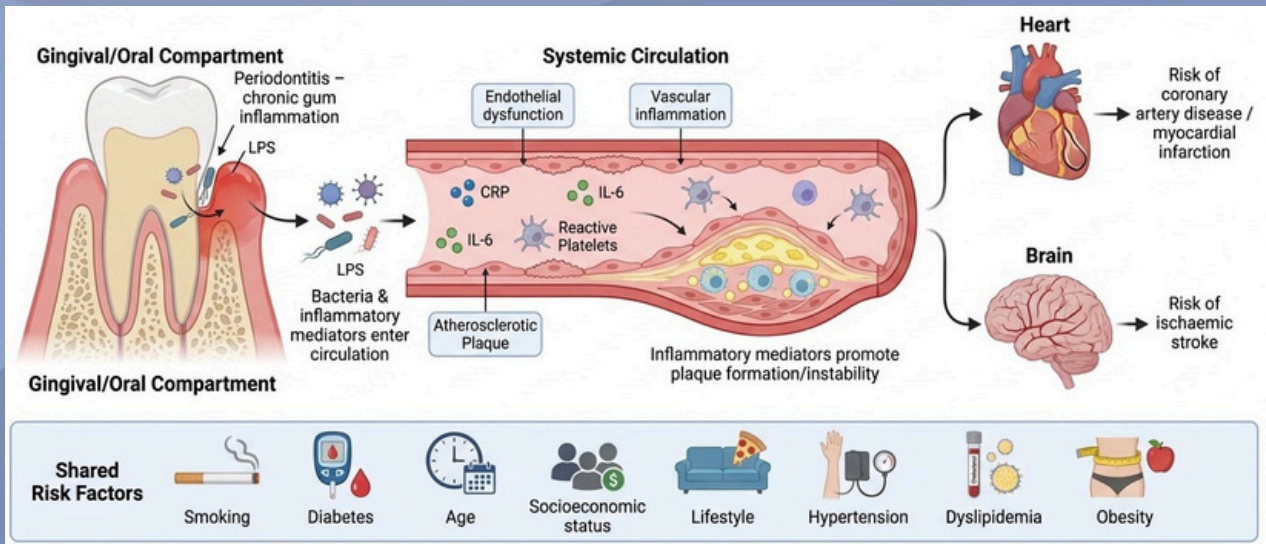
Smoking and hypertension have a much stronger causal status. Periodontitis is better described as a risk modifier. A modifier does not act alone. It changes the weight of a situation. It may make an already vulnerable patient slightly more vulnerable.

Think of it this way: periodontitis may not start the fire but it may add fuel.

This idea fits clinical reality. A young, healthy patient with mild gingival inflammation is not the same as an older patient with severe periodontitis, diabetes, hypertension and a history of myocardial infarction. The disease is the same in name but the biological context is completely different.

Clinical studies and meta-analyses have repeatedly reported associations between periodontitis and cardiovascular outcomes, including coronary artery disease, myocardial infarction and all-cause mortality ⁵. A specific association has also been reported between periodontitis and stroke risk, although the strength of evidence varies across study designs and stroke subtypes ⁶.

Perio-medicine asks us to read periodontal inflammation inside that wider context.



Visual representation of the mouth–heart connection. Generated with FigureLabs

Can scaling prevent strokes?

This is the question people want to ask, even if it makes researchers uncomfortable.

Periodontal therapy works for the periodontium. It reduces bleeding, pocket depth, bacterial burden and local inflammation. Studies have also reported improvements in systemic markers after periodontal treatment, including inflammatory biomarkers, endothelial function, blood pressure or metabolic control in selected groups of patients⁷.

But can scaling and root planing prevent myocardial infarction or stroke? At the moment, we cannot say that. Evidence showing a direct reduction in major cardiovascular events is still limited⁷. Periodontal treatment should not be presented as a replacement for statins, antihypertensive drugs, smoking cessation or cardiological follow-up.

Still, this does not make periodontal treatment less relevant. Reducing a chronic inflammatory source is a good thing, particularly in patients already carrying a high vascular burden.

The message should be strong, but clean: treat periodontitis because it damages the mouth, affects function and quality of life and may contribute to systemic inflammatory load. Do not promise that it will save the heart. Say that it may reduce one piece of the inflammatory puzzle.

What should students do?

For dental students, perio-medicine is not just another topic to memorise before an exam. It changes the way we look at routine clinical acts.

A periodontal chart is not just a table of numbers and bleeding on probing is not just a red dot. These details may show how oral inflammation, habits, vascular risk and patient behaviour meet in the same person.

This does not mean that dentists should act as cardiologists. It means they should stop acting as if the mouth were detached from the patient.

A student who understands perio-medicine will ask better questions. Does the patient smoke? Is diabetes controlled? Is there a history of myocardial infarction or stroke? Is the patient taking anticoagulants, antiplatelet drugs or antihypertensive medication? Is periodontal inflammation severe enough to require closer follow-up?

None of these questions belongs only to medicine or only to dentistry. They belong to patient care.

So, is dentistry medicine?

The mouth–artery connection is not a slogan. It is not a promise that brushing teeth prevents stroke, nor does it mean that periodontitis should be treated as a proven direct cause of cardio-cerebrovascular events. The evidence is more cautious than that.

But caution should not become silence. Periodontitis may still represent one modifiable source of chronic inflammation, especially in patients who already carry other vascular risks. For dental students, this changes the meaning of periodontal care: it is not only about treating gums but also about prevention, risk awareness and patient education.

More than a century after the first theories linking oral infection and systemic disease, modern perio-medicine no longer asks us to fear the mouth as a source of “focal sepsis” but to understand it as part of the patient’s inflammatory biology².

So, is dentistry medicine? The most reasonable answer is yes, provided we understand what that means. Dentistry does not replace cardiology, diabetology or general medicine. Yet it diagnoses disease, reduces inflammation, manages risk, restores function and works within the biology of the whole patient.

Periodontology makes this especially clear. Even when the evidence does not allow us to claim that treating periodontitis prevents heart diseases, it still reminds us that oral health belongs to general health.

Dentistry is medicine because the mouth is part of the body and periodontal care is one of the clearest daily reminders of that connection.

For References



MICROSURGICAL APPROACHES IN PEDIATRIC ORAL SURGERY

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Oral surgery constitutes one of the most extensively debated and advanced disciplines within dental medicine, arguably rivaled only by aesthetic and restorative dentistry and implantology—contingent upon the latter being regarded as a distinct surgical sub-specialty.

For the novice practitioner or student, oral surgery remains a quintessential 'unicorn,' offering a vast spectrum of technically intricate and visually compelling procedures. Nevertheless, pediatric oral surgery continues to be a relatively niche and under-discussed domain among surgical enthusiasts, despite affording technical opportunities as comprehensive as those found in conventional surgery.

The present article aims to promote and disseminate knowledge regarding pediatric surgical techniques, articulated in a manner accessible to those at the inception of their careers. Furthermore, it seeks to share personal clinical insights and protocols, evaluating their efficacy and delineating their inherent limitations.

What is pediatric oral surgery?

Both the AAOMS (American Association of Oral and Maxillofacial Surgeons) and AAPD (American Association of Pediatric Dentistry) consider pediatric oral surgery to be "a highly specialized intersection of dental medicine and maxillofacial surgery" [1,2] being a discipline dedicated to both diagnostics and surgical management of both hard and soft tissue in children and adolescents. Pediatric oral surgery encompasses a spectrum of procedures, ranging from rudimentary interventions such as surgical and non-surgical extractions of primary or permanent teeth, gummectomy of third molar tooth germs, frenectomies, gingivectomies, and simple drainage procedures, to highly complex and specialized interventions including facial reconstructions, cleft-palate reconstructions, oncological surgery, and orthognathic surgery. For evident reasons, this article will focus exclusively on detailing the procedures that are recurrently performed in dental practices [2].

Pediatric oral surgery – when and why to perform?

Surgical interventions in pediatric patients, regardless of their complexity, should never be considered routine and require careful evaluation from clinical, therapeutic, and psychosocial perspectives. Surgery should only be indicated when its anticipated benefits clearly outweigh its potential disadvantages, minimizing both physical and psychological burden for the child.

Before considering surgical management, clinicians should ask themselves: "Is a surgical treatment plan truly justified, or is there a less invasive and less traumatic alternative available?" If the answer is "yes, alternatives do exist," surgical treatment should be postponed and reserved for cases in which conservative measures have failed, making it the final therapeutic option [4,5,6,7].

In pediatric dentistry, "alternative therapy" may often consist of "doing nothing" beyond observation and clinical monitoring. The pediatric oral environment is dynamic and continuously evolving, and physiological processes such as tooth eruption, root resorption, and craniofacial growth may produce inflammatory manifestations that mimic pathology. Consequently, clinicians should exercise "self-control" and avoid premature intervention, as hastily made decisions may result in more complications than benefits.

The most common indications for pediatric oral surgery include primary or permanent tooth extractions, frenectomies, and procedures aimed at controlling acute odontogenic infections, such as drainage or emergency endodontic access interventions [1,2,3].

Anatomy and development of primary teeth

Primary dentition, commonly referred to as "baby teeth," represents the first set of teeth to populate the oral cavity and is essential for craniofacial development, mastication, phonation, and guidance of permanent tooth eruption. Their development begins during the sixth to seventh weeks of gestation with dental lamina formation, followed by the cap and bell stages. Primary tooth eruption is a multifactorial process that typically starts at approximately 6 months of age with the mandibular central incisors and is completed by 30 months. Compared with permanent teeth, primary teeth are smaller, lighter in color, less mineralized, and possess thinner enamel and dentin, larger pulp chambers, more prominent pulp horns, and divergent molar roots that accommodate developing permanent tooth germs. These anatomical characteristics favor the rapid progression of carious lesions and necessitate specific therapeutic approaches in pediatric dentistry. Eruption timing may be influenced by physiological and pathological factors, and disturbances in eruption chronology may result in conditions such as eruption cysts, impaction, ectopic eruption, or transposition, occasionally requiring orthodontic or surgical management [6,7]. The following sections focus on primary tooth extractions, the most commonly performed surgical procedures in pediatric dentistry. [4,5,7]

Primary Tooth Extractions – Practical Considerations, Clinical Protocols, and Instrumentation Concepts

In approximately 90% of cases, the extraction of a primary tooth is a relatively straightforward procedure that does not require specialized techniques. Most primary teeth extracted in clinical practice exhibit moderate to advanced mobility and, for various reasons, fail to exfoliate spontaneously, subsequently causing discomfort during mastication or contributing to the development of the so-called “shark teeth syndrome.”[5,6,7]. Sharks are well known for possessing multiple rows of teeth, and a similar phenomenon may occur in children, most commonly in the mandibular anterior region, where the permanent central incisors erupt lingually while the corresponding primary incisors remain in place. In many instances, this temporary double dentition does not compromise function but creates an aesthetic concern, which is generally perceived by the parents rather than by the child [4,5,6].

The remaining 10% of cases consist of more challenging extractions that require a tailored approach and increased attention. Procedural difficulty may arise from regional anatomical considerations, alterations in the physiological process of root resorption leading to ankylosed teeth with limited or absent mobility, or human factors, including insufficient clinical experience or poor patient cooperation.

In complex cases, adopting a microsurgical perspective may improve efficiency and reduce trauma for both the patient and the clinician. In pediatric oral surgery, this concept encompasses not only the use of highly specialized instruments instead of conventional extraction equipment, but also the implementation of specific instrumentation techniques. The following sections will describe several practical protocols and clinical approaches designed to achieve predictable and minimally traumatic outcomes [2,3,4,5,6,7].



Figure 1: Examples of instruments used in atraumatic surgery: Dental mirror; tweezers; periodontal probe; periodotomes (1.0 mm and 1.5 mm working tips); narrow-headed luxator; mosquito forceps (used as an alternative to conventional extraction forceps); local anesthesia (single-use plastic syringes, which appear less intimidating than traditional metal syringes); saline solution.

Please note that the following protocols represent a combination of personal clinical preferences, techniques that have demonstrated positive outcomes, and information derived from the scientific literature, as well as expert opinion within the field.

Conventionally, dental extraction is performed using elevators and forceps, which generally provide predictable outcomes when the clinical situation allows exclusive use of these instruments. However, in complex cases requiring higher precision and a minimally invasive approach, reliance solely on these tools is insufficient.

Periotomes are specialized periodontal instruments designed to sever periodontal ligament (PDL) fibers with minimal trauma, primarily by reducing alveolar bone expansion during extraction. Unlike conventional elevators, they enable effective PDL sectioning while limiting socket expansion, which is particularly important in pediatric patients due to the reduced resistance of alveolar bone and the risk of osseous injury. The luxation phase involves both PDL sectioning and alveolar expansion; periotomes selectively address ligament disruption while minimizing bone trauma.

When periotomes are insufficient, adjunctive microblades (detachable or fixed), including ophthalmic instruments and microblades such as No. 370, 390, and 390C, or conventional blades (15, 15C, 12, 12D) may be used, although with increased caution.



Fig. 2 : examples of microblades

Magnification systems, particularly surgical loupes (2.5×–3.5×), are recommended to improve visualization and reduce iatrogenic trauma, while higher magnifications (4.0×–5.0×) may be limited in pediatric patients due to reduced cooperation and increased movement. A key principle is minimizing both the number of movements and applied force during extraction, ensuring proper stabilization on adjacent hard tissues. When using forceps, a supination grip is preferred over pronation, as it provides superior control of forces transmitted to the tooth and surrounding bone.

Conclusions

Pediatric oral surgery requires a balanced, evidence-informed and minimally invasive approach, in which clinical judgment, anatomical understanding and instrument selection are essential for predictable outcomes. While most primary tooth extractions are straightforward, complex cases benefit from microsurgical principles, including the use of periotomes, microblades, magnification, and controlled force application. The emphasis on preserving alveolar structures, minimizing trauma, and respecting physiological processes highlights the importance of conservative decision-making and precise technique. Ultimately, successful pediatric surgical management relies on integrating classical instrumentation with modern minimally invasive strategies to optimize both functional and psychological outcomes for young patients.



GUIDED ENDODONTICS: A MODERN APPROACH TO MANAGING CHALLENGING CASES

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3rd and 4th grade



The concept of guided or assisted dentistry is not entirely novel, as its underlying principles have long been established in implantology, oral surgery, and restorative dentistry. Guided dentistry relies on the use of prefabricated devices tailored to the patient's individual anatomical characteristics, commonly referred to as guides. These guides are designed using datasets acquired through various diagnostic modalities, including conventional or digital impressions, facial scans, and cone-beam computed tomography (CBCT).

The present article aims to explore the concept of guided endodontic treatment through the use of guides customized to the patient's individual root morphology, while also proposing clinical protocols and identifying the situations in which such an approach may be most appropriate and beneficial.

What is guided dentistry and how are guides manufactured?

technologies with additive manufacturing methods, particularly three-dimensional (3D) printing, in order to improve the precision, predictability, and safety of clinical procedures. Although this approach was initially developed and widely adopted in implantology, its clinical applications are progressively expanding into other dental and maxillofacial fields, including endodontics, oral surgery, and orthognathic surgery, where anatomical complexity and the need for high procedural accuracy make guided interventions especially valuable [1,2].

This approach relies on patient-specific guides designed according to the individual anatomical characteristics of each patient, using datasets acquired from conventional or digital impressions, intraoral scans, facial scans, and cone-beam computed tomography (CBCT). This data is integrated into dedicated software platforms that allow virtual planning of the intended procedure and the fabrication of customized guides capable of accurately controlling the position, angulation, and depth of instrumentation [1]. In endodontics, guided techniques have demonstrated particular usefulness by facilitating the localization of calcified or obliterated canals, supporting the preparation of minimally invasive access cavities, and helping preserve healthy dental tissues. By improving access to complex anatomical structures while reducing the risk of iatrogenic complications such as perforations or excessive dentin removal, guided endodontics contributes to a more conservative and biologically oriented treatment approach [2,3].

Additive manufacturing, particularly 3D printing, remains the preferred method for guide fabrication and generally involves three main stages: data acquisition, digital design, and printing, all performed within a Computer-Aided Design (CAD) workflow [3]. Its principal advantages include the wide availability of printing systems, the diversity of printable materials, and the possibility of producing highly individualized devices in a relatively efficient manner. However, this technology is not without limitations, as microscopic manufacturing errors, interlayer discrepancies, or structural discontinuities may occasionally compromise the fit, stability, or mechanical integrity of the final guide [2,3]. Subtractive techniques, such as Computer-Aided Manufacturing (CAM) milling, represent an alternative fabrication method and may offer superior dimensional accuracy and finer reproduction of details, with lower tolerance for manufacturing defects. Nevertheless, they are less frequently used in routine clinical practice, mainly because of cost, equipment requirements, and limitations related to material selection. Other technologies, including sintering, may theoretically be employed for guide fabrication, but their use remains limited due to the complex and resource-intensive technical infrastructure they require [3].

The intricate geometries of the root – morphological and architectural variations of root canals:

The pulp system can be defined as a complex three-dimensional network comprising structures such as the pulp chamber, pulp horns, main root canals, accessory and lateral canals, isthmuses, apical deltas, secondary canals, and fine accessory canals. According to S. Cohen's "Pathway of the Pulp," the pulp system is described as "rarely a single round tube." [8]

The pulp chamber represents the coronal portion of the pulp space, containing the dental pulp and serving as the primary anatomical structure communicating with the root canals. Its configuration is determined by the rigid dentinal walls and is closely related to coronal morphology [8].

Main root canals are defined as the principal anatomical structures establishing communication between the pulp chamber and the apical foramen. Their morphology and anatomical variations are highly complex and have been extensively classified by Vertucci and Weine. [8]

Accessory, lateral, and fine canals represent branching extensions of the main canal system, forming a network that ensures communication between the primary pulp canal axis and adjacent structures such as dentin and periodontal ligament. [8]

The isthmus is a narrow communication zone between two main canals within the same root. It is particularly characteristic of molars, both mandibular and maxillary, with a reported prevalence of approximately 80–85%. It connects the MB and ML canals in mandibular first molars and the MBI and MB2 canals in maxillary first molars. [8]

The apical delta is a divergent canal network located in close proximity to the apical region, typically described as a “fan-shaped” configuration. Its presence plays a critical role in endodontic success, as inadequate cleaning or shaping of these anatomical structures may lead to persistent or recurrent inflammatory processes. [8]

Table 1 summarizes the most important statistical data regarding the anatomical characteristics of the pulp system [5,6,8]:

Tooth	Root anatomy	Typical canals	Vertucci common types	Extra canals (e.g., MB2)	Isthmus prevalence	Apical delta	Lateral canals	C-shaped canals	Clinical notes
Maxillary central incisor	Single root	1 (95–100%)	Type I	<5%	Low (~10–20%)	Moderate (~20–40%)	Common (~30–50%)	Absent	Simple anatomy; rare bifurcation
Maxillary lateral incisor	Single root	1 (90–95%)	Type I / II	<10%	Moderate (~20–30%)	Moderate (~20–40%)	Common (~30–50%)	Absent	Dens invaginatus possible
Maxillary canine	Single root	1 (95–99%)	Type I	<5%	Low (~10–20%)	Moderate (~20–40%)	Common (~30–50%)	Rare	Long root, curvature apical possible
Mandibular incisors	Single root	1 (60–70%), 2 (30–40%)	Type II/III common	2nd canal ~30–40%	Moderate (~30–50%)	Moderate (~30–50%)	Common (~30–50%)	Rare	High risk missed lingual canal
Maxillary first premolar	Often 2 roots	2 (55–65%)	Type IV common	Two canals common	High (~40–60%)	Moderate (~30–50%)	Common (~30–50%)	Rare	Highly variable anatomy
Maxillary second premolar	Single root	1 (75–85%)	Type I	10–25%	Moderate (~30–50%)	Moderate (~30–50%)	Common (~30–50%)	Rare	More stable than first premolar
Mandibular first premolar	Single root	1 (70–75%), 2 (25–30%)	Type I/IV	25–30%	Moderate (~30–50%)	Moderate (~30–50%)	Common (~30–50%)	Rare	Often lingual canal missed
Mandibular second premolar	Single root	1 (85–95%)	Type I	5–15%	Low (~20–30%)	Moderate (~30–50%)	Common (~30–50%)	Rare	Generally simple anatomy
Maxillary first molar	3 roots	MB2 present 60–90%	Type IV MB common	MB2 high prevalence	High (~60–80%)	High (~60–80%)	Common	Rare	Most important MB2 anatomy
Maxillary second molar	3 roots (variable)	MB2 40–70%	Variable	Moderate MB2	High (~60–80%)	High (~60–80%)	Common	Rare	More fusion variability
Mandibular first molar	2 roots	3 canals common	Type IV/complex	Middle canal variation	Very high (~80–95% mesial)	High (~60–80%)	Common	C-shaped rare	Most complex mandibular tooth
Mandibular second molar	2 roots (often fused)	1–3 canals variable	Variable	High variability	Moderate (~40–70%)	Moderate	Common	C-shaped 5–10%	High anatomical unpredictability

Endo-guides – a new perspective in endodontics:

One of the major challenges in achieving successful endodontic treatment without recurrence or the need for retreatment lies in the complete and accurate instrumentation of the complex root canal system. As illustrated in the previous table, teeth exhibit an approximately 40–50% probability of presenting apical deltas or accessory micro-canals, highlighting not only the complexity of root canal anatomy but also the difficulties associated with providing high-quality treatment [6,7].

This anatomical variability is further complicated by the presence of calcified canals and previous inadequate instrumentation, both of which may increase the likelihood of endodontic failure and recurrence of pulpal or periapical inflammation. In such situations, an important question arises: “Is there a method capable of reducing these negative factors?” The answer appears to be affirmative through the implementation of guided endodontic therapy using so-called endo-guides. [4,6]

An endodontic guide serves a purpose analogous to that of a surgical guide, assisting the clinician in performing procedures with greater precision and reducing operator-dependent errors. Similar to conventional surgical guides, endo-guides are fabricated following the acquisition of diagnostic datasets, including CBCT scans and digital impressions, which are subsequently used to design a patient-specific guide. [4,5,6,7]

These guides assist clinicians in planning and executing access cavity preparation, minimizing unnecessary removal of dental tissue while ensuring optimal alignment between the access cavity and root canal anatomy. According to the current literature, guided endodontics is particularly indicated for anterior teeth presenting pulp canal obliteration (PCO), where direct visualization and haptic navigation are often limited. [3,5,7]

Nevertheless, guided endodontics is not without limitations. The requirement for complex digital workflows, advanced manufacturing technologies, and specific clinical conditions—including atypical dental morphology, restricted mouth opening, or insufficient interocclusal space—may limit the routine implementation of endo-guides in daily clinical practice. [6,7]

Conclusions

Guided endodontics represents a promising evolution in contemporary endodontic practice, combining digital planning, advanced imaging, and computer-assisted manufacturing to improve procedural accuracy and predictability. By facilitating the management of anatomically complex cases, particularly those involving calcified or obliterated canals, endo-guides enable more conservative access preparation while reducing the risk of iatrogenic complications. Despite current limitations related to cost, technology requirements, and clinical applicability, guided endodontic techniques have the potential to become an increasingly valuable tool for enhancing treatment outcomes and preserving dental structures.



For References

RESTORING THE CEJ AFTER GUM RECESSION

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The cemento-enamel junction (CEJ) is the anatomical boundary between the tooth's crown and root. It is a landmark where the enamel of the crown meets the root's cementum.

Beyond its anatomical significance, the CEJ plays a crucial role in periodontal diagnosis, treatment planning, and evaluation of gingival recession, serving as a reference point for assessing root exposure and planning periodontal procedures.

As reported by a study done in 2015, the most common relationship between cementum and enamel at the CEJ was an edge-to-edge junction, with no overlap (36.7% of cases), followed by cementum overlapping the enamel (33.3%). Less commonly, a gap was observed between the cementum and enamel, exposing the underlying dentin (16.7%). The least common configuration was enamel overlapping the cementum (13.3%). (1) This study emphasized the importance of morphology and the need for proper implementation of dental procedures and oral hygiene.

One of the most common reasons why the cemento-enamel junction needs treatment in the first place is the harmful effects of recession. Which causes non-carious cervical lesions and destroys the CEJ.

Effects of recession and development of non-carious cervical lesions.

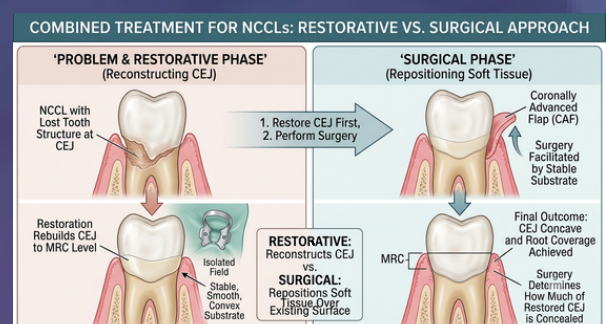
According to Grippo, Simring, and Schreiner (2004), non-carious cervical lesions are multifactorial defects that may result from stressful mechanical and chemical processes, including abrasion, erosion, and occlusal stress. (2) It is well known that gingival tissue is sensitive to inadequate mechanical forces. Using an incorrect brush or brushing technique, strong orthodontic forces, or incorrectly adjusted prosthodontic appliances (crowns and veneers) on a thin gingival phenotype can eventually cause tissue recession.

Although gingival recession does not directly alter the structure of the Cemento-enamel junction (CEJ), it exposes the cervical region of the tooth, making the CEJ more prone to external traumatic factors and predisposing it to cervical lesions. On the contrary, as stated in a 2011 study done by Prof. Giovanni Zucchelli and Prof. Martina Stefanini, the etiology of NCCLs is multifactorial; it also includes factors such as corrosion and abfraction (3)

With this being said, when it comes to choosing the treatment plan, clinicians mainly pay attention to the topographic standpoint of the patient. There are two treatment modalities for non-carious cervical lesions: restorative therapy and mucogingival surgery.

Treatment Modalities: When to Use Surgical vs. Restorative Treatment

An important distinction must be made between covering the CEJ and restoring it. A coronally advanced flap does not rebuild lost tooth structure; it only repositions soft tissue over whatever surface already exists. When an NCCL has destroyed part of the CEJ, restorative treatment must first rebuild the missing structure up to what is known as the maximum root coverage (MRC) level, before the surgical flap is advanced over the restored surface (4). Completing the restorative therapy before mucogingival surgery offers clinical advantages for both procedures: the restoration can be finished in an isolated field without interference from soft tissue, while the coverage surgery is facilitated by a stable, smooth, and convex substrate created by the restoration (4). In short, restorative treatment reconstructs the CEJ, while surgery determines how much of it can ultimately be concealed by tissue.



Classification Systems Guiding CEJ Restoration

To determine the appropriate treatment approach, clinicians rely on classification systems that assess the severity of gingival recession. Cairo's classification (2011) categorizes recession into three types RT1, RT2, and RT3 based on the clinical attachment level at the interproximal site relative to the buccal site (6). This system improved on earlier classifications by using a more reproducible anatomical reference point, allowing for more consistent prediction of root coverage outcomes between examiners. RT1 defects, which present without interproximal attachment loss, generally have the most favorable prognosis for complete root coverage, whereas RT2 and RT3 defects, involving progressively greater interproximal attachment loss, present a more limited and less predictable outcome for CEJ restoration.

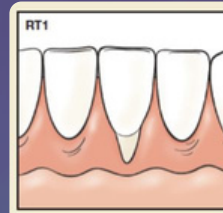
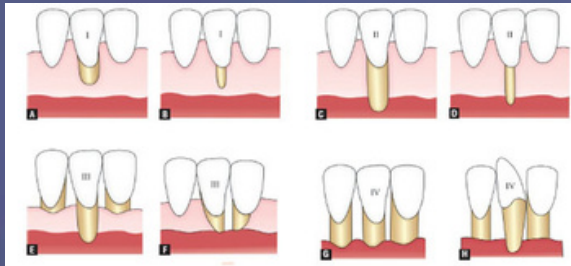


Figure 8-9. Recession Type 1 (RT1). Recession of the gingival margin on the facial aspect of the left central incisor.

- The level of clinical attachment loss on the facial aspect is 3 mm
- There is no detectable loss of interproximal attachment

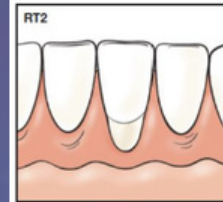


Figure 8-10. Recession Type 2 (RT2). Recession of the gingival margin on the facial aspect of the left central incisor.

- The level of clinical attachment loss on the facial aspect is 4 mm
- Interproximal attachment loss of 3 mm

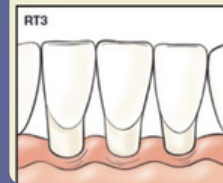


Figure 8-11. Recession Type 3 (RT3). Recession of the gingival margin on the facial aspect of the left central incisor.

- The level of clinical attachment loss on the facial aspect is 6 mm
- Interproximal attachment loss of 8 mm

Gingival phenotype and treatment prognosis

Unfortunately, in dentistry and medicine, there are genetic limitations that vary from person to person. In periodontology, treatment outcomes are also influenced by gingival phenotype, broadly categorized as thick or thin, based on tissue volume and vascularity. A systematic review found that complete root coverage was achieved in a range of 70–86.12% in patients with a thin biotype, compared to 77.8–96% in patients with a thick biotype, suggesting a trend toward more favorable outcomes with thicker tissue, though the difference was not statistically significant when biotype was analyzed as an independent variable (7).

This is further supported by long-term data: root coverage achieved with CAF alone tends to relapse over time, whereas outcomes remain significantly more stable when CAF is combined with a connective tissue graft, a technique often used specifically to compensate for thin, less resilient gingival tissue (8). Nevertheless, the primary focus of treatment must always be to achieve maximum root coverage, with phenotype considered a prognostic factor influencing long-term stability rather than an absolute limitation on treatment choice.



MANIFESTATIONS OF IMMUNODEFICIENCY IN THE ORAL CAVITY



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Immunodeficiency describes the loss or dysfunction in one or more components of the immune system. This results in an impaired ability of the body to mount a response against infectious agents. These conditions are classified into primary immunodeficiencies, also known as inborn errors of immunity (IEIs), and secondary immunodeficiencies. IEIs are caused by hereditary pathogenic variants that disrupt immune function, whereas secondary immunodeficiencies develop later due to extrinsic factors such as immunosuppressive treatment, persistent infections, or poor nutritional status [1-3].

Oral manifestations of systemic diseases can serve as early diagnostic markers of underlying conditions, as the oral cavity frequently reflects internal pathological processes.

When immunity weakens, infections speak first

One of the most common consequences of impaired immunity is the occurrence of opportunistic infections. Oral candidiasis (OC) remains one of the most frequently encountered oral manifestations. It is caused predominantly by *Candida albicans*. It is mostly associated with local or systemic immunosuppression, including individuals with HIV infection, those receiving prolonged antibiotic or corticosteroid therapy, and both pediatric and geriatric populations.

Rather than presenting in a single form, oral candidiasis may appear as different clinical pictures. Although pseudomembranous candidiasis is the most frequent disease manifestation, it can also present with persistent white lesions, such as chronic hyperplastic candidiasis. Erythematous lesions include angular cheilitis and median rhomboid glossitis. These diverse clinical presentations highlight the importance of careful oral examination, especially when lesions recur or fail to respond to routine treatment. Uncomplicated cases generally respond to topical antifungal agents such as nystatin, clotrimazole, or miconazole. Systemic therapy is indicated for refractory infection or when a patient is at high risk of dissemination [4,5].



Acute pseudomembranous oral candidiasis in a patient with stage IV lung cancer undergoing active chemotherapy



Herpes palati duri

Viral reactivation represents another important consequence of impaired immune surveillance. Herpes simplex virus type 1 (HSV-1), a double-stranded DNA virus within the Alphaherpesvirinae subfamily, establishes lifelong latency within the trigeminal ganglion after primary infection [7]. The immune system keeps the virus under control under normal circumstances. However, stress, illness, trauma, ultraviolet radiation, or immune suppression may trigger reactivation [7, 8].

Typically, recurrent HSV-1 infection presents as herpes labialis or localized oral lesions, often with reported burning or tingling sensations. Primary infections commonly present as herpetic gingivostomatitis in children. It is characterized by fever, generalized weakness, lymphadenopathy and painful oral ulcerations due to vesicle rupture. Although treatment is primarily supportive, antiviral therapy with acyclovir may reduce the duration and severity of symptoms [6, 8-10].

Not every oral lesion is an infection

Opportunistic infections are common manifestations of immunodeficiency, but immune dysregulation itself may also contribute to inflammatory oral lesions. Aphthous ulcers are one example. They may occur either as an isolated condition or with systemic disorders [11,12].

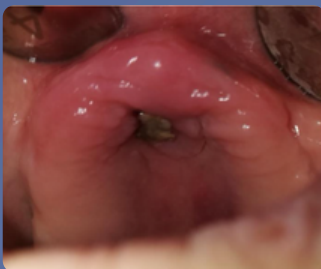
Although the exact pathogenesis of recurrent aphthous stomatitis (RAS) remains incompletely understood, current explanations include T-cell-mediated immune responses, increased TNF- α production, genetic predisposition, and microbial influences [14, 15]. Clinically, lesions appear as well-defined, superficial ulcers that usually affect non-keratinized mucosal surfaces. They are classified as minor, major, or herpetiform ulcers, with the minor form being the most common [14,16].

For clinicians, recurrent oral ulceration should prompt consideration of a broader differential diagnosis. Conditions such as Behçet disease, PFAPA syndrome, and HIV infection may present with similar findings and should be excluded when ulcers are severe, persistent, or unusually frequent [14,17]. Treatment aims to reduce pain, facilitate healing, and prevent recurrence using topical corticosteroids, analgesics and antiseptic agents. Corticosteroids, colchicine, thalidomide or other immunomodulatory agents may be considered if the cases are severe or persistent [18–20].



Aphtha major (before and after)

Lesions that raise suspicion of significant immune suppression



Neutropenic palatal ulceration in a patient with acute leukemia

Some oral lesions are particularly valuable because they may act as clinical warning signs of profound immune dysfunction. Oral hairy leukoplakia (OHL) is a benign mucosal lesion associated with Epstein-Barr virus (EBV) which occurs predominantly in immunocompromised individuals [21,22].

EBV is a double-stranded herpesvirus that remains latent within B lymphocytes and oral epithelial cells. When immune surveillance is reduced, viral replication may lead to the development of characteristic white lesions, most commonly located on the lateral borders of the tongue [22,23]. It was initially described in patients with HIV/AIDS. OHL has since been reported in a variety of immunocompromised states, including organ transplantation and prolonged corticosteroid therapy [24, 25]. Diagnosis can be confirmed through detection of EBV by in situ hybridization. Characteristic histological findings include epithelial hyperplasia, parakeratosis, and nuclear changes caused by viral replication. Treatment is generally unnecessary in asymptomatic cases. However, antiviral therapy may be considered for symptomatic lesions or aesthetic concerns. Recurrence can occur after discontinuation [25, 27].

When your mouth sends an alarm

Some diseases can present with unusual or similar symptoms, which is why we sometimes mistake them for another condition and do not treat them appropriately. In the absence of adequate treatment of the primary disease, oral manifestations may persist and have a tendency to recur.

- Recurrent oral ulcerations may be associated with celiac disease.
- Oral candidiasis can be an early sign of diabetes mellitus
- Necrotizing ulcerative gingivitis may occur in patients with HIV/AIDS.
- Oral hairy leukoplakia remains strongly associated with HIV-related immunosuppression.

Recognizing these patterns can contribute to earlier diagnosis, timely referral, and improved patient outcomes.

Say “AAA” to AI

Based on the work of Liang and colleagues, OralCam, a mobile application that enables users to examine their oral cavity using smartphone photographs independently, was presented [29]. Although it showed very high sensitivity, the technology is expected to continue developing in this direction, making home detection increasingly possible.

A mouthful of wisdom

Not every oral lesion is a dental problem. When infections keep coming back or lesions fail to heal, the immune system may point to a broader story. Early identification can help uncover hidden systemic diseases and lead to earlier diagnosis and better outcomes. After all, the mouth is often the body's most accessible window into health.

Guidelines for oral health examination

The criteria for oral health assessment were adapted from the “Basic Oral Health Examination” form proposed by the FDI World Dental Federation (2025) [28]:

1. Lips – dryness and color changes
2. Breath – unusual odors
3. Tongue – unusual texture, coating, swelling and discoloration
4. Gums – swelling, bleeding and redness
5. Cheeks – ulcerative changes, color changes and lumps
6. Hard and soft palate – ulcerative changes, color changes and lumps
7. Teeth – decay, missing, fractured, malpositioned teeth, plaque and tartar build-up

The author would like to express sincere gratitude to Ana Glavina, DMD, PhD, from the University Hospital of Split for providing the photographs used in this article.



RETENTION MECHANISMS IN PINLEDGE CROWNS

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Teeth do not have the regenerative ability found in most other tissues. Therefore, once enamel or dentin is lost as a result of caries, trauma, or wear, restorative materials must be used to reestablish form and function. Teeth require preparation to receive restorations, and these preparations must be guided by essential principles from which basic criteria can be developed to help in predicting the success of prosthodontic treatment [1,2].

A pinledge crown is a conservative partial veneer restoration that derives its retention and stability from pins placed within precisely prepared ledges and pinholes on the tooth structure. A pinledge may be used as a single restoration, generally to reestablish anterior guidance, in which case only the lingual surface is prepared. Pinledges have a long history of successful clinical application as fixed partial denture (FDP) retainers or to splint periodontally compromised teeth [3].

WHAT ARE THE CLINICAL INDICATIONS?

The pinledge is indicated for undamaged anterior teeth in dentitions with little or no caries. The presence of a small proximal carious lesion does not preclude its use. If aesthetic appearance is highly important, the advantage of this restoration is that the labial tooth surface remains intact, although this is sometimes offset by the display of a very slight amount of metal along the incisal edge. Pinledges can be prepared on bulbous teeth that are unsuitable for three-quarter crowns; on such teeth, a significant amount of unsupported enamel interproximally would result. To establish or reestablish the optimal anterior guidance, a pinledge restoration can be efficiently used to modify the lingual concavity of a maxillary anterior tooth [4].

RETENTION MECHANISMS IN FDP

The pinledge has been cited in the literature for many years as being both an aesthetic and conservative retainer for fixed partial dentures. There is no single factor on which retention is completely dependent. In fact, retention comprises of a list of factors, all of which have to be taken into consideration during all the stages starting from tooth preparation to the final cementation. Even if a single factor is ignored, it can alter the retention of the casting, which further has a direct impact on the longevity of the restoration.

Retention and resistance are provided primarily by pins that extend 2 mm into dentin. The major aspect of the pinledge is that it relies heavily upon substitution of pinholes for axial walls that are left unveneered. Also, serrated pins have been found to produce better retention than smooth pins.

Retention can be increased by using larger diameter or longer pins increasing the number of pins. As few as two and as many as four have been suggested as the optimum number of pins, with three pins recommended most often. [5].

CLINICAL CONSIDERATIONS

In some cases, one or more of the proximal surfaces are included in the preparation design to provide adequate space for the required connectors. Diagnostic preparation on an accurate cast is useful during the planning phase. Preparation of a number of parallel pinholes with a common path of placement can be very complex. With adequate practice, however, most clinicians can achieve this free-hand, especially with the use of a tapered tungsten carbide bur. Also, paralleling devices are available for practitioners who find the preparation of multiple pinholes demanding. Additionally, plaque control after treatment is easier because of short margin length and largely supragingival margin location.

An ideal marginal finish line is critical for retention. An improper finish line in some areas of the preparation can lead to microleakage thus leading to the loss of retention. Sharp points and undercuts also represent a significant aspect of preparing pinledge crowns. All the sharp points and undercuts should be removed or rounded off to prevent the accumulation of stresses and thus prevent the ultimate failure of the restoration [6].

In conclusion, the pinledge crown preparation is an exacting technique that requires great attention to detail and careful treatment planning. In comparison with other retainers, the pinledge preparation is among the most conservative of tooth structure. The preparation steps themselves are not difficult, but advanced planning and a thorough understanding of the various steps are fundamental [4]. Moreover, if treatment is carefully planned, the aesthetics of the pinledge can be successful. Despite receiving less attention in current graduate prosthodontic programs, the pinledge technique continues to represent a conservative and aesthetically acceptable treatment modality. The clinical applications highlight its potential as a reliable option for appropriately selected patients, underscoring its ongoing significance within contemporary fixed prosthodontics.

WHAT ARE THE CLINICAL CONTRAINDICATIONS?

The contraindications for a pinledge crown include when caries or a restoration extends past the normal outline of the preparation, or when either of these conditions would involve an area in which a retentive pinhole must be placed. The pinledge retainer is not indicated when the crown of the tooth exhibits an abnormal form or other developmental defects. If the crown of the tooth is so thin labiolingually that the preparation would allow the retainer to show through the labial enamel, or the labial enamel would be left unsupported by dentin, a pinledge retainer preparation is not recommended. Contraindications also include conditions that subject the retainers to severe torsional forces. Specifically, abnormal alignment, the creation of a lever arm by the prosthesis, or an excessive span length can generate these destructive forces [4].

Patients with inadequate oral hygiene or extensive caries are not suitable candidates for any type of cast restoration. Young patients with enlarged pulp chambers generally are better served by a resin-retained FDP. It is often unfeasible to place pinholes of proper size and length in teeth that are thin labiolingually. Pinledges are contraindicated on nonvital teeth and when the alignment of the abutment conflicts with the proposed path of placement of a planned FDP. Because reduced surface area is involved in the preparation, pinledges are not as retentive as their less conservative counterparts. Therefore, their application should be avoided when optimum retention is needed [5].

For References



FOREIGN BODY REACTION IN ENDODONTICS

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A foreign body reaction is an inflammatory reaction following implantation of a medical device, prosthesis, or biomaterial. This reaction is composed of macrophages and foreign body giant cells in the end-stage inflammatory response (1).

Endodontics is a specialised field of dentistry that deals with the treatment of tooth pulp and the tissues surrounding the apex of a tooth (2). Treatment involves removal of necrotic pulp and filling the pulp chamber with sealers and obturation material. In relation to endodontics, a foreign body reaction relates to an inflammatory reaction to extruded material during the obturation and cleaning process, which may result in endodontic failure (3). This reaction tends to be non-microbial in aetiology as it is a soft tissue reaction to extruded material rather than a reaction to a specific microbial. The most commonly found foreign bodies include displaced fractured roots of teeth or whole displaced teeth, dental burs, implants, and root filling material.

Aetiology of the formation of foreign body cells

Even though filling and sealer materials are biocompatible and bioinert, overfilling the root canal can result in irritation of periapical tissues and persistent inflammation, resulting in the formation of foreign body giant cells. Figure 1 shows the biochemical reaction for a foreign body reaction that can lead to periapical pathology. Resolution of the acute and chronic inflammatory responses normally occurs and resolves within 2 weeks, the persistence of the inflammatory response beyond three weeks usually indicates infection (2).

Following resolution of the inflammatory response persistent granulation tissue associated with the foreign body may remain, presenting radiographically as an apical radiolucency that is typically asymptomatic (4).

The prognosis of filling material in the periapical tissues depends on solubility in the tissue fluids and susceptibility to phagocytosis as well as the physical and chemical properties of the filling material (5).

Dental sealant materials have potential cytotoxic properties that can cause damage to biological structures. A systematic review by Piscopo et al. 2026 showed that all categories of sealers showed some degree of cytotoxicity, especially when tested in freshly mixed conditions, higher concentrations, or prolonged exposure, with zinc oxide-eugenol and glass ionomer sealers having higher cytotoxic potential (6).

The chance for a foreign body reaction to extruded material is highly influenced by canal preparation, over-instrumentation, and operator technique (7). Conservation of the apical constriction increases the prognosis of an endodontically treated tooth, decreasing the chance of a foreign body reaction occurring (8).

Symptoms

A foreign body inflammatory response is often associated with the formation of an asymptomatic response; therefore, findings may be accidental upon accidental radiographic findings. Radiographic appearances include a periapical radiolucent lesion which can be seen radiographically around the tooth apex, or around the extruded material (Figure 2). Extruded material will appear as a radiopaque mass located away from the root canal, not located inside the canal itself (Figure 3). When a patient presents with symptoms, it is often similar to the symptoms of apical periodontitis, where the tooth is tender to percussion or sensitive to biting forces, persistent pain, and possible swelling.

However, differential diagnosis for foreign body reactions may include apical periodontitis, radicular cysts, or granulomas, therefore, special investigations to conclude a definitive diagnosis may include, pulp sensibility testing, CBCT (appropriate radiographic imaging) and thorough clinical history and examination. Figures 3 and 4 show extruded material at the apex of UR6 and UR4 due to overfilling the root canal during obturation. Symptoms this patient presented with included persistent headaches, pain on the buccal aspect of the associated teeth that has been persistent for 6 months post endodontic treatment (10).

Treatment and management

Complete removal of the stimulus is essential for resolution of inflammation. For symptomatic reactions, management of foreign body reactions in endodontics involves removal of the stimulus and replacing it with a new filler and sealer. However asymptomatic lesions may go unnoticed and only be found upon radiographic investigations for other pathology, therefore no treatment may be performed, or the lesion may be monitored to assess if there are any changes in size or shape before commencing further interventions. Non-surgical treatment options involve leaving the tooth if asymptomatic, or endodontic retreatment which does not require surgical intervention. Surgical treatment options include gum flap and removal of the foreign object surgically through the alveolar bone. Both these options should resolve the inflammatory process and symptoms, with a resolution of periapical radiolucency. Preventing foreign body reaction in endodontics is important for the prognosis and success of endodontically treated teeth, therefore, endodontic procedures should be conducted properly. This includes proper isolation techniques, accurate measurements, appropriate radiographs and avoiding over-instrumentation and over-filling.

Conclusions

In conclusion, a foreign body reaction in endodontics involves an acute inflammatory response followed by granulation tissue formation, leading to a periapical pathology. Although endodontic failure related to overfilling of the material has been described in the literature, only a few studies have used microscopic techniques to identify the type of filling material associated with the lesion and tissue changes. Therefore, preventing a foreign body reaction from occurring through good practitioner techniques is important for improving prognosis and outcomes for endodontically treated teeth.

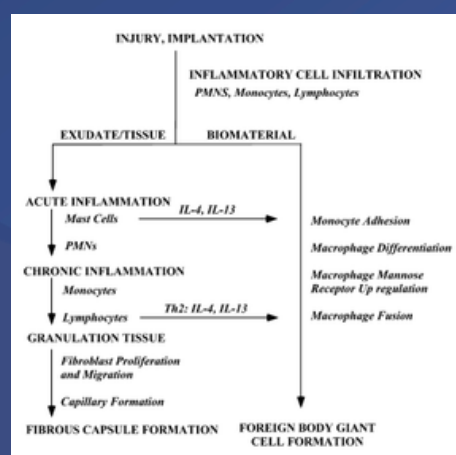


Figure 1: sequence of events involved in the inflammatory and wound healing response leading to foreign body giant cell formation

FACIAL ESTHETICS CRITERIA IN ORTHODONTICS

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Facial esthetics in orthodontics has been explained as related to beauty; however, beauty is a very subjective term. Rather than beauty, a more effective clinical goal is facial harmony, which relates to the balance that exists between the teeth, jaws, lips, nose, chin, and soft tissues that make up the face and which can be measured objectively. It is important to understand the difference between facial esthetics and facial harmony when considering orthodontic diagnosis, as treatment must be based on the face, not just the teeth position. It shows that in harmonic faces there is a balanced relationship between the hard skeletal tissue, which supports the soft facial tissue. This means that a dentist who disregards the skeletal and dentoalveolar issues will not appreciate the whole picture of the malocclusion.

Hard Tissues vs Soft Tissues

In the process of orthodontic diagnosis, the distinction between local dento-alveolar deformities and general skeletal malformations becomes increasingly important. It is obvious that dento-alveolar deformities, such as tooth inclination or tooth crowding, could be significant from a functional and aesthetic point of view; but at the same time, they do not necessarily cause changes in general facial proportions. In turn, skeletal discrepancies like maxillary hypoplasia and mandibular retrusion have a general impact on the facial profile because they change the underlying bony structure, on which the soft tissues of the lips and mid-face are based.

This is why in the assessment of the face it is impossible to focus only on the study of dental casts. The soft tissues can mask, highlight, or change the underlying skeletal pattern.

Relevance of Soft Tissue Analysis

The relevance of the soft tissue in orthodontics and orthognathics is particularly evident when developing a treatment plan. The soft tissue cephalometric analysis developed by Arnett was created precisely to overcome the problems that come from using exclusively hard tissue, and it is based on the idea of facial measurement as the foundation of both diagnosis and planning. The clinical importance of such a method is in its ability to relate measurements to the actual result of facial appearance.

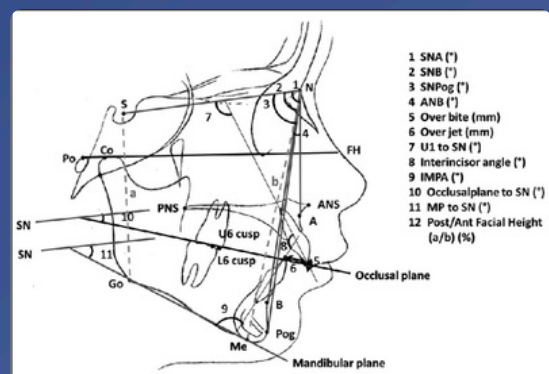
The true vertical line and natural head position are the key elements of such analysis. Instead of assessing the face based on an arbitrarily chosen internal reference, the practitioner assesses the face in a position closer to natural. This way, the assessment is more clinically relevant, especially when it comes to profile and the relationship between lips, chin and base of the nose.

What We Measure

A well-defined facial analysis must account for both the horizontal and vertical proportions. Relevant landmark points for horizontal assessment include the upper and lower lips, A and B soft tissue points, soft tissue pogonion, soft menton, and midface. These landmarks are related to the true vertical plane, which is used as an extra-cranial reference.

The vertical analysis is equally important. The clinician assesses the exposure of upper incisors, lip length, interlabial gap, lower facial height, maxillary height, mandibular height, and overbite because each one of these has an impact on the facial proportion. Changes in any one of these measurements directly affect the appearance of the lower face, particularly at rest and when speaking.

Gender differences should also be taken into consideration. The thickness and proportion of the soft tissues vary in men and women, meaning that the identical value may carry a different significance in each. Ethnic differences have been demonstrated in population studies, confirming the necessity of individualized interpretation rather than standard esthetic values.



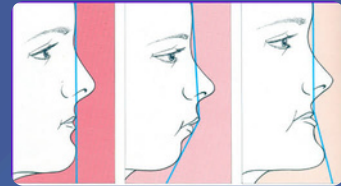
Three-Dimensional Balance

Facial balance needs to be assessed from three dimensions. The sagittal dimension involves front-to-back relations, the vertical dimension deals with the height of the face, and the transverse dimension deals with the width of the face. As the face is three-dimensional, all three dimensions play a role in the final presentation, and neglecting any one of these three dimensions will make the diagnosis incomplete.

It is especially important when orthodontic treatment is planned for growing children. The growth process in the face is not even, and due to the cephalocaudal gradient, various structures grow at different stages. The growth pattern, which is genetically determined, also affects facial esthetics and determines the direction of development of the dentofacial complex. It can be stated that the same malocclusion will lead to different esthetic outcomes depending on the patient's age and growth pattern.

Head Position and Profile

Head position is another important component in facial analysis. A natural head position is more realistic compared to the clinical head position since it approximates how the person is normally seen in their daily life. It is especially significant in profile analysis wherein slight alterations in head tilt can create variations in the facial features, especially in the relationships of the nose, lips, and chin.



One means of evaluating head position is by making use of the true vertical line. Once the vertical reference line is determined, practitioners can assess whether the face is balanced between the anterior and posterior portions, and whether there is harmony in the midface, lips, and lower face. This is one reason why modern facial analysis has progressed from simple skeletal cephalometry to soft tissue analysis.

Clinical Meaning

For students and young clinicians, the main lesson is that facial esthetics is not about applying a rigid ideal. It is about recognizing harmony, understanding the tissue relationships that create the facial profile, and appreciating how treatment may improve or disturb those relationships. In this sense, orthodontic diagnosis is not merely technical; it is also visual, developmental, and patient-centered.

The most successful treatment plans are those that preserve individuality while correcting dysfunction. A face does not need to look artificially perfect to be aesthetically successful. It needs to look coherent, proportionate, and supported by a well-planned balance of dental, skeletal, and soft tissue factors. That is why facial analysis should always precede intervention, and why it should remain a central part of orthodontic training and clinical decision-making.

Conclusion

Harmony should be the focus of facial esthetics in orthodontics. With careful analysis of all the parameters of the face, variations in soft tissue, and age and gender considerations, the treatment will become accurate and patient-sensitive. And that is the ultimate purpose of orthodontic treatment – not to make faces look alike, but to allow them to develop in a harmonious manner.



CORONAL CRACKS IN VITAL TEETH

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Cracked teeth are the third most common reason for tooth extraction after caries and periodontal disease. Cracks in teeth are an important problem because they can cause pain and tissue defects, and their early identification and treatment pose clinical challenges. Cracks in teeth can be defined as plastic deformations that manifest as a fracture in the tooth line structure, but without actual separation or loss of dental hard tissues. Cracks can develop in various depths and directions. It is important to note that cracks are only a clinical finding and are not considered a diagnosis. Such damage can be caused by bruxism, trauma or excessive tooth wear.

Symptoms of cracked tooth

For patients with cracked tooth, if the condition is not controlled in time, the gradual deepening of crack may cause pulpitis and periodontal lesions (1).

The most characteristic symptom is a sharp, transient pain experienced during biting or upon release of biting pressure. Patients frequently report sensitivity to thermal stimuli, particularly cold foods and beverages, and the discomfort may be intermittent and difficult to reproduce during clinical examination. In some cases, the pain can be localized to a specific tooth, whereas in others patients may have difficulty identifying the source of discomfort. Sensitivity to sweet foods and occasional lingering pain after chewing have also been reported. As the crack progresses toward the pulp, symptoms may resemble irreversible pulpitis, including spontaneous pain, prolonged thermal sensitivity, and a persistent dull ache (8).

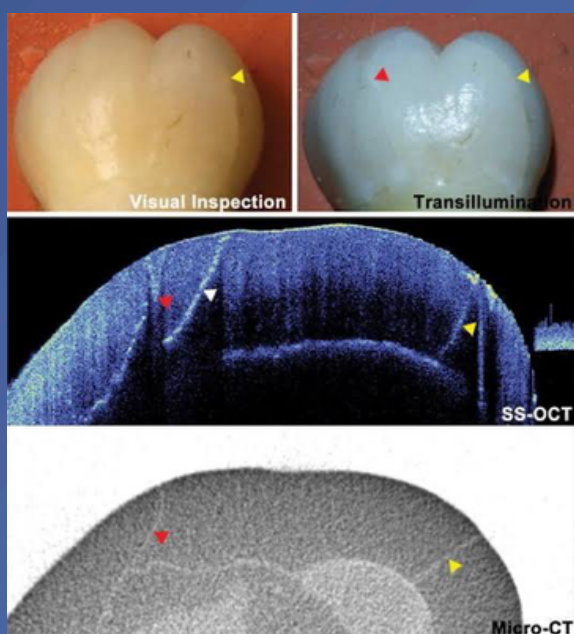


Image 1: Optical coherence tomography identification of cracks of the tooth (9).

DIAGNOSTIC OPTIONS

It is often difficult to accurately and quantitatively assess the scope of cracks at present. So it is necessary to find a real method of early quantitative and non-destructive crack detection.

1. Vitality test

Sensitivity to thermal stimuli often suggests the presence of proximal cracks or cracks extending close to the pulp. Marked sensitivity to cold, together with a positive bite test, is considered a valuable clinical indicator for the diagnosis of a cracked tooth (4).

2. Diagnostic dyes may be applied to enhance the visualization of tooth cracks. Commonly used staining agents include methylene blue, gentian violet, and iodine-based solutions. Although dye application can improve the identification and localization of cracks, this method has several limitations. It may adversely affect the aesthetics of the tooth and potentially interfere with subsequent restorative procedures. Furthermore, while dyes can help determine the presence and location of a crack, they provide limited information regarding its depth, extent, or progression (4).

3. Transillumination is a diagnostic technique that uses fiber-optic light to illuminate the tooth structure. When the light beam encounters a crack, it is scattered or interrupted, making the defect more visible and facilitating its detection. Yellow light has been reported to be particularly effective for identifying tooth cracks. In addition, specialized crack-detection devices and lamps have been developed to enhance the accuracy and reliability of this diagnostic method (4).

4. Microscope

It is difficult to detect on naked-eye visual inspection when the crack width is less than 18 μm , and dental surgery microscope can be used to assist in locating cracks (4,6)

5. Periodontal probing

The presence of an isolated, narrow, and deep periodontal pocket adjacent to a suspected tooth may be indicative of a crack extending below the gingival margin. Research has demonstrated that teeth affected by cracks and exhibiting periodontal probing depths greater than 4 mm are associated with a higher risk of pulpal necrosis compared with teeth showing shallower probing depths (4).

6. Optical coherence tomography

Optical coherence tomography (OCT) is a non-invasive imaging technique that generates high-resolution cross-sectional images of internal biological structures. Studies have demonstrated that swept-source OCT (SS-OCT) exhibits high sensitivity and specificity for the detection of dental caries and tooth cracks, particularly when using near-infrared wavelengths around 1310 nm (4, 5, 9).

7. Magnetic Resonance therapy (MRI) and CBCT

Schuurmans (7) compared the ability of magnetic resonance imaging (MRI) and cone-beam computed tomography (CBCT) to detect root cracks in extracted root-filled teeth. The study concluded that MRI was more effective than CBCT in identifying incomplete and hidden root cracks. Furthermore, the presence of root canal fillings or coronal restorations had minimal impact on the quality and diagnostic accuracy of MRI images. MRI has the potential to become a valuable diagnostic tool for the detection of cracked teeth. However, further improvements in its sensitivity are required to enhance diagnostic accuracy. In addition, the relatively high cost of MRI examinations must be considered before its widespread adoption in routine dental practice (4).

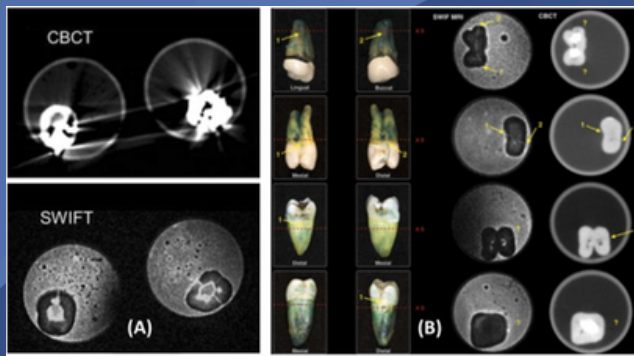


Image 2: MRI identification of hidden cracks (4).

Treatment options

Although patients might seek dental intervention for their cracked teeth, it is worth noting that monitoring without restorative treatments is a viable option under certain circumstances. Ferracane et al. (2) reported that most cracked teeth were monitored without restorative treatments at baseline. Nonetheless, restoration is often recommended when cracked teeth show caries and biting pain (1).

Direct restoration is a simple and effective option for cracked teeth with caries or defects. Furthermore, direct restorations can be completed at one visit, and the treatment outcome is favorable (1).

Regarding indirect restorations with cuspal coverage, a full crown is most frequently used to restore cracked teeth in dental practice. Wu et al. [21] reported that 18.7 % of 155 cracked teeth treated with provisional orthodontic bands followed by full-crown restorations developed irreversible pulpitis or pulpal necrosis after three years (1, 3).

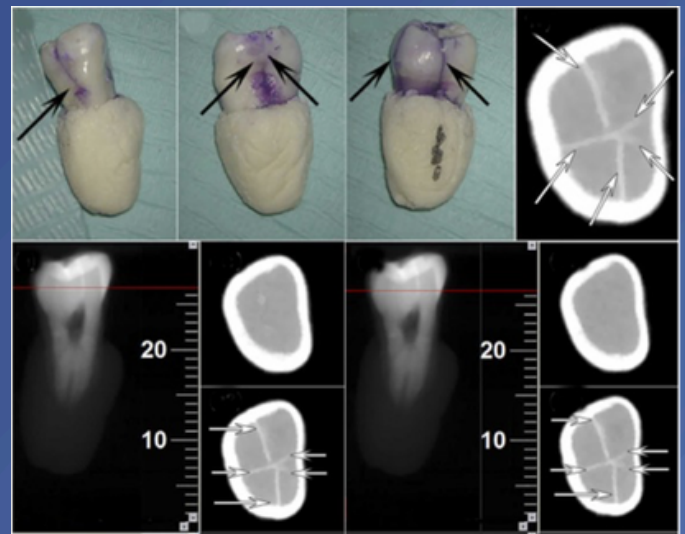


Image 3: Contrast medium ability of CBCT to identify cracked teeth (4).

Cracks of the tooth are an important area of research in dentistry, as they can be the result of various types, causes and consequences.

Knowledge about etiology and possible factors of the developing cracks helps to improve the diagnosis, treatment and prevention of other dental diseases.



For References

REASONS FOR DELAY IN THE DIAGNOSIS AND TREATMENT OF ORAL CANCER

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The Hidden Burden

Oral cancer remains a significant global health burden, with rising incidence across Europe and persistent challenges in achieving timely diagnosis. Despite advances in surgical techniques, radiotherapy, and systemic treatments, overall survival has improved only modestly in recent decades. A major contributing factor is that many patients continue to be diagnosed at advanced stages (TNM III–IV), when management becomes more complex, and prognosis significantly worsens [3,5].

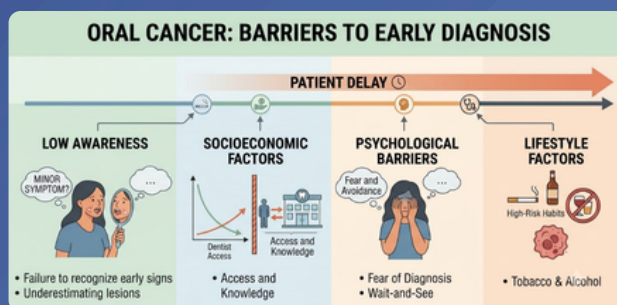
Early diagnosis is strongly associated with improved survival, reduced treatment morbidity, and better functional outcomes, including preservation of speech and swallowing. In contrast, delayed diagnosis often necessitates multimodal treatment approaches, resulting in substantially greater physical, psychological, and economic burden [4,11].

Although the oral cavity is readily accessible for clinical examination, early lesions are frequently subtle, asymptomatic, and easily mistaken for benign conditions. This creates a persistent diagnostic challenge for both patients and healthcare professionals, contributing to delays across Europe [11].

Silent Presentation

Patient delay refers to the interval between first noticing symptoms and seeking professional care. A consistent finding in the literature is limited public awareness of early oral cancer signs, which significantly contributes to late presentation.

Early lesions such as leukoplakia, erythroplakia, or persistent ulcers are often painless and therefore not perceived as clinically significant [7,10]. As a result, individuals may delay seeking advice for several weeks or even months. Systematic reviews estimate that patient delay commonly ranges between three and six months [5].



Socioeconomic status and health literacy also play an important role. Individuals with lower educational attainment or reduced access to dental services are more likely to present with advanced disease, reflecting persistent structural inequalities in healthcare access across Europe [5,10].

Psychological factors further exacerbate delay. Fear of a cancer diagnosis, anxiety, and avoidance behaviour often result in a “wait-and-see” approach, even when symptoms persist. In addition, high-risk lifestyle factors such as tobacco and alcohol use are associated not only with increased cancer risk but also with reduced engagement in preventive healthcare behaviours [1].

Clinical and System Barriers

Dental professionals are often the first healthcare providers to encounter oral mucosal abnormalities. However, early oral cancer lesions frequently resemble benign conditions such as traumatic ulcers, inflammatory lesions, or infections, making clinical differentiation challenging. This uncertainty may lead to a cautious approach, where lesions are monitored rather than immediately referred. Such hesitation is particularly common among less experienced clinicians and dental students, where diagnostic confidence is still developing [8]. Time constraints in primary care settings may further limit the thoroughness of soft tissue examinations during routine appointments, increasing the risk of missed or under-evaluated lesions [6].

Importantly, evidence-based guidelines emphasise that any oral lesion persisting longer than two weeks without an identifiable cause should be regarded as suspicious and referred for further investigation [6]. Failure to adhere to this principle can significantly prolong diagnostic timelines.

Beyond patient and clinician-related factors, healthcare system limitations also play a significant role in delayed diagnosis. Referral pathways between primary and secondary care are often inconsistent, with variability in urgency criteria, documentation quality, and communication processes. Delays may occur at multiple stages, including referral processing, specialist consultation, biopsy scheduling, and histopathological confirmation. These cumulative inefficiencies contribute substantially to late-stage presentation [5,6]. Healthcare access inequalities further exacerbate the issue. Patients in rural or underserved regions frequently experience longer waiting times for specialist assessment and diagnostic procedures, reflecting broader disparities within European healthcare systems [9].

Hidden Progression

The biological behaviour of oral cancer also contributes significantly to diagnostic delay. Early lesions often present as non-specific mucosal changes that may not immediately raise clinical suspicion [7,10]. High-risk anatomical sites, particularly the lateral border of the tongue and floor of the mouth, are difficult for patients to self-examine. Consequently, lesions in these areas may progress unnoticed until they reach a more advanced stage [1,10].

A key challenge is that many oral squamous cell carcinomas arise from potentially malignant disorders such as leukoplakia and erythroplakia [12]. However, clinical appearance alone is insufficient to distinguish benign from dysplastic changes, and histopathological examination remains essential for definitive diagnosis [10,12].

Tumour progression is highly heterogeneous. Some lesions evolve rapidly, while others remain stable for prolonged periods. This variability means that even relatively short delays can have a meaningful impact on staging and prognosis.

Early Detection Strategy

Improving early detection requires a multifactorial strategy integrating education, clinical practice, and healthcare system optimisation. Although population-based screening programmes for oral cancer remain controversial due to cost-effectiveness concerns, opportunistic screening during routine dental examinations remains a key strategy for early detection [2].

Enhanced undergraduate and postgraduate dental education is essential to improve diagnostic confidence and reduce uncertainty in identifying potentially malignant lesions [8,6].

Public awareness campaigns are also important, particularly in highlighting persistent ulcers and red or white mucosal patches as warning signs of potential malignancy [11]. Improved awareness may reduce patient delay and encourage earlier presentation. Routine opportunistic screening should include a systematic intraoral soft tissue examination at every dental visit, regardless of the presenting complaint [6].



Finally, streamlined referral systems and improved communication between primary and secondary care can reduce delays between clinical suspicion and definitive diagnosis. Digital referral pathways may further enhance efficiency and reduce administrative burden [6,9].

Conclusion

Delays in oral cancer diagnosis arise from a complex interaction of patient-related, professional, system-related, and lesion-related factors. Limited awareness, clinical uncertainty, fragmented referral pathways, and healthcare inequalities all contribute to late-stage presentation across Europe.

Evidence consistently demonstrates that delayed diagnosis is associated with poorer prognosis and reduced survival outcomes [4,5]. Addressing this challenge requires coordinated improvements in education, clinical vigilance, and healthcare system integration.

Ultimately, improving early detection not only enhances survival but also significantly reduces treatment-related morbidity and improves patients' quality of life.



SALIVA BIOMARKERS AND ORTHODONTICALLY INDUCED ROOT RESORPTION



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Orthodontically induced inflammatory root resorption (OIIRR) is an undesirable consequence of orthodontic treatment that arises from the biological mechanisms responsible for tooth movement (1). Among the adverse effects associated with orthodontic treatment, OIIRR is often reported as one of the most prevalent, following white spot lesions (2). Unlike enamel demineralisation, which is limited to the crown surface, OIIRR involves the loss of root structure and may have lasting clinical implications (2).

The clinical significance of OIIRR lies not only in its prevalence but also in the variability of its severity. One study reported apical root resorption in 45.4% of orthodontic patients (3). The extent of root loss varies considerably among patients, ranging from minor apical irregularities to substantial root shortening. To facilitate clinical assessment, the severity of OIIRR is commonly classified according to the Malmgren index, which ranges from minor apical irregularities to severe resorption exceeding one-third of the original root length (4).

While radiographs remain the primary method for detecting root resorption, they often reveal changes only after significant tissue loss has occurred (4). In addition, they cannot indicate whether the resorptive process is ongoing and require repeated radiation exposure for monitoring. As a result, researchers have increasingly turned their attention to saliva as a readily accessible source of biomarkers that may enable earlier detection of root resorption.

Understanding OIIRR

The development of OIIRR is influenced by a combination of patient-related, local, and treatment-related factors. Individual characteristics such as age, genetic predisposition, systemic health, and nutritional status may affect susceptibility to root resorption, while local factors including root morphology, previous trauma, and malocclusion severity also play a role. In addition, treatment-related variables such as treatment duration, force application, appliance type, and treatment mechanics can influence the extent of root resorption (5).

Histologically, OIIRR may range from superficial resorption confined to the cementum to more extensive dentinal and apical root resorption that can result in permanent root shortening. The process is initiated by mechanical stress within the periodontal ligament during orthodontic tooth movement, triggering an inflammatory response and activation of clastic cells responsible for hard tissue resorption. Once the stimulus is reduced, repair mechanisms involving cementum deposition may occur; however, the extent of healing varies and may not fully restore the original root structure.

(1)

Why saliva?

Saliva has emerged as a promising diagnostic fluid in both medicine and dentistry due to its easy accessibility and non-invasive collection. Unlike radiographic examinations, saliva sampling can be performed repeatedly throughout orthodontic treatment without exposing patients to ionising radiation. In addition, saliva contains numerous proteins, cytokines, and tissue breakdown products that reflect ongoing biological processes (6,7). These characteristics make saliva an attractive source of biomarkers for the early detection and monitoring of orthodontically induced inflammatory root resorption.

Which Biomarkers Matter?

Saliva has emerged as a promising diagnostic fluid in both medicine and dentistry due to its easy accessibility and non-invasive collection. Unlike radiographic examinations, saliva sampling can be performed repeatedly throughout orthodontic treatment without exposing patients to ionising radiation. In addition, saliva contains numerous proteins, cytokines, and tissue breakdown products that reflect ongoing biological processes (6,7). These characteristics make saliva an attractive source of biomarkers for the early detection and monitoring of orthodontically induced inflammatory root resorption.

When evaluating potential salivary biomarkers for OIIRR, specificity is a key consideration. Biomarkers originating from tissues directly affected by root resorption are theoretically more likely to reflect the ongoing resorptive process than those associated with inflammation alone. These include dentine-derived proteins such as dentine sialophosphoprotein (DSPP), dentine phosphoprotein (DPP), and dentine matrix protein 1 (DMP1), as well as the cementum-derived protein cementum protein 1 (CEMP1) (6). Because these molecules originate from hard tissues that undergo degradation during root resorption, they may provide a more direct indication of OIIRR. In contrast, inflammatory cytokines are frequently investigated but lack specificity, as their levels may be influenced by multiple factors, including orthodontic tooth movement, the type and mechanics of orthodontic treatment, and other inflammatory processes within the oral cavity (8).

Are We There Yet?

Saliva has emerged as a promising diagnostic fluid in both medicine and dentistry due to its easy accessibility and non-invasive collection. Unlike radiographic examinations, saliva sampling can be performed repeatedly throughout orthodontic treatment without exposing patients to ionising radiation. In addition, saliva contains numerous proteins, cytokines, and tissue breakdown products that reflect ongoing biological processes (6,7). These characteristics make saliva an attractive source of biomarkers for the early detection and monitoring of orthodontically induced inflammatory root resorption.

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Although dentine- and cementum-derived proteins are considered the most biologically specific candidates, evidence supporting their clinical utility remains limited. Among them, DMP-1 has shown particularly promising results. One study reported significantly higher peak salivary DMP-1 concentrations during orthodontic treatment in subjects who developed more than 10% OIIRR compared with those who did not, suggesting a potential association between DMP-1 levels and root resorption severity (9). Beyond dentine- and cementum-derived proteins, several other classes of salivary biomarkers have been explored, including microRNAs, immunological markers, cytokines, and molecules identified through proteomic and metabolomic studies.

Salivary exosomal microRNAs, particularly miR-146a and miR-155, have demonstrated increased expression during orthodontic treatment and were positively associated with the severity of root resorption (10).

Immunological biomarkers have also attracted considerable interest. Studies evaluating antibodies against dentine-derived antigens found that patients who developed moderate-to-severe root resorption exhibited significantly higher salivary secretory IgA (sIgA) levels (11). Notably, elevated anti-human dentine extract sIgA levels before treatment were associated with more advanced root resorption after six months of orthodontic therapy, suggesting a potential predictive value (11). Additional studies have shown that salivary IgG antibodies may react more strongly to specific dentine proteins in patients with root resorption, further supporting the potential of immunological biomarkers for OIIRR detection (12).

Advances in salivary proteomics and metabolomics have further expanded the range of potential biomarkers. Proteomic analyses have identified novel candidate proteins, including fetuin-A and p21-ARC (13). Metabolomic analyses have further revealed distinct salivary metabolic profiles in patients with OIIRR, characterized by alterations in metabolites associated with inflammation, energy metabolism, and oxidative stress (14).

In addition, elevated salivary levels of cytokines such as IL-7, IL-10, IL-12p70, and interferon- γ have been reported in patients with moderate-to-severe OIIRR (15). However, these markers may reflect broader inflammatory responses rather than root resorption itself.

Although these findings highlight the potential of saliva as a non-invasive source of biomarkers, many of the investigated molecules reflect broader inflammatory and metabolic responses rather than root resorption itself, limiting their diagnostic specificity. Consequently, despite promising results, no salivary biomarker has yet achieved routine clinical application for the assessment of OIIRR.

The Road to Clinical Practice

The transition from promising research findings to routine clinical use remains challenging. Differences in study design, biomarker selection, sampling protocols, and methods for assessing root resorption limit comparisons across studies. In addition, no salivary biomarker has yet emerged as a universally accepted standard for the detection or prediction of OIIRR. Future research should focus on identifying and validating the most reliable biomarkers in large prospective studies, as well as developing standardized methodologies that would facilitate their translation into routine clinical practice.

Conclusion

OIIRR remains a common and clinically relevant consequence of orthodontic treatment, highlighting the need for methods that enable earlier detection than conventional radiographic assessment. Saliva represents an attractive diagnostic medium because it can be collected non-invasively and contains molecules that reflect ongoing biological changes within the periodontal tissues. Among the investigated biomarkers, dentine- and cementum-derived proteins currently appear to offer the greatest biological specificity, while emerging approaches such as microRNA profiling, proteomics, metabolomics, and immunological markers continue to broaden the field. Although no salivary biomarker has yet reached routine clinical use, ongoing research is expanding our understanding of salivary biomarkers and may help establish their future role in the early detection and monitoring of orthodontically induced inflammatory root resorption.





THE LONGEVITY OF DENTAL BONDS

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Every dental student recalls the moment they stepped into their first operative dentistry class – a pivotal experience filled with precision and focus. From shaping the internal angles of a cavity preparation to mastering the careful application of phosphoric acid and the art of air-drying adhesives before the final curing with that iconic blue light, these procedures lay the foundation for modern dentistry. Central to this training is the emphasis on adhesive systems as the cornerstone of conservative dentistry, enabling us to conserve vital tooth structure without compromising on aesthetics. However, amid this intricate dance of clinical steps, a pressing question often remains unasked: what becomes of the microscopic hybrid layer when it faces five, ten, or even fifteen years of the oral cavity's relentless challenges?

As future dental professionals in Europe and beyond, the adhesive protocols we choose will not only dictate the longevity of our restorations but also influence patient satisfaction. A deeper understanding of the mechanisms that silently dictate the durability and performance of dental adhesives is essential – not just an academic requirement but a core principle for delivering evidence-based, long-lasting care.

Modern Adhesive Systems: A Comparative Insight

To ensure long-term success, it's crucial to evaluate the adhesive technologies available today. Broadly, modern dental adhesives fall into two categories based on their mode of interaction with dental tissues: etch-and-rinse (ER) and self-etch (SE) systems.

The traditional etch-and-rinse method employs a separate phosphoric acid etching step to thoroughly dissolve the smear layer and demineralize dentine. While this approach excels at creating strong micro-retentive enamel bonds, it encounters significant complexities when bonding with dentine.

A landmark review by Breschi and colleagues underscores that multi-step etch-and-rinse systems, though considered a gold standard for enamel bonding, demand exceptional technique sensitivity when applied to dentine (1). Over-drying dentine following the acid-etch can collapse the fragile collagen matrix, thereby obstructing proper infiltration by adhesive resins (1).

To address this issue, manufacturers developed self-etch adhesives and versatile "universal" or multi-mode systems. According to a systematic review by Patias et al., universal adhesives offer remarkable adaptability, allowing clinicians to toggle between bonding strategies based on patient-specific conditions (2). These systems deliver excellent short- to medium-term retention and minimize postoperative sensitivity concerns (2).

The Achilles' Heel: What Drives Adhesive Degradation?

The oral cavity presents an arduous environment for any synthetic material. Restorations endure relentless stress from temperature shifts, cyclic masticatory forces, fluctuating pH levels, and continuous exposure to saliva. Over time, two interconnected processes undermine the integrity of the adhesive interface: hydrolytic resin degradation and enzymatic breakdown of collagen. Among these culprits, water emerges as a primary adversary. Simplified adhesives are laden with hydrophilic monomers designed to infiltrate dentine's inherently moist surface. However, as Cadenaro and colleagues point out, these monomers inadvertently act as water magnets, turning the adhesive interface into a moisture reservoir (3). The trapped water weakens the resin's mechanical properties by plasticizing its matrix and incrementally leaching polymer chains into the oral cavity (3).

Additionally, dormant enzymes inherent to human dentine, such as matrix metalloproteinases (MMPs) and cysteine cathepsins, are activated upon contact with acidic etchants or monomers. Once activated, these enzymes gradually degrade exposed collagen fibers in the hybrid layer that remain unprotected by resin infiltrates. Fronza and colleagues have highlighted how the interplay between enzymatic digestion and resin hydrolysis poses the most formidable challenge to maintaining long-term bond stability at these interfaces (4).

Prolonging Bond Longevity: A Science-Driven Approach

Fortunately, delving into these degradation mechanisms equips clinicians with strategies to mitigate them effectively. By incorporating evidence-based modifications into bonding protocols early in our careers, we can significantly enhance restoration durability.

One such breakthrough lies in harnessing advanced functional monomers like 10-methacryloyloxydecyl dihydrogen phosphate (10-MDP). According to an exhaustive review by Delgado and Van Meerbeek, 10-MDP has emerged as a transformative innovation featured in nearly half of today's commercially available dental adhesives (5). Its unique chemical makeup enables it to form a highly stable, insoluble nanolayer with hydroxyapatite – establishing a robust chemical bond that resists hydrolytic degradation over extended periods (5).

The Road Ahead

Armed with knowledge about both the potential pitfalls and advancements in adhesive technology, dental students have an incredible opportunity to proactively shape their future practice. By mastering materials and techniques that prioritize durability, we can ensure not only prolonged restoration success but also enhanced patient trust in our care. The hybrid layer may remain microscopic and unseen, but its resilience – or lack thereof – speaks volumes about our dedication to evidence-based practice in modern dentistry.

Does clinical technique matter?

While the chemical formulation of dental products plays a crucial role, clinical technique remains a cornerstone of successful outcomes. Research by Carvalho et al. highlights that the active application of adhesives – by vigorously rubbing or scrubbing them into the dentine substrate – markedly enhances both immediate and long-term bond strengths compared to passive application (6). This mechanical action not only improves monomer infiltration but also helps disperse the smear layer and expedites solvent evaporation (6).

Additionally, integrating bioactive approaches offers significant benefits in preventing secondary caries, which, as noted by Melo and colleagues, is the leading cause of resin-based restoration failures (7). Techniques such as incorporating MMP inhibitors like chlorhexidine or employing advanced resin technologies capable of releasing therapeutic ions effectively deactivate harmful enzymes and bolster interfacial remineralization (7).

Is newer always better?

For many young dental professionals, the appeal of sleek marketing campaigns promoting 'all-in-one' adhesive systems are hard to ignore – promising efficiency and time savings at chairside. However, streamlined procedures do not necessarily guarantee better clinical outcomes. Multi-step adhesive systems continue to be highly reliable, as they separate critical processes: the hydrophilic priming phase and the hydrophobic bonding phase. The final hydrophobic resin layer acts as a waterproof shield, protecting the hybrid layer beneath it from oral fluids. While universal adhesives offer exceptional versatility, prioritizing speed over precision can compromise results. A prematurely failing restoration due to hurried bonding protocols exacts a severe biological toll.

The durability and effectiveness of dental adhesive systems ultimately hinge on maintaining a delicate interplay among material chemistry, protection of the biological substrate, and precise clinical technique. Although modern universal adhesive systems introduce unparalleled convenience, their success largely depends on the clinician's adherence to meticulous, evidence-based methods. By mastering techniques such as active application, selecting high-performance functional monomers like 10-MDP, and leveraging enzymatic inhibitors, dental practitioners can shift from merely filling cavities to creating robust and enduring biological seals that stand the test of time.



For References

NON – TRAUMATIC APPROACH FOR GINGIVAL TISSUE IN PROSTHETICS WITH FIXED DENTURES

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5th Grade

Fixed prostheses may be supported by either natural teeth or dental implants, with each pathway leading to a distinct biological interface (Figure 1). Tooth-supported restorations interact directly with the periodontal attachment, whereas implant-supported restorations interface with the peri-implant mucosa. Although the final prosthetic result may appear clinically comparable, these two pathways represent fundamental differences in how surrounding tissues respond to margin placement, displacement techniques, and restorative contours.



Figure 1: Flowchart outlining tooth-supported versus implant-supported prostheses and their respective support tissue.

A non-traumatic approach in fixed prosthodontics prioritises the preservation of soft-tissue integrity throughout every phase of treatment. Disrupting tissue stability risks triggering localised inflammation and recession, ultimately compromising both functional longevity and aesthetics.

This article outlines evidence-based strategies to minimize gingival trauma during fixed prosthodontic therapy, promoting predictable tissue stability and long-term treatment success.

Biological Principles of Gingival Tissues

The supracrestal tissue attachment (SCTA), previously known as biological width, classified as such at the 2017 World Workshop is a biological barrier that prevents microorganism infiltration into the periodontium (1)(Figure 2). Comprising the junctional epithelium and supracrestal connective tissue attachment, Gargiulo et al. (1961) reported its mean dimension to be approximately 2 mm (2). However, as identified in this study, SCTA demonstrates significant inter-individual variability, from 0.75mm to 4.3mm (2). Consequently, SCTA dimensions must be carefully evaluated when placing restorative margins. Encroaching this area prompts a physiological response to re-establish the biological space, resulting in marginal gingival inflammation, accelerated bone loss, and deepened periodontal pockets.

Gingival phenotypes are classified according to gingival thickness (GT) and keratinised tissue width (KTW) (Table 1), with distinct phenotypes presenting varying prosthodontic risks. As demonstrated in a systematic review by Kumar M P et al. (2024), individuals with thin gingival phenotype are also at higher risk of of aesthetic complications and susceptible to recession, as opposed to thicker gingival phenotypes(3).

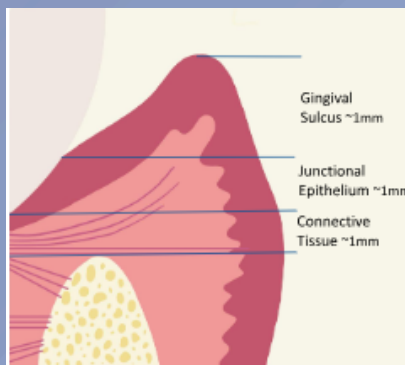


Figure 2: Schematic illustrating gingival tissues relevant to prosthodontic design.

Diagnostics and planning

Prior to prosthodontic intervention, periodontal health must be systematically evaluated via a Basic Periodontal Examination, mobility, occlusion and recession. Unresolved inflammatory disease or post-stabilisation gingival recession will compromise aesthetic outcomes by exposing restoration margins. Periodontal stabilisation that enforces oral hygiene instruction and professional mechanical plaque removal is mandatory pre-restorative treatment.

Pre-operative gingival phenotype assessment establishes patient-specific risk profiles. GT can be evaluated using the periodontal probe transparency test; visibility of the probe through the sulcular wall indicates a thin phenotype susceptible to post-restorative recession. Avetisyan et al. (2021) demonstrated GT screening effectively predicts soft-tissue outcomes following placement of fixed prosthodontics (7).

Alongside inter-person differences, SCTA dimensions exhibit intra-individual variability influenced by tooth position, labial bone thickness, and gingival phenotype. Clinical assessment of all prosthodontically implicated teeth is therefore essential prior to finish-line placement. Transgingival probing under local anesthesia provides accurate patient-specific SCTA dimensions to guide margin placement (8).

Marginal depth selection requires balancing aesthetic demands, periodontal health and SCTA preservation (Table 2). Subgingival margins conceals tooth restorative interface but SCTA violation triggers inflammatory response. A recent systematic review by Cortés-Sánchez et al (2026) highlights subgingival full-crown margins are associated with increased gingival inflammation and greater periodontal probing depth (9). Margin design principles suggest this may be positioned 0.5mm below sulcal depth if pockets are 1.5mm or less. If exceeds 1.5mm, margin can be placed half of pocket depth. Other considerations such as root caries may influence margin depth decisions.

To avoid SCTA violation and subsequent gingival trauma during margin placement, adjunctive tissue-conserving therapies may be indicated. Surgical crown lengthening (gingivectomy with or without osseous resection) allows the supracrestal tissue attachment to re-establish at a more apical level. Alternatively, orthodontic extrusion offers a conservative approach to preserve adjacent soft-tissue contours and preventing inflammatory breakdown(9).

Gingival Phenotype (2)	Definition & Clinical Assessment (2)	Subclassification (2)	Prosthodontic Implication (2)(4)(5)(6)
Gingival Thickness	Dimensional thickness of the soft tissue	Thin	Delicate, high susceptibility to mechanical trauma during cord packing, subgingival prep, or margin impression; prone to gingival recession and dehiscence.
		Thick	Resilient to mechanical trauma, more prone to pocket formation or inflammation if margins violate the SCTA
Keratinised Tissue Width	Distance from free gingival margin to mucogingival junction.	Narrow	Poor resistance to tension/recoil from crown margins; increased mucosal inflammation risk around subgingival restorations.
		Wide	Provides a strong, stable seal around crown margins, offering structural resistance against retraction cords and crown placement.

Table 1: Classification of gingival phenotype and prosthodontic implications. Classification guidelines adapted from 2017 World Workshop parameters (2).

Tooth Preparation and FPD Design

Multiple stages aacross the prosthodontic workflow carry the risk of mechanical, chemical, or thermal trauma to the surrounding periodontium (Table 3). Careful management of soft tissues during tooth preparation and impression procedures is critical to prevent marginal breakdown and chronic inflammation. Resin-bonded fixed partial dentures (RBFPDs) are recommended for periodontally compromised anterior teeth due to their conservative nature. By enabling supragingival margin placement, RBFPDs facilitate effective plaque control and minimize direct mechanical trauma to the gingival attachment (13).

Although contemporary systematic reviews demonstrate no significant difference in long-term periodontal parameters between RBFPDs and conventional FPDs (14), the theoretical periodontal advantages are according to biological principles. In addition to preparation depth, restorative material selection and fabrication methods directly influence periodontal health. Monolithic and layered zirconia CAD/CAM provide a more accurate fit than traditional cast frameworks, minimizing marginal gaps, cement breakdown, and microleakage (12).

Margin Depth	Prosthodontic Implications
Supragingival	Hygienic, incongruent margin, non-aesthetic
Equigingival	Can provide smooth interface
Subgingival	Conceal tooth/restoration interface, too deep margin may trigger inflammatory response as body fails to establish SCTA. Root caries, tooth inadequacies?

Table 2: Depicts margin types and prosthodontic implications (8).

Post-Treatment Considerations

MultPatient compliance with supportive oral hygiene is essential following restoration delivery. While polished restoration margins reduce plaque retention, bacterial adhesion cannot be entirely eliminated. As highlighted by Ercoli and Caton (2018), effective daily plaque control is a key factor in preventing fixed and removable restorations from negatively impacting periodontal health (16).

Prosthodontic Workflow Stage	Gingival Trauma Risks	Considerations
Tooth Preparation	Thermal injury from bur friction Rough margins encouraging bacterial adhesion and plaque retention	Use adequate water cooling Select fine-grit burs for smooth margins Shield soft tissue using a Zekrya retractor or flat plastic. 8 degree taper for good retention
Retraction	Friable gingivae, may tear during impression taking Excessive packing causes gingival trauma Chemical trauma from strong haemostatic agents	Retraction cord to protect gingivae, provide better impression, consider single vs double retraction Chemical retraction - hydroxyl gel, containing haemostatic agent e.g. Expansyl If gingival bleeding, soak in haemostatic agent e.g. aluminium chloride Measures to avoid chemical trauma Consider surgical retraction
Cementation	Excess cement acts as a surface for bacterial attachment. Marginal discrepancies may result in thick cement, poor hermetic seal which enables microleakage, secondary caries and gingival inflammation. Operator variables affect cement quality. Porosity can increase during the mixing and polymerisation shrinkage.	Appropriate tooth preparation (8 degree). Operator variables Floss interproximally Automixer
Provisional and permanent restorations	Well constructed provisional provides tissue tone prior to permanent. Overhanging or subgingival margins can encroach on the SCTA. Overcontouring enables plaque retention. Embrasure and pontic design Remove subgingival margins Inaccurate marginal and internal discrepancies result in marginal discrepancy and thick cement.	Avoid overhangs and subgingival margins Pontic design ovate most cleansable. Interdental papillae area is cleansable
Embrasure and pontic design	Poor cleansability leading to plaque accumulation and gingival inflammation	Use cleansable pontic design e.g. ovate Maintain good oral hygiene access

Table 3: Prosthodontic workflow stages and gingival trauma considerations (10, 11, 12)

Conclusions

Ultimately, periodontal considerations must be integrated across every phase of the prosthodontic workflow. The gingival tissues respond dynamically to mechanical and biological alterations, shifting toward inflammatory breakdown if compromised. Respecting the supracrestal tissue architecture and tailoring treatment to the patient's gingival phenotype are therefore essential prerequisites for achieving long-term periodontal health and predictable aesthetic outcomes.



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