Cementoblastoma: A Rare Clinical Encounter – Case Report

ADAMS SCHOOL OF DENTISTRY

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ABSTRACT

Cementoblastoma is a rare, benign neoplasm of odontogenic ectomesenchymal origin, accounting for less than 6% of all odontogenic tumors. It is characterized by the production of cementum and primarily occurs in individuals in their second and third decades of life, with a preference for the posterior region of the mandible. The primary differential diagnoses include hypercementosis, condensing osteitis, osteoblastoma, and osteosarcoma.
This report discusses an uncommon presentation of cementoblastoma in the maxilla, specifically in the furcation area of the maxillary right molar. We present the case of a 24-year-old pregnant woman diagnosed with benign cementoblastoma associated with localized chronic osteitis. This case is particularly notable because it can be mistaken for malignancy due to its ill-defined borders and extensive root resorption.

INTRODUCTION

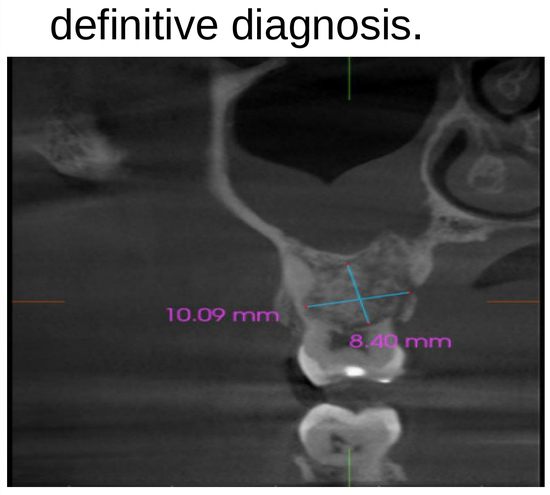
•**Clinical presentation:**
A 23-year-old pregnant female presented with a one-year history of intermittent right-sided pain, which is exacerbated by chewing. She was evaluated by a resident at the UNC Endodontics Graduate Clinic. The patient has no significant medical history and is currently taking multivitamins.

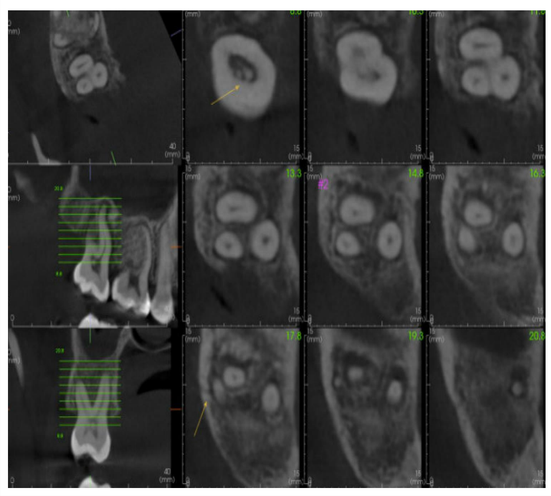
METHODS & MATERIALS

Clinical Examination:
•Extraoral: No swelling, masses, or lymphadenopathy
•Intraoral: No hard or soft tissue pathology; PD's <5mm for #2, #3, #4
•Teeth #2 & #3: Grade II mobility, positive percussion test.
•Cold test: #3: +ve, very faint.
#2: +ve, very faint.
Transillumination: did not show any identifiable crack on Teeth #2, #3, #4, #5

Radiographic Findings
•Tooth #2: PDL widening (M and D root), normal bone level
•Tooth #3: MO composite restoration. PDL widening (M and D root). Mixed RO/RL pattern in furcation area. Distal root resorption

Advanced Imaging
•Small field of view CBCT of upper right molar area ordered for definitive diagnosis.



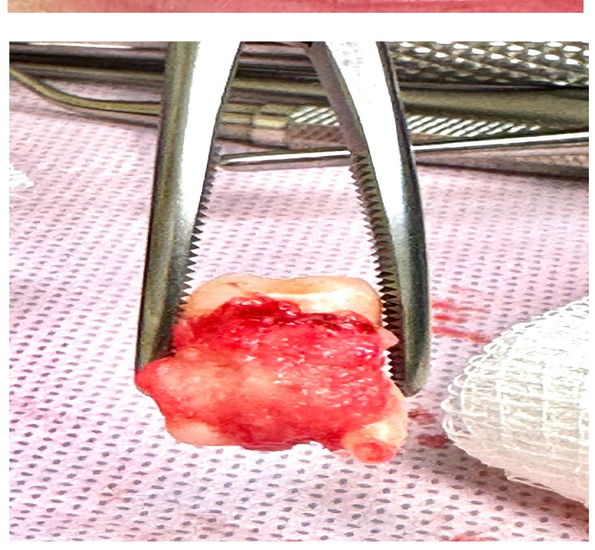


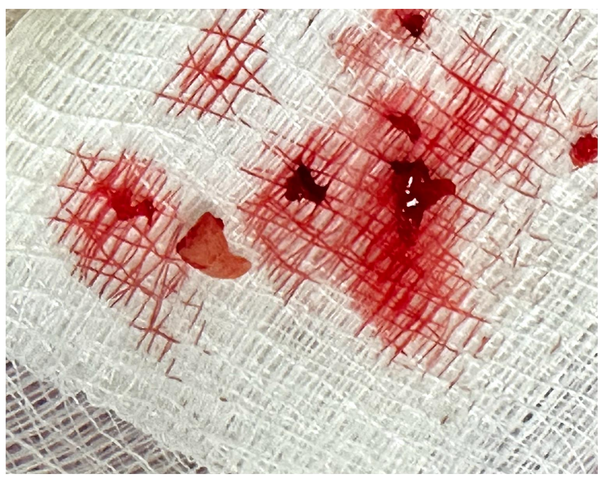
RESULTS

Radiographic Findings
•Moderately ill-defined, heterogeneously opaque lesion at furcation of tooth #3 (10 × 8 mm). Extensive root resorption (MB, DB, P roots). Surrounding alveolar bone resorption
•PDL space widening. Circumferential loss of lamina dura

Differential Diagnosis
1.Atypical cementoblastoma
2.Low-grade osteosarcoma
3.Osteoblastoma
Patient was seen in OMFS clinic and treatment conducted by a 4th year dental student included extraction of teeth #2 and #3, with the associated lesion attached to the furcation area between the roots of tooth #3.
Biopsy was sent to oral pathology lab at UNC for histopathological examination.

Histopathological diagnosis:
Cementoblastoma with localized chronic osteitis. There is no evidence of malignancy.





CONCLUSIONS

Cementoblastoma is a rare, benign neoplasm that primarily affects the mandible, particularly the first molar region. While often asymptomatic, it can sometimes cause pain and swelling. Radiographically, it appears as a well-defined, radiopaque mass fused to the root of a tooth, typically surrounded by a thin radiolucent border.
This case is unusual due to its maxillary location and aggressive radiographic features, which initially mimicked a malignancy. Chronic inflammation contributed to a presentation more aggressive than that of typical cementoblastomas. Given the ill-defined borders and extensive root resorption, histopathological analysis was essential for an accurate diagnosis and for determining the optimal treatment approach
This case underscores the critical role of a precise diagnostic approach, proving that even rare conditions with atypical presentations can be accurately identified and effectively managed in a general dentistry setting.

REFERENCES

Microplastics In Dentistry

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Introduction

Microplastics are small fragments of plastic defined as particles 0.1 cm (1000 µm) to 1 µm (micron) and can be viewed with an optical microscope [1]. They are well known for their threat to our oceans, as plastics are the most common pollutant in ocean waters [3]. While plastic pollution's environmental impact is an important consideration regarding dental waste, an equally important but lesser-studied topic is the contribution of microplastics and their effects on the human body. In a 2022 study, Leslie et al. found concentrations of microplastic particles, PMMA, PP, PS, PE and PET in measurable amounts in 77% of the donor human blood sample tested [2]. Armed with the knowledge that microplastic particles now exist in the human body, we must consider the effects on the human body, and how they enter the body. To answer the latter, we should consider how most things enter the body, through the mouth, and with that a consideration should be given to oral hygiene products and dental materials used in a clinical dental setting. This literature review analyzes the current data on prevalence of different sources of microplastics in clinical dentistry, specifically focusing on products frequently used in the oral cavity.

Results

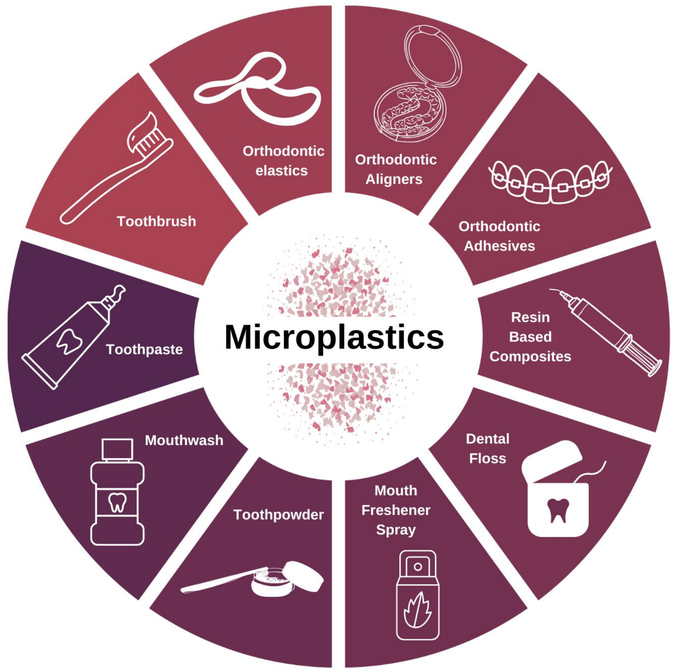

Figure 1: The various sources of microplastics in dentistry.

Results

Table 1.

Topic:	Significant Findings:	Ref:
Toothpaste	A 2022 study on 10 commercially available toothpaste brands in India found MP particles ranging from 100-339 µm. The percentage of the **product by weight that was MP particles ranged from 0.2%-0.9%.**	[4]
Toothbrush	Concentrations of MP are between **30-120 particles per brush per day,**with the majority being being 0.3mm or smaller. It's estimated that toothbrushes contribute to a **yearly exposure of 48,910 particles**.	[5]
Orthodontic Adhesives	Release l**ess than 150 microplastic particles** across all of the four adhesive brands tested. The greatest release was Aqualine LC, while the least amount of MP was released from Ormco Enlight.	[6]
Orthodontic Aligners	Mechanical friction contributed to the release of microplastics composed of two plastic polymers, PET and PU. All of **the brands tested released greater than 10 MP particles**, besides one, Invisalign, which only released <10.	[7]
Orthodontic Elastics	Around **110 microplastic and nanoplastic particles were found** using SEM imaging of an elastic band sample with an area of 35 x 40 µm . The overall area of an elastic is 69.6 mm², making the estimated number of MP particles released in the millions.	[8]
Operatory Surfaces	Dental operative environments contain microplastics, with an average concentration reported of ~**836 microplastics per gram of dust** per day from the 480 tested samples	[9]

Results

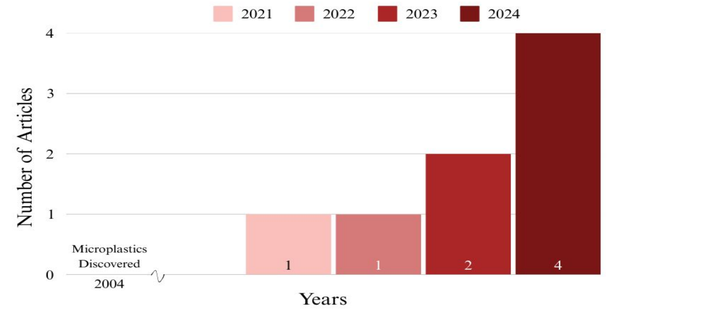

Figure 2: The number of articles published pertaining to Microplastic research in dentistry as of Dec 2024.

Discussion

Findings

- Microplastic abundance varies depending on the brand of a dental product being used.
- Dental materials that are being stretched or pulled in the mouth and changed often such as orthodontic aligners, and orthodontic elastics are releasing higher numbers of microplastic particles.
- Microplastics can be found in the air in dental operatories.

Environmental Concerns

- In addition to leaching microplastics, if short-term use items like floss or toothbrushes are discarded regularly, alternative materials such as bamboo could be considered as they do not release microplastics into the body or the environment.
- The dental materials examined in this poster are some of countless plastic based dental products used directly in a patient's mouth during a visit. Considerations must also be made for the various single use products such as barriers and PPE changed between every patient. We must look for alternative ways these products can be sustainably discaseded, recycled, or exchanged with more eco friendly materials.

Future Research

- As a dental student and patient, I wonder how microplastic release might impact providers like myself throughout their careers.
- The topic of microplastics in dentistry is both very new and understudied. As the effects of plastic pollution on Earth become clearer, investing in sustainable dental materials and products is worth considering.

References

1. Andrady, A. L. (2017). The plastic in Microplastics: A Review. *Marine Pollution Bulletin*, *119*(1), 12–22. https://doi.org/10.1016/j.marpolbul.2017.01.082
2. Leslie HA, van Velzen MJM, Brandsma SH, Vethaak AD, Garcia-Vallejo JJ, Lamoree MH. Discovery and quantification of plastic particle pollution in human blood. Environ Int. 2022 May;163:107199. doi: 10.1016/j.envint.2022.107199. Epub 2022 Mar 24. PMID: 35367073.
3. Moore, C. J. (2008). Synthetic polymers in the marine environment: A rapidly increasing, long-term threat. *Environmental Research*, *108*(2), 131–139. https://doi.org/10.1016/j.envres.2008.07.025
4. Madhumitha, C. T., Karmegam, N., Biruntha, M., Arun, A., Al Kheraif, A. A., Kim, W., & Kumar, P. (2022). Extraction, identification, and environmental risk assessment of microplastics in commercial toothpaste. Chemosphere, 296, 133976. https://doi.org/10.1016/j.chemosphere.2022.133976
5. Periyasusha, G. B., Kavitha, B., Robin, R. S., Nithin, A., Ineyathendral, T. R., Shivani, S. S., Anandavelu, I., Sivasamy, S., Samuel, V. D., & Purvaja, R. (2024). Microplastics in oral healthcare products (OHPs) and their environmental health risks and mitigation measures. *Environmental Pollution*, 343*, 123118. https://doi.org/10.1016/j.envpol.2023.123118
6. Divakar, A., Sundari, S. K., & Jeyachandran, S. (2024). Detection and identification of various microplastics in different orthodontic adhesives. Cureus. https://doi.org/10.7759/cureus.55221presence
7. Quinzi, V., Orilisi, G., Vitiello, F., Notarstefano, V., Marzo, G., & Orsini, G. (2023). A spectroscopic study on Orthodontic Aligners: First evidence of secondary microplastic detachment after seven days of artificial saliva exposure. Science of The Total Environment, 866, 161356. https://doi.org/10.1016/j.scitotenv.2022.161356
8. Fang, C., Awoyemi, O. S., Luo, Y., & Naidu, R. (2023). Investigating microplastics and Nanoplastics released from a rubber band used for orthodontic treatment with improved Raman imaging algorithms. Environment & Health, 1(1), 63–71. https://doi.org/10.1021/envhealth.3c00051.
9. Naseem Akhtar, Arifa Tahir, Abdul Qadir, Rehana Masood, Zain Gulzar, Muhammad Arshad, Profusion of microplastics in dental healthcare units; morphological, polymer, and seasonal trends with hazardous consequences for humans, Journal of Hazardous Materials, Volume 479, 2024, 135563, ISSN 0304-3894,https://doi.org/10.1016/j.jhazmat.2024.135563.

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Soft tissue height following implant placement with Acellular dermal matrix: A systemic review and Meta-analysis.

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Introduction

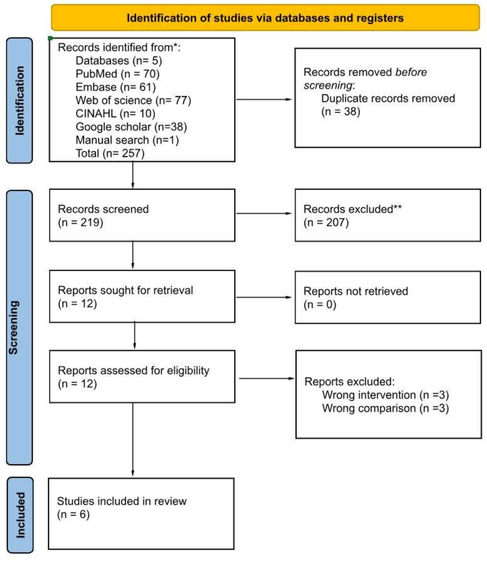
In general, bone reduction is seen after implant placement more in buccal bone than lingual/palatal bone [1]. Consequently, alternatives to tissue grafts such as the acellular dermal matrix (ADM) or Collagen matrix have been used simultaneously with dental implants to compensate for soft tissue collapse to peri-implant mucosa, which in turn may decrease the contour change of bone.

Aim of study

- To evaluate the amount of soft tissue height (STH) gained after augmenting the soft tissue graft with ADM in combination with dental implants.

Material and methods

- ❑ This systematic review and meta-analysis were conducted by (PRISMA) guidelines and registered on PROSPERO.
- ❑ Inclusion criteria: Clinical trials, studies compared ADM group to non-grafted group, and studies assessed STH.
- ❑ Exclusion criteria: Non-clinical trials, trials compared only two groups "ADM vs SCTG", and studies did not assessed STH.



- **Figure1.** *Screening flowchart for the investigated studies following the PRISMA guidelines*

Results

A total of 257 articles were initially identified through electronic and manual searches. 38 duplicates were removed. A thorough reading of the title and abstract as well as full-text screening was obtained and led to the inclusion of six studies **(Fig.1).**

❑ Vertical soft tissue thickness

The pooled mean difference (MD) was 0.84 (95% CI: 0.28, 1.39) with a statistically significant p-value <0.0001. Zang et al.(2022) reported the highest MD of 1.80mm (95% CI: 1.53 to 2.07 mm) contributing 17% of weight, (Kanafi et al.2021) was 0.94mm of MD and (95% CI: 0.42 to 1.45 mm) with 15.4% of weight, (Puisys et al.2024) was the least of all mean differences of -0.20mm (95% CI: -0.48 to 0.08 mm) contributing 17% of weight, (Verardi et al.2022) revealed 0.83mm of MD and (95% CI: 0.48 to 1.18 mm) with 16.6% of the analysis weight, (Lee et al.2023) reported 1.23mm of MD with (95% CI: 0.97 to 1.49 mm) and 17.1% of weight, and (Solderer et al.2024) reported 0.44 mm of MD with (95% CI: 0.15 to 0.73 mm) and 16.9% of weight (Fig.2).

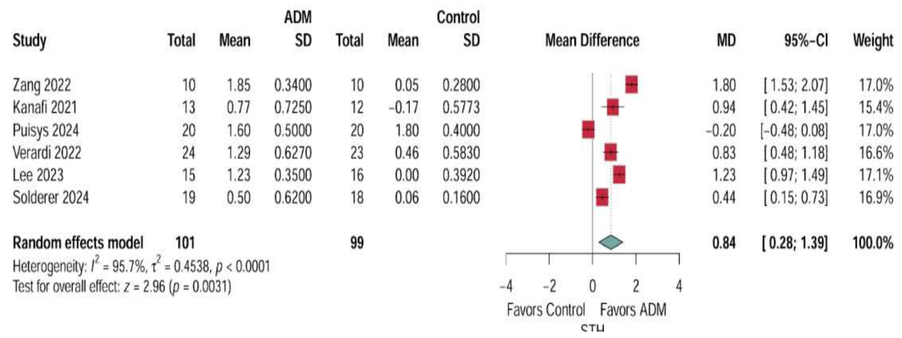


Figure 2. *Pooled mean difference of vertical soft tissue change at the implant site***.**

❑ Marginal bone loss

A total of three studies, 108 patients, reported the marginal bone loss at baseline and 12 months after placing implants. The forest plot (Fig.5) illustrates the pooled mean difference of marginal bone loss (MBL) around implants, comparing the mean change from baseline to 12 months. The random effect model revealed a mean difference of 0.07mm (95% CI: -0.21 to 0.35 mm, p= 0.6325), proposing no statistically significant difference in MBL between the groups. (Lee et al.2023) revealed a mean difference of -0.40 mm (95% CI: -1.46 to 0.65 mm), contributing 63.1% of the weight in the analysis. (Puisys et al.2024) and (Solderer et al.2024) reported mean differences of -0.10 mm (95% CI: -0.55 to 0.35 mm), with 30.35% and 6.75%, respectively. Heterogeneity among the studies was low (I^2 = 10.8%, Tau= 0.0162, p= 0.325) (Fig.3).

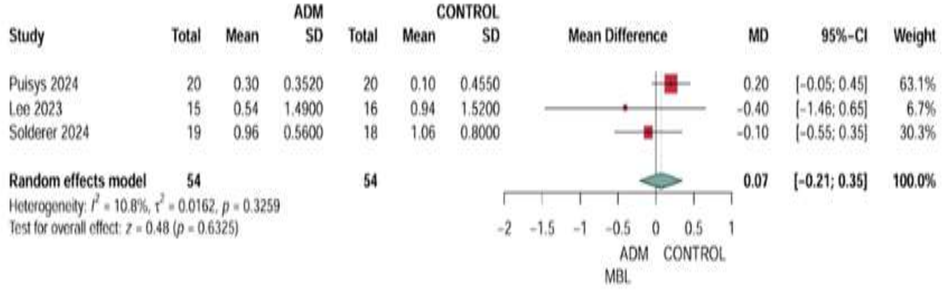


Figure 3. *Pooled mean difference of marginal bone level changes around the immediate implant at 12 months***.**

Discussion

The present systematic review and meta-analysis aimed to explore the potential prognostic effects and implications of Acellular dermal matrix on soft tissue and bone changes. A previous meta-analysis conducted by (Aldhohrah et al.2022)[2], compared the soft tissue augmentation materials in conjunction with immediate and delayed implants. The results of comparing SCTG to non-grafted sites showed a statistically significant finding of 0.8mm pooled mean difference in buccal tissue thickness, which is strengthening the significant result of our study in gaining soft tissue height around the implants by adding ADM at the time of implant placement. Furthermore, a systematic review and network meta-analysis of peri-implant soft tissue phenotype modification techniques conducted by (Tavelli et al.2021)[3], Despite the study provides strong evidence supporting the use of specific techniques, the soft tissue height augmentation was not conducted in the network meta-analysis due to the insufficient data.

The clinical relevance should be questioned because one of the studies in the present meta-analysis had confidence intervals crossing zero, this might reflect the reason of which the mentioned study has smokers were higher in number than the other studies. However, the use of ADM for soft tissue augmentation in dental implant procedures has shown promising results in increasing vertical soft tissue thickness, especially in patients with thin gingival phenotype. (Kanafi et al. 2023) and (Zang et al 2022) revealed that ADM improved soft tissue dimensions compared to control groups significantly, within mean gains of 0.76mm and 1.85mm, respectively. These studies also highlighted that ADM did not prevent peri-implant mucosal recession or interproximal bone resorption. When compared to other techniques such as tenting technique or SCTG, ADM showed similar efficacy in soft tissue augmentation.

Conclusions

The included studies reinforced the importance of selecting the appropriate soft tissue augmentation technique based on specific clinical situations. ADM is a promising alternative to SCTG, reducing patient morbidity by avoiding a second surgical site. However, while ADM significantly improves vertical soft tissue thickness, it does not significantly impact marginal bone loss or pocket probing depth. Future long-term studies are needed to establish its clinical efficacy.

References

1. Chappuis V, Engel O, Reyes M, Shahim K, Nolte LP, Buser D. Ridge alterations post-extraction in the esthetic zone: a 3D analysis with CBCT. J Dent Res. 2013;92(12 Suppl):195s-201s.10.1177/0022034513506713.
2. Aldhohrah T, Qin G, Liang D, Song W, Ge L, Mashrah MA, et al. Does simultaneous soft tissue augmentation around immediate or delayed dental implant placement using sub-epithelial connective tissue graft provide better outcomes compared to other treatment options? A systematic review and meta-analysis. PLoS One.
3. Tavelli L, Barootchi S, Avila-Ortiz G, Urban IA, Giannobile WV, Wang HL. Peri-implant soft tissue phenotype modification and its impact on peri-implant health: A systematic review and network meta-analysis. J Periodontol. 2021;92(1):21-44.10.1002/jper.19-0716.

Cross-Tissue Analysis Reveals Oral and Systemic Link in Chronic Periodontitis

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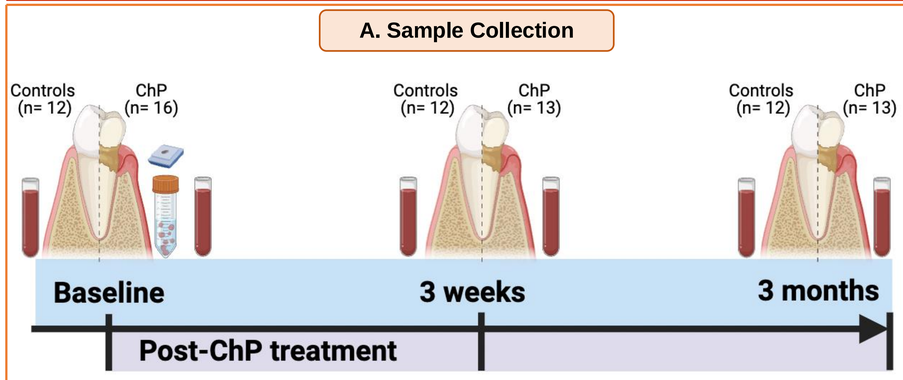
ABSTRACT

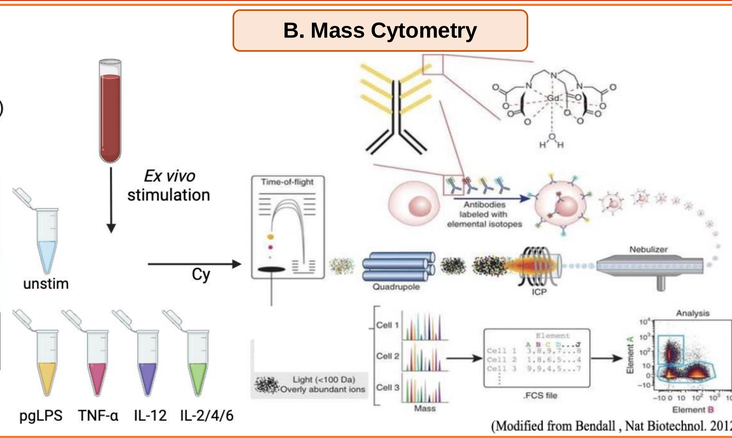
- **Introduction**: Despite advances in dental care and oral hygiene, the prevalence of chronic periodontitis (ChP) remains high at 47.2% in the U.S. ChP not only leads to severe gum bleeding and tooth loss but also contributes to systemic diseases, including diabetes mellitus, adverse pregnancy outcomes, and cardiovascular diseases. The mechanisms of the connection between ChP and systemic health are still not fully understood. In our phase I study, we demonstrated systemic and cell-specific immune dysfunctions in patients with ChP, which can be temporarily reversed by the local treatment of ChP. For phase II study, we aim to 1) validate our findings with larger cohorts across wider time range and 2) investigate ChP oral and systemic immunological interaction by a multiplex cross-tissue analysis.
- **Methods**: Whole-blood samples from 16 patients with ChP and 12 controls were collected at baseline (n=28), 3 weeks post-ChP treatment (n= 25), and 3 months post-ChP treatment (n= 25) in the Bell Dental Center (San Leandro, CA). The blood samples were left unstimulated or stimulated with *Porphyromonas gingivalis* lipopolysaccharide (PgLPS), tumor necrosis factor α (TNF-α), interleukin (IL-12), or a cocktail of interleukins 2/4/6 (IL-2/4/6), then will be analyzed using mass cytometry (CyTOF). The gingival tissue from ChP patients at baseline will be examined with imaging mass cytometry (IMC).
- **Future Directions**: An integrated multiomic approach will be employed to analyze the results from CyTOF and IMC.
- **Conclusion**: The results obtained from this study will empower us to explore the synergies of systemic and oral immune mechanisms that contribute to a defined ChP-driven immune milieu while underscoring the effectiveness of standard nonsurgical periodontal treatment.

OBJECTIVES

- **To validate the findings of systemic and cell-specific immune dysfunctions in patients with ChP using a larger cohort across a wider time range to enhance the robustness and generalizability of the results**
- **To investigate ChP oral and systemic immunological interaction via multiplex cross-tissue analysis along with cutting-edge multiomic technologies**

METHODS





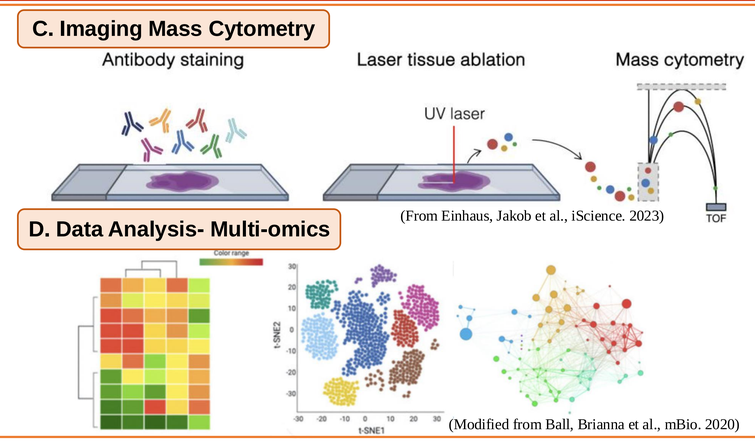


Figure 1. Workflow

RESULTS

Demographics Table

Mean±SD, *t* test.

	Control (n=12)	ChP (n=16)
Demographics		
Age (years)	32.2±5.0	31.7±5.5
Race/ethnicity		
Asian	7	4
African American	1	1
White	0	1
Hispanic	4	10
Sex		
Female	7	10
Male	5	6
Health Metrics		
BMI (kg/m²)	26.8±6.0	29.3±6.4
DBP (mmHg)	117.4±11.0	121.3±12.3
SBP (mmHg)	82.0±8.9	78.6±11.1
HR (bpm)	73.0±10.1	74.2±11.3
Smoking History	N/A	N/A

Table 1. Patient Demographics

Lymphocytes		Myeloid cells		Structural		Signaling		Functional
IMC	CyTOF	IMC	CyTOF	IMC	CyTOF	IMC	CyTOF	IMC
CD45	CD45	CD66b	CD66b	vimentin	cRARP	pERK	pERK1/2	Granzyme B
CD20	CD19	CD14	CD14	aSMA	CD235ab	pS6	pS6	VEGF
CD45RA	CD45RA	CD209	CD123	NE	CD61	pp38	pp38	Ki67
CD4	CD4	CD16	CD16	PanCK		pSTAT1	pSTAT1	MMp-9
CD8a	CD8a	CD11b	CD11b	CD31		pMAPKAPK2	pMAPKAPK2	
CD3	CD3	CD11c	CD11c	Collagen1		pNFkB	pNFkB	
CD56	CD56	CD15	CD33			pCREB	pCREB	
FoxP3	FoxP3	CD163	CCR2	**Nuclear**		pSTAT3	pSTAT3	
	CD62L	HLA-DR	HLA-DR	IMC	CyTOF	pSTAT5	pSTAT5	
	CD161		FcεRIα	Iridium-191	Iridium-191		pSTAT6	
	Tbet		CRTH2	Iridium-193	Iridium-193		IκB	
	TCRγδ		CXCR4	Histone H3				
	CD25		OLFM4					
	CD7							

Table 2. IMC and CyTOF Antibody Panel

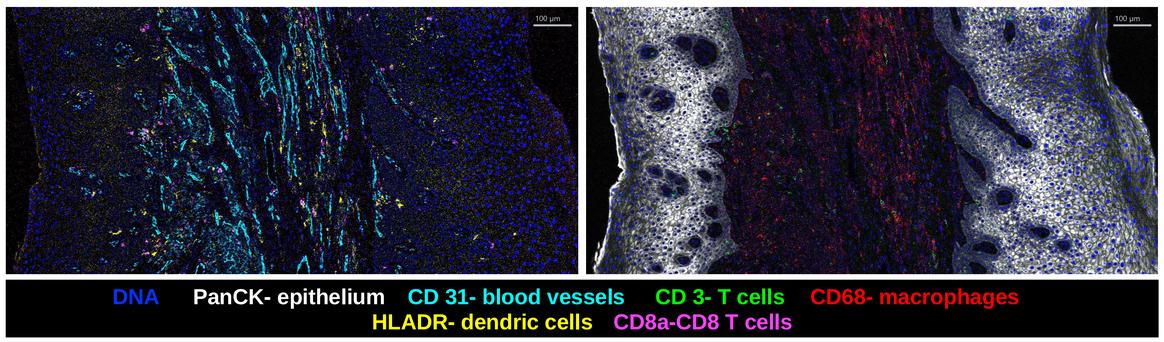


Figure 3. Representative IMC images of gingival tissue from patients with ChP collected at baseline.

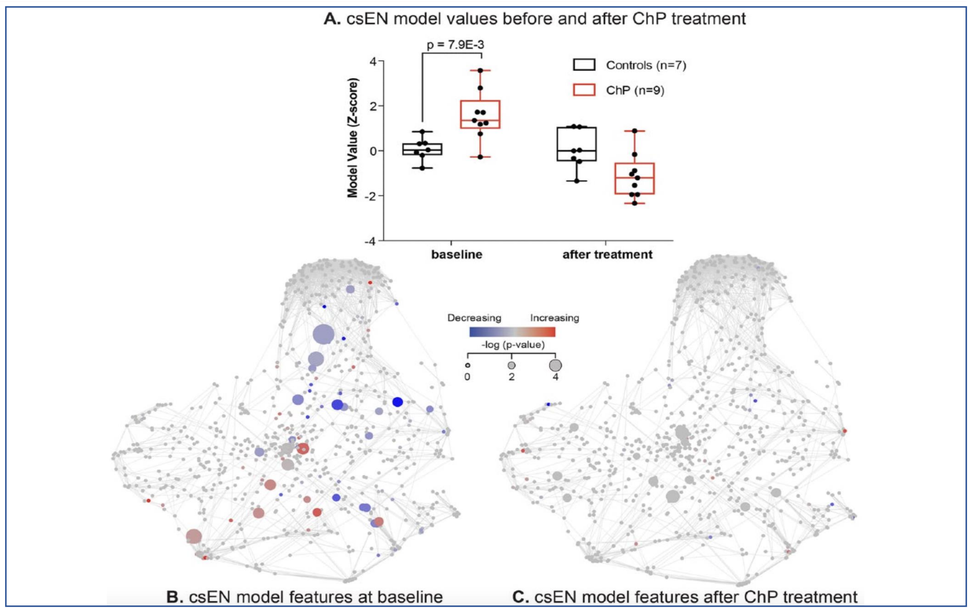


Figure 2. Systemic immune signature of chronic periodontitis (ChP) pre- and post-ChP treatment (phase I study). (A) Box plot illustrating the cell signaling–based elastic net (csEN) model values in subjects with ChP and controls, pre- and post-ChP treatment. Before ChP treatment, the csEN values increase in subjects with ChP in comparison to controls (9 patients, 7 controls, Wilcoxon rank sum test P = 7.9E-3). There is no change in the csEN values between subjects with ChP and controls post-ChP treatment. **(B, C)** csEN values overlaid on the immune signaling network for subjects who underwent ChP treatment. **(B)** Pre-treatment. **(C)** Post-treatment.

FUTURE DIRECTIONS

- Proceed with future experiments and data analysis to address the **hypothesis**: The active innate immunity in local gingival tissue and peripheral blood due to chronic periodontitis could be normalized with ChP treatment.

Future Experimental Timeline	
04/2024-06/2024	Conduct CyTOF experiment
07/2024-09/2024	Conduct IMC experiment
10/2024-present	Data analysis

REFERENCES

Ball, B., et al. "Fun(Gi)Omics: Advanced and Diverse Technologies to Explore Emerging Fungal Pathogens and Define Mechanisms of Antifungal Resistance." MBio, vol. 11, no. 5, 27 Oct. 2020, https://doi.org/10.1128/mbio.01020-20. Accessed 12 May 2022.

Einhaus, Jakob, et al. "Spatial Subsetting Enables Integrative Modeling of Oral Squamous Cell Carcinoma Multiplex Imaging Data." IScience, vol. 26, no. 12, 1 Dec. 2023, pp. 108486–108486, https://doi.org/10.1016/j.isci.2023.108486. Accessed 21 Apr. 2024.

Gaudilliere, D.K., et al. "Systemic Immunologic Consequences of Chronic Periodontitis." Journal of Dental Research, vol. 98, no. 9, 21 June 2019, pp. 985–993, https://doi.org/10.1177/0022034519857714.

Tsimpiris, Athanasios, et al. "Association of Chronic Periodontitis with Helicobacter Pylori Infection in Stomach or Mouth: A Systematic Review and Meta-Analysis." European Journal of Dentistry, 18 Nov. 2022, https://doi.org/10.1055/s-0042-1756690. Accessed 24 Jan. 2023.

Osteomyelitis of Maxilla As A Post-Extraction Complication - Treatment and Rehabilitation

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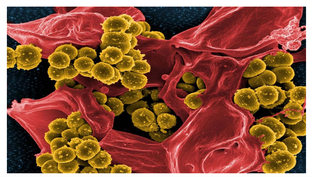
Introduction

Osteomyelitis is defined as an inflammatory disease of the bone. It starts as an infection of the medullary cavity, which quickly spreads to the Haversian systems and extends to the periosteum of the affected area.
Osteomyelitis is commonly caused by **Staphylococcus aureus.**

- **Classification**
  - **Acute** - An early or acute phase caused by an infection, injury, or another condition. It is usually suppurative.
  - **Chronic** - One that lasts longer than a month in duration or if the infection persists. It may or may not be suppurative.
- **Immune Compromise is a Risk factor for osteomyelitis**
  - Immun suppression, Diabetes, HIV, Kidney disease requiring dialysis, and malnutrition.
- **With regards to dental conditions, osteomyelitis can occur:**
  - As a complication from an odontogenic infection, or following dental extraction, or as a complication following trauma
- **Signs and Symptoms** of osteomyelitis include fever, pain, swelling, discharge, and non-healing wounds
- **Diagnosis follows c**linical assessment supplemented by imaging modalities such as radiographs, CT imaging, MRI, bone scans, tissue or bone biopsy, and microbial culture to identify causative pathogens
- **Treatment:**
  - Antibiotic Therapy: Empirical therapy can begin with broad-spectrum antibiotics, later refined to target specific pathogens.
  - Surgical Debridement
  - Restoration and Rehabilitation
  - Long-term Monitoring
- **Prognosis:**
  - With timely intervention and an individualized treatment plan, the prognosis for chronic suppurative osteomyelitis can be significantly improved, reducing the risk of complications.



Stock image of Staphylococcus aureus (MRSA).

Patient Information/Timeline Narrative

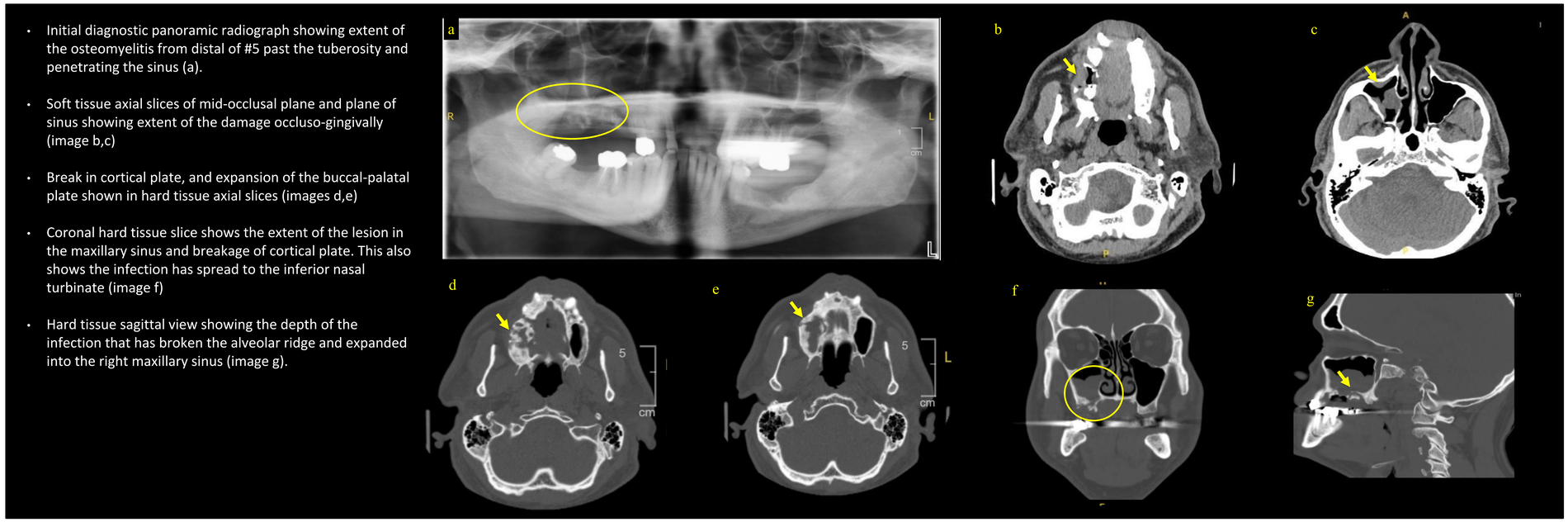
A 55-year-old male patient was referred from another hospital to the University Hospital. He was evaluated for severe pain and purulent discharge in the right posterior maxillary region. He said that he underwent an extraction in Virginia 2.5 years ago for teeth #1-4. The extraction site never healed, and he experienced pain; however, he never followed up with the dentist.
PMH: HIV+, Type 2 diabetes mellitus with diabetic neuropathy, primary hypertension, chronic kidney disease.

Clinical findings:
- Recurrent pain and pain increased on lying down.
- Area of necrotic bone distal to tooth #5 past the tuberosity with purulent discharge. CT scan shows maxillary sinus involvement.

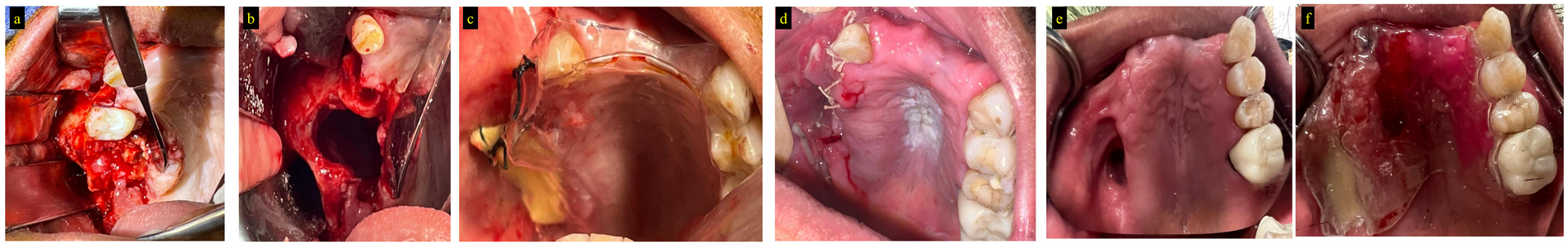
Diagnosis:
- CT MaxFace scan of the maxilla was reviewed.
- A biopsy was performed, and the results confirmed osteomyelitis with actinomycosis odontolyticus and alpha-hemolytic streptococci species.

Diagnostic Imaging of Maxillary Osteomyelitis

- Initial diagnostic panoramic radiograph showing extent of the osteomyelitis from distal of #5 past the tuberosity and penetrating the sinus (a).
- Soft tissue axial slices of mid-occlusal plane and plane of sinus showing extent of the damage occluso-gingivally (image b,c)
- Break in cortical plate, and expansion of the buccal-palatal plate shown in hard tissue axial slices (images d,e)
- Coronal hard tissue slice shows the extent of the lesion in the maxillary sinus and breakage of cortical plate. This also shows the infection has spread to the inferior nasal turbinate (image f)
- Hard tissue sagittal view showing the depth of the infection that has broken the alveolar ridge and expanded into the right maxillary sinus (image g).

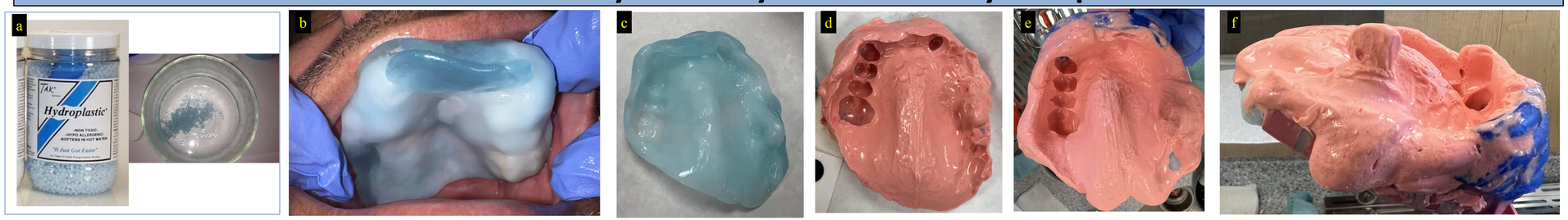


Surgical Management of Maxillary Osteomyelitis – post-surgical obturator stent



After full mucoperiosteum flap was raised, specimen from the infected bone and tooth were taken for biopsy (image a). Removal of the infected sinus, and debridement of the surrounding bone showing clean margins before suturing (image b). Image C shows the full closure of the retraction and placement of iodoform gauze in the sinus (image c). It protruded out for easy retrieval. Image d shows 10 days post op and removal of the stent/iodoform gauze. Image e shows 1 month post op and extraction of tooth #7 which was periodontally compromised with grade 2 mobility. Image f shows the placement of another stent that patient will wear while drinking/eating so that no debris gets caught in the sinus

Dental Rehabilitation of Maxillary Osteomyelitis- maxillary cast partial denture obturator



Using hydroplastic material aka “blue beads” (image a), we were able to fabricate a custom tray inside the patient’s mouth (image b). This created a more accurate custom tray without having to take an initial impression and fabricating a custom tray from the poured-up model (image c). An alternative method of using hydroplastic material is as an add-on to a stock tray (image e). After adding some blue wax to the outer edges, we can also use the hydroplastic material to extend into the defect, and further support impression material for a more accurate impression (image e,f). With either option, we were able to take an accurate impression using minimal alginate material, making the process less messy and more convenient for both the patient and the clinician (image e,f).

Fracture Resistance of Different Designs of Zirconia Surveyed Crowns

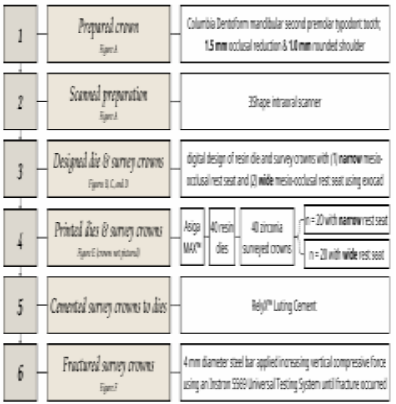
Grace Shei, Melissa Gomez, Omer Ilus, Dieu Ngo, Munair lewis-Francis, Aaron Segal, Salwa Mekled *

* Kornberg School of Dentistry, Temple University, Philadelphia, PA, * .

Introduction:
Digital dentistry has become increasingly prevalent among clinicians, with advancements in CAD/CAM technology enabling more accurate and predictable results in less time compared to conventional techniques. Surveyed crowns, commonly used in removable partial dentures (RPDs), can feature various occlusal rest seat designs. However, limited research has evaluated the fracture resistance of CAD/CAM-fabricated surveyed crowns..

Objectives
This study aims to assess the fracture resistance of zirconia CAD/CAM surveyed crowns with two different occlusal rest seat designs. The null hypothesis states that there is no significant difference in fracture resistance between the two designs.

Materials and Methods



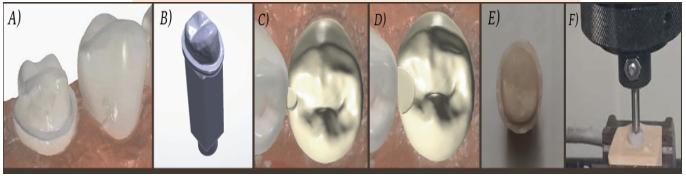


Table 1. Descriptive statistics of the fracture resistance by narrow vs. wide rest seats (N).

	n	Mean	Standard Deviation	Minimum	Median	Maximum	p-value
Narrow Rest Seats	20	2250	335	1400	2250	2800	0.179
Wide Rest Seats	19	2142	293	1400	2100	2600	

*p-value was derived from Wilcoxon signed-rank test.

Results:
The mean fracture resistance for the narrow rest seat group was 2250 ± 335 N, while the wide rest seat group had a mean resistance of 2142 ± 293 N (Table 1). Although the narrow rest seat group exhibited higher mean fracture resistance, statistical analysis revealed no significant difference between the two groups (p = 0.179).

Conclusion:
- Although statistical analysis did not indicate a significant difference, zirconia based CAD/CAM surveyed crowns with narrow occlusal rest seats exhibited higher mean fracture resistance than those with wide occlusal rest seats.

Developing a Hybrid Module to Enhance Dental Students' Learning at California Northstate University

Cat-Quynh Nguyen*, Shadi Javadi*, Shymaa Bilasy*
*California Northstate University College of Dental Medicine

Abstract

In this study, we explored the impact of a variety of pedagogical strategies to enhance dental students' engagement in several didactic courses. As expected, additional teaching strategies such as clinical cases, facilitator-guided sessions, and student-led activities yielded a more interactive learning experience, active class discussions and improved students' satisfaction. Hands-on experiences and models led to a better understanding of didactic lectures. Ultimately, reinforcing didactic knowledge with educational activities and hands-on experiences could enhance the students' preparation as future clinicians.

Introduction

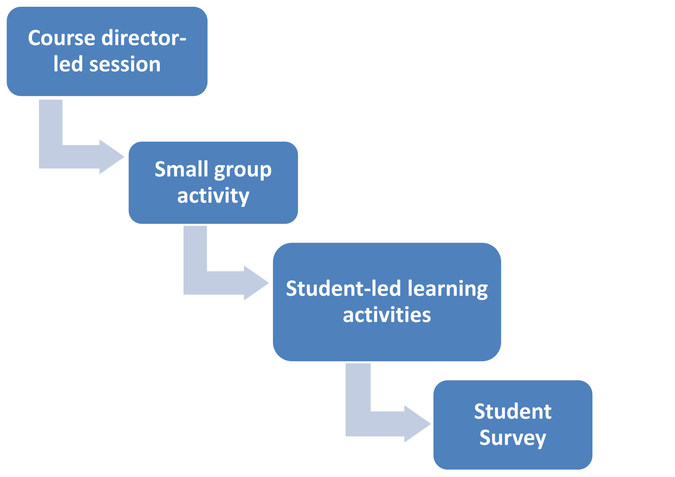
Dental education has long been rooted in traditional lecture-based teaching, a model that has been rather stagnant despite recent studies emphasizing the significance of student involvement. The 2009 ADEA Commission on Change and Innovation in Dental Education has called for the need for curricular reformation, emphasizing that many dental schools were slow to adopt active learning methodologies.

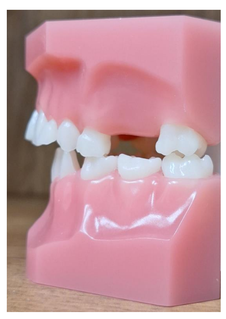
Some studies demonstrate that active learning strategies, such as flipped classrooms and case-based learning, can significantly enhance student engagement and comprehension. For instance, flipped classroom models was more effective than conventional lecture-based teaching, particularly when pre-lecture quizzes are incorporated to reinforce self-learning.[8] Likewise, case-based learning has been well-received by both students and faculty; students believed it enhanced their learning, and faculty saw a spike in student engagement and motivation.[9]

We acknowledge every student has a unique method of studying and understanding. Therefore, we aimed to analyze the students' satisfaction of a hybrid learning module that combines flipped classroom techniques, case-based learning, and supplemental active learning activities.

Methodology

The protocol for this study was reviewed and approved by the California Northstate University Institutional Review Board. The survey was provided to classes of 2025-2028 student cohorts in their first and second year of dental school. We conducted this study in the following didactic courses: Pharmacology, biomedical and clinical sciences, dental anatomy, foundations of medical sciences, growth and development, and introduction to orthodontics.

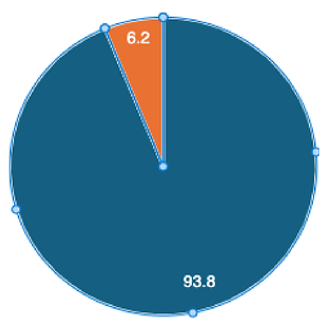


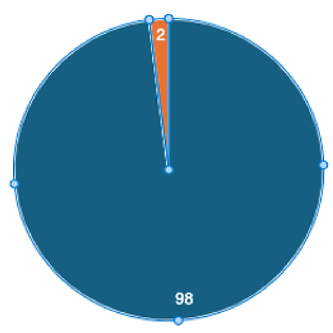

Results

This study showcased the positive impact of additional educational modalities on students' satisfaction levels of their educational experience. We analyzed a total of 20 survey questions and found that the hybrid model was beneficial to students. Percentages of students reporting significant improvement in their understanding of the lecture material per method are listed bellow:

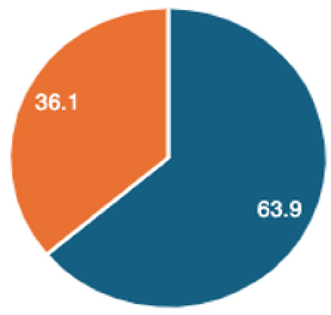
- Attending live lectures: 69.2%, facilitator-lead sessions: 86.4%, clinical cases: 93.8%, questions during presentations: 90.3%, pre/post quizzes: 63.9%, orthodontic hands-on models and activities: 98%, educational videos: 100%, magnified tooth models: 89.7%, tooth wax-ups/carvings/drawings: 70.6%, Kahoot question/student-led presentations: 64.1%, Pharm I lectures delivered after physiology lectures: 100%.



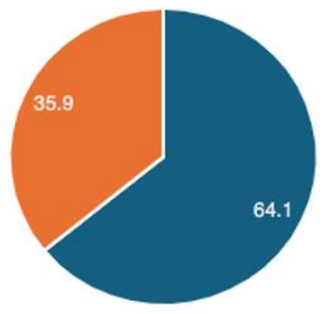
Clinical cases beneficial



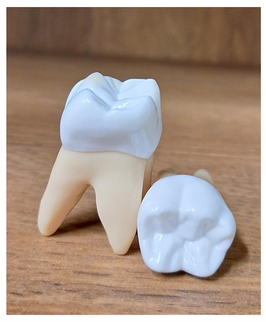
Hands-on and educational activities/models helpful in understanding orthodontic lectures and enhance clinical skills

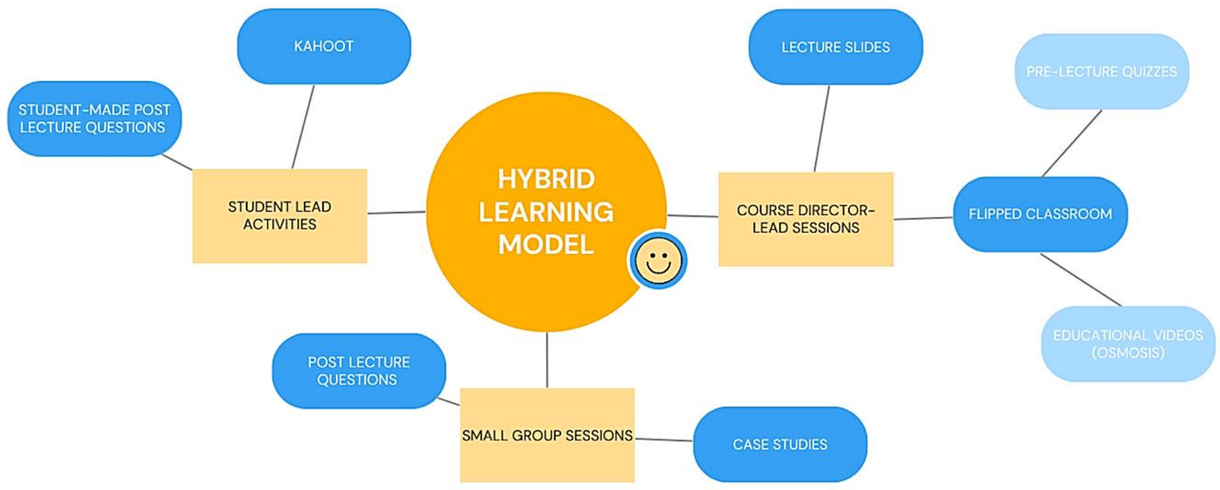


Pre/post quizzes beneficial



Student-led presentations helpful and enhanced communication skills

Conclusions

Using a variety of learning modalities not only helps accommodate different learning styles but also helps students achieve more favorable outcomes. Hands-on experiences could prepare students better as future clinicians, and active learning exercises will transform students into more independent learners. Prior studies demonstrated that active learning positively influences dental education. Future studies should focus more on skill development rather than students' satisfaction.[10]

Impact & Significance

As a newer dental institution, we have the flexibility and opportunity to adopt a state-of-the art model of learning. We hope that this project enhances the quality of our students' education and creates lasting effects throughout the entirety of their careers.

Acknowledgements and References

This work was developed during the following didactic courses: pharmacology, biomedical and clinical sciences, dental anatomy, foundations of medical sciences, growth and development, and introduction to orthodontics. Tables and references enclosed.

Deep Learning for Automated Classification of Oral Cancer: A Convolutional Neural Network Approach

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Johns Hopkins University | Krieger School of Arts and Sciences | Baltimore, MD

Introduction

Oral cancer is a significant public health concern, accounting for a substantial number of cancer-related deaths worldwide. Early detection is crucial for improving patient outcomes, but traditional diagnostic methods, such as visual examination and biopsy, can be subjective and time-consuming.

Recent advancements in deep learning have enabled the development of automated image classification models, which can assist healthcare professionals in identifying cancerous lesions more efficiently. In this study, we propose a Convolutional Neural Network (CNN) for classifying lip and tongue images into cancerous and non-cancerous categories.

By leveraging deep learning, this project aims to enhance **early diagnosis and detection** of oral cancer, potentially assisting medical professionals in clinical decision-making.

Objectives

The primary goal of this project is to develop an automated oral cancer detection system using deep learning. The specific objectives are:

1. **Develop a Convolutional Neural Network (CNN):** Design and train a deep learning model to classify oral cancer images as cancerous or non-cancerous.
2. **Preprocess Image Data:** Normalize and resize lip and tongue images to ensure optimal model performance.
3. **Evaluate Model Performance:** Assess accuracy, precision, recall, and F1-score using confusion matrices and classification reports.
4. **Enhance Early Diagnosis:** Provide an AI-assisted tool that could help healthcare professionals in early detection of oral cancer, potentially improving patient outcomes.
5. **Explore Future Applications:** Investigate the feasibility of integrating the trained model into clinical settings or a mobile/web-based application for real-world use.

Materials & Methods

This study utilizes the Oral Cancer - Lips and Tongue Images dataset from Kaggle, containing images categorized as cancerous and non-cancerous. The dataset was preprocessed by resizing all images to 128×128 pixels, normalizing pixel values to the range [0,1], and splitting the data into 80% training and 20% testing subsets.

To classify the images, a Convolutional Neural Network (CNN) was implemented. The model architecture consists of an input layer accepting 128×128 RGB images, followed by two Conv2D layers with 3×3 filters and ReLU activation functions, each paired with a MaxPooling layer (2×2 pooling size). The extracted features were then flattened and passed through a fully connected Dense layer with 128 neurons, followed by a Dropout layer (0.5) to prevent overfitting. The final output layer employs a Softmax activation function with two neurons to classify images into cancerous or non-cancerous categories.

The model was trained using the Adam optimizer and Sparse Categorical Cross-Entropy loss function, with a batch size of 32 and a total of 10 epochs. Performance evaluation was conducted using key metrics, including accuracy, confusion matrix, precision, recall, and F1-score. Visualization techniques such as training vs. validation accuracy/loss curves, confusion matrix heatmaps, and sample classified images with true vs. predicted labels were used to analyze model performance.

Results

Figure 1 – Sample Images of Cancerous Oral Lesions Used for Model Training

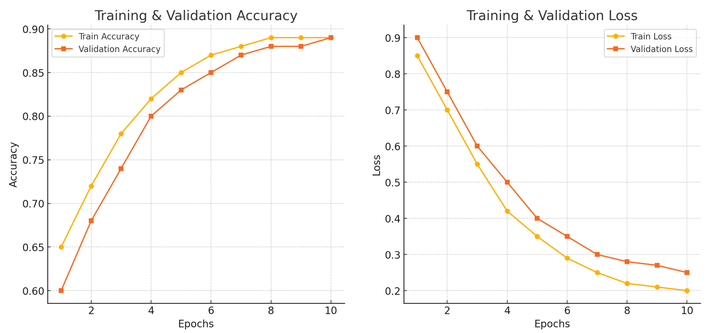


Figure 2 —Training & Validation Loss
The training and validation loss curves indicate the model's learning progression over 10 epochs. A steady decline in both training and validation loss suggests effective learning, while the minimal gap between the two curves indicates that the model is not overfitting and generalizes well to unseen data.

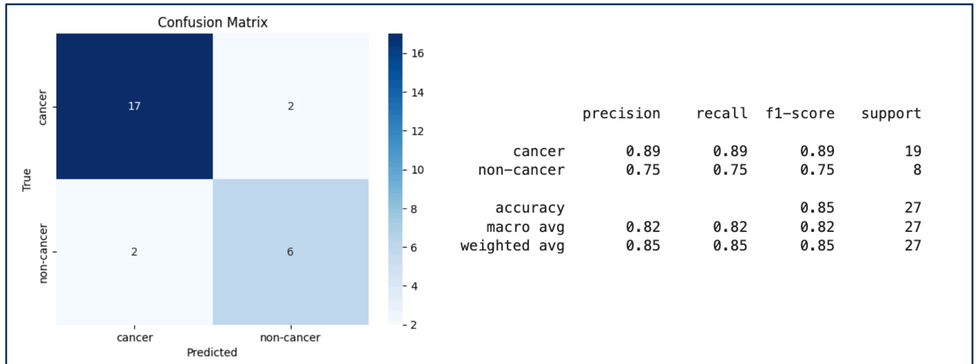


Figure 3 — Confusion Matrix and Classification Report for CNN Model Performance
The confusion matrix shows that the CNN correctly classified 17 cancerous and 6 non-cancerous cases, with two misclassifications in each category. The classification report indicates an overall accuracy of 85%, with precision and recall scores of 89% for cancerous cases and 75% for non-cancerous cases. While the model performs well in detecting cancerous cases, its lower recall for non-cancerous cases suggests room for improvement in distinguishing benign conditions.

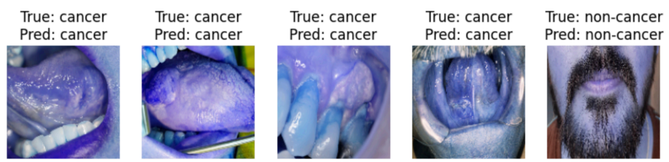


Figure 4 – Model-Predicted Cancerous Cases: Examples from the Test Set

Conclusion

The CNN model demonstrated 85% accuracy in classifying oral cancer images, effectively identifying cancerous cases with high precision and recall. While the model performed well, its lower recall for non-cancerous cases highlights the need for further optimization, such as dataset expansion or architecture refinement. Future work will focus on improving generalization and exploring deployment in clinical settings for real-world applicability.

Oral Manifestation of Congenital Tooth Agenesis and Management Strategies

Baker Al-Rawi[†], Simerit Kaur[†], Lauren Farias[†], Reina Karaki[†], Dalia Lopez-Pelayo[†], Shadi Javadi[†], Shymaa E. Bilasy[†*]
[†]California Northstate University College of Dental Medicine

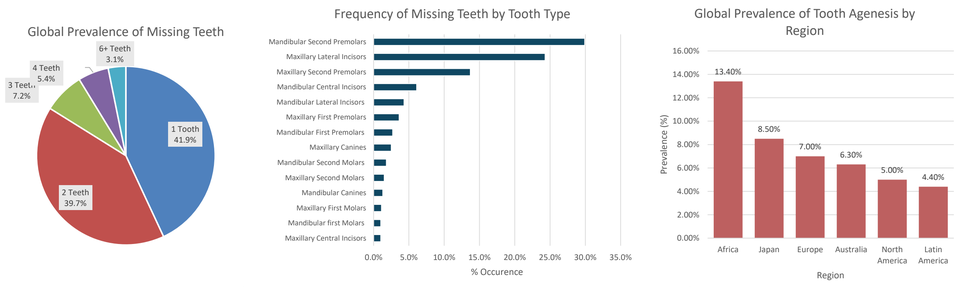
Abstract

Congenitally missing teeth can pose challenges for children, parents and dentists. Patients can experience difficulties in speech, mastication, and aesthetic concerns that can negatively impact their mental well-being. Current replacement methods seem to come with challenges and limitations. Therefore, more novel treatment modalities involving regenerative approaches are currently being investigated. Multiple studies suggested removable dentures (with overall satisfaction rates of 50-81%), fixed partial dentures (with a satisfaction rate of 84 %), and dental implants (with survival rates of 88%). Future management modalities include utilizing antibodies or stem cells.

Introduction

Congenital tooth agenesis is associated with an absence of primary or permanent teeth. Acquired tooth loss occurs after birth due to factors such as caries, periodontal disease, trauma, or other medical conditions. The congenital form of tooth loss is linked to genetics, environmental factors, and disorders, with cases ranging from hypodontia (absence of a single tooth) to anodontia (complete loss of dentition) [1].

In primary dentition, tooth loss prevalence ranges from 0.4% to 2.4%, with Europeans most commonly missing maxillary lateral incisors and Japanese populations more affected by mandibular incisors [2]. Hypodontia is more frequent in Japanese populations, while Caucasians have a prevalence of less than 1%, with most cases being unilateral [1]. Permanent dentition agenesis is more common, affecting more females except in Japanese, where second premolars are most frequently missing, and 20% of individuals lack third molars [2].



Hypodontia is influenced by environmental and genetic factors, though exact mechanisms vary. Thalidomide, Rubella, maternal smoking and alcohol use, chemotherapy in children, are linked to dental anomalies and tooth agenesis [2]. Over 300 genes, including FGF, MSX1, PAX9, AXIN2, WNT10A, EDA, TGF, BMP, RUNX2, and SHH, are involved in tooth agenesis, which is associated with more than 60 congenital disorders such as Down's syndrome, ectodermal dysplasia, Turner syndrome, Apert syndrome, Pierre Robin syndrome, and Wolf-Hirschhorn syndrome [3].

Congenital Disorders	Type of Agenesis
Down's Syndrome	54.6-58.5% impacting Maxillary Laterals, Second Mandibular Premolars, Second Maxillary Premolars
Turner Syndrome	Wnt10A involvement causing tooth agenesis, cleft lip and palatal conditions
Apert Syndrome	46.4% affecting Maxillary laterals and Mandibular Second Premolars

Tooth agenesis impacts quality of life, particularly for patients missing primary molars, leading to reduced chewing ability and overbite issues. These patients may have concave facial profiles with retruded upper lips, requiring early treatment for better outcomes [4]. Agenesis of maxillary laterals is one of the most common congenital anomalies, affecting dentofacial esthetics and self-confidence during adolescence [5].

Treatment strategies involve orthodontic interventions to manage spacing and alignment. Early primary tooth extraction may aid permanent tooth movement but does not always prevent spacing issues [6]. Diagnosis starts in infancy through clinical evaluations and imaging, as missing teeth impact both oral function and overall development [3]. Restorative treatments have shown some success, however also present with limitations [7]. A study conducted by Naishlos et al. confirmed a 100% survival rate of the restorations over a mean follow-up of 48 months. Although there were minimal complications, which included porcelain chipping (9% of cases) and restoration detachment (6% of cases), the radiograph showed no cases of secondary caries or restoration replacement [18]. Alternative novel therapies include dental stem cell and gene therapies [9, 10].

Methodology

This narrative review included *in-vitro* and *in-vivo* studies investigating different management modalities for congenital tooth agenesis. We included articles investigating the prevalence, etiology, and treatment approaches for congenital tooth loss and excluded acquired tooth loss. We also examined future management modalities including stem-cell and antibody-mediated tooth replacement.

Results

Treatment Modalities	Pros	Cons
Removable Partial Dentures (RPDs) 	• Replace multiple teeth • More cost effective than implants • Only minor adjustment needed • Suitable for growing children	• Not tolerated by all • Visible clasps • Mobile teeth • Ridge resorption if distal extension is used
Fixed Partial Dentures/ Bridges (FPDs) 	• Replace multiple teeth • More cost effective than implants • More esthetic than RPDs	• Significant modification of abutment teeth • May cause food trapping • Not viable for growing children and primary teeth
Dental Implants 	• Cause less ridge resorption since stress is distributed differently • Does not compromise masticatory function • More aesthetic and cleanable than FPDs	• Not a viable option for growing children • More expensive • Medically compromised pts may not be a good fit • Risky when involving areas close to sinuses or nerves • Ridge/sinus modifications may be needed

Stem Cells:
- Self-renew & recreate functional tissues.
- Studied for TMJ, periodontal, pulp capping & coronal regeneration.
- In mice, dentinal bridges formed using bioactive substances in the extracellular matrix [16].

BMPs (-2, -4, -7):
- Bone Morphogenic Proteins in initiation and shape a of tooth development [11].

USAG-1 Neutralizing Antibodies:
- 3D structure unknown but shares high homology with Sclerostin (SOST) from the BMP antagonist DAN family [12].
- Investigated for preventing anodontia/replacing missing teeth.
- USAG-1 abrogation affects Wnt signaling pathway regulation.

RUNX2 (Runt Related Transcription Factor 2):
- Regulates root & tooth formation in rodents.
- Linked to cleidocranial dysplasia, anodontia.
- RUNX2 genetic ablation → downregulation of WNT inhibitor NOTUM → disrupts odontoblastic differentiation [13].
- In vitro studies show RunX2 stealth siRNA-induced anodontia could be rescued with USAG-1 stealth siRNA #304 (P=0.020).
- siRNA-loaded cationized gelatin shows promise for delivery in mice; topical siRNA application showed partial tooth rescue [14].

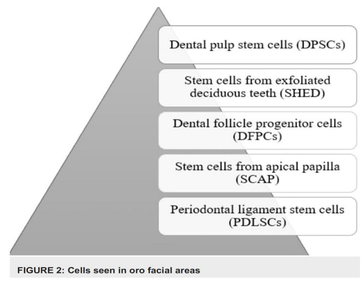
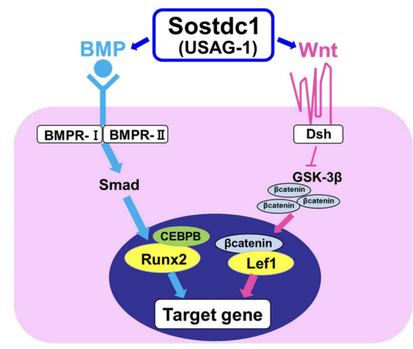
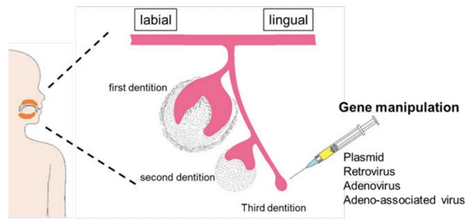


FIGURE 2: Cells seen in oro facial areas





Limitations:
- Topical USAG-1 stealth siRNA partially inhibits USAG-1 mRNA (~50%) [14].
- siRNA delivery challenges: cell transfer, biostability, vesicle selection [14].
- Embryonic stem cells have risk of tumorigenicity and ethical concerns so adult stem cells must be used.
- Difficulty obtaining sufficient quantities and preserving dental stem cells for therapy treatment [19].
- New treatment lacks long-term data; financial concerns may deter patients.

Feasibility:
- USAG-1 antibody therapy shows success in animal models [14].
- Targeting RunX2-related anodontia possible before adult tooth eruption.
- Gene therapy modalities approved by FDA for other conditions (e.g., sickle cell disease in patients 12+) [17].

Conclusions

Congenital tooth agenesis presents significant challenges in speech, mastication and aesthetics, which can impact patients' well-being. Removable dentures, fixed partial dentures, and dental implants are successful, but they come with limitations. Meanwhile, USAG-1 monoclonal antibody therapy regulates developmental pathways in tooth formation, which has the potential to regenerate missing teeth in animal models. Novel approaches have the potential to transform congenital tooth agenesis treatments to provide patients with more efficient and longer-lasting solutions.

Impact & Significance

Multidisciplinary approach involving novel therapeutic methods including stem-cell and antibody-based approaches could potentially improve the comfort and satisfaction rates of patients with congenitally missing teeth.

Acknowledgements and References

We want to thank our CNU CDM Faculty and the CNU Office of Research team for the opportunity to present our research study. References utilized in this study are available using the following QR code.

Dental Treatment in Down Syndrome Patients:

Prevalence, Barriers, and Interventions

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ABSTRACT

Background: Down Syndrome (DS) is the most common chromosomal disorder, affecting 1/700 live births[1]. With life expectancy averaging 60 years, it is crucial for healthcare professionals to address the needs of this growing population[2]. Common craniofacial features include maxillary hyperplasia, hypodontia, and malocclusions, which can affect functions like speech, chewing, and breathing[3]. These challenges make individuals with DS more likely to require significant dental treatment including specialty treatment[4]. However, despite the benefits of comprehensive dental treatment for patients with DS, there is insufficient understanding of the need and feasibility for specialty treatment, thus leading to inadequate referrals to specialists. **Methods:** DS patients who received orthodontic and prosthodontic referrals at Boston Children's Hospital (BCH) from 2003 to 2023 were reviewed. Patient demographics, medical and dental history, including specialty treatment details, including referral, consultation, and treatment duration, were obtained and analyzed. **Results:** Ninety-nine DS patients referred for orthodontic consultation were reviewed. The sample had an even sex distribution with 43.4% with >10 years at referral. The most common orthodontic issues were maxillary arch crowding (44.4%), crossbites (25.3%), and tooth impaction (16.2%). Among referred, 38.4% proceeded, with 76.3% of them completing treatment. The most frequent reasons for not starting treatment included being lost to follow-up (42.6%) or inadequate cooperation (21.3%). Most of fifteen DS patients with prosthodontic referral were female (73.7%) and >15 years of age (46.7%). Frequent prosthodontic concerns were congenitally missing teeth (73%), peg laterals (13.3%), and acquired tooth loss (13.3%). Forty percents initiated and completed the treatment, including implant-supported prostheses (50.0%), crowns (16.6%), dentures (50.0%), and fixed partial dentures (33.3%). **Conclusions:** Forty percents of DS patients who were referred for specialty treatment proceeded and completed the treatment, indicating the potential for successful dental outcomes when treatment is initiated and supported appropriately. The main barrier to starting treatment was due to loss of follow-up rather than inadequate cooperation, suggesting that ongoing support and monitoring may be key to improving treatment adherence.

MATERIALS AND METHODS

- Patient charts at the Boston Children's Hospital (BCH) Dental Clinic from 2003 to 2023 were screened with the following inclusion criteria: **1)** medical diagnosis of DS, **2)** ≥ 6 years of age, **3)** initial comprehensive or periodic evaluation performed including orthodontic or prosthodontic assessment, 4) at least one additional appointment at the BCH Dental Clinic.
- Patient radiographs, clinical notes, and billing codes were reviewed.
- Patient demographic characteristics were documented.
- Referral, consult, treatment start, and completion dates were noted.
- Barriers to overall treatment success were recorded.

RESULTS

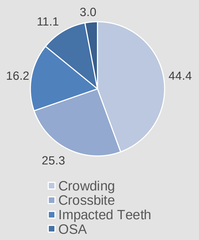
Orthodontic Patients

Our study identified 99 patients with DS who had received orthodontic referral and the demographics (Table 1) and referral reasons (Figure 1) are shown below.

Table 1: Orthodontic Patient Demographics

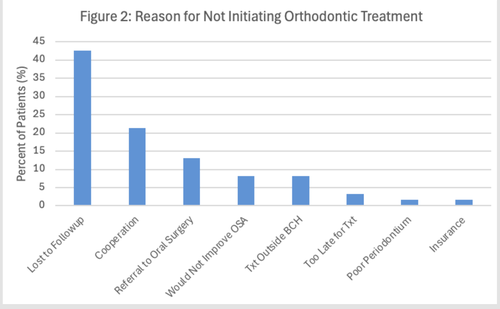
Variable	Category	n (%)
Patients	Total Number	99 (100)
Sex Distribution	Male	52 (52.5)
	Female	47 (47.5)
Age at Referral	≤10 years	28 (28.3)
	>10 years	43 (43.4)
	Unknown	28 (28.3)
Missing Teeth	Yes	55 (55.6)
	No	44 (44.4)
Orthodontic Parameter	Class I	33 (33.3)
	Class II	24 (24.2)
	Class III	42 (42.4)
	Crowding	77 (77.8)
	Openbite	36 (36.4)
	Deeepbite	25 (25.3)
	Crossbite	59 (59.6)
	Impacted Teeth	47 (47.5)
Number of Medical Conditions	≤1	9 (9.1)
	2 or 3	15 (15.2)
	>3	75 (75.7)

Figure 1: Orthodontic Referral Reason (%)



Of referred patients, 61.6% initiated treatment with the reasons for 38.4% of patients not initiating treatment seen below (Figure 2).

Figure 2: Reason for Not Initiating Orthodontic Treatment



Among the patients who initiated the treatment, 76.3% successfully completed their orthodontic treatment.

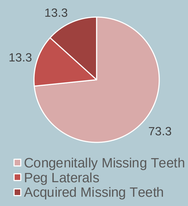
Prosthodontic Patients

Our study identified 15 patients with DS who had received prosthodontic referral and the demographics (Table 2) and referral reasons (Figure 4) are shown below.

Table 2: Prosthodontic Patient Demographics

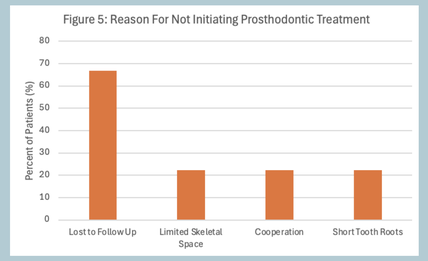
Variable	Category	n (%)
Patients	Total Number	15 (100)
Sex Distribution	Male	4 (26.7)
	Female	11 (73.3)
Age at Referral	≤ 10 years	0 (0.0)
	≤ 15 years	3 (20)
	>15 years	7 (46.7)
	Unknown	5 (33.3)
Missing Teeth	Yes	4 (26.7)
	No	11 (73.3)
Number of Medical Conditons	≤ 1	3 (20)
	2 or 3	7 (46.7)
	>3	5 (33.3)

Figure 4: Prosthodontic Referral Reason (%)



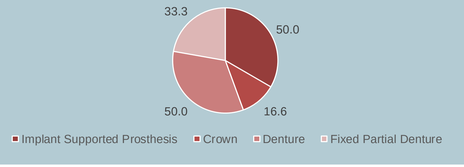
Of referred patients, 40% of patients initiated treatment with the reasons for 60% of patients not initiating treatment seen below (Figure 5).

Figure 5: Reason For Not Initiating Prosthodontic Treatment



All patients who initiated treatment successfully completed treatment with the treatment types shown in Figure 6.

Figure 6: Type of Completed Prosthodontic Treatment (%)



DISCUSSION

Despite the belief that those with DS may not tolerate certain dental treatments due to factors such as hearing loss, anxiety, or difficulty with utilizing appliances, it is clear from the present study that such individuals are able to successfully complete specialty treatment.[5] Moreover, technological advancements in materials and the overall warmness and patience of those with DS have the potential to further facilitate treatment.[6] Because it is increasingly clear that comprehensive dental care and appropriate specialty interventions could significantly improve oral function, aesthetics, and overall quality of life for these individuals, further efforts must be made to target those with DS for early comprehensive dental treatment.

CLINICAL APPLICATIONS

1. DS patients often need specialty care due to their characteristic development of craniofacial and dental development.
2. Completion of orthodontic and Prosthodontic treatment are feasible with DS patients with education and support.
3. General dentists should consider making specialty referrals to orthodontics and prosthodontics early on to support these growing populations.

REFERENCES

1. Centers for Disease Control and Prevention. (2023, June 28). *Data and statistics on Down Syndrome*. Centers for Disease Control and Prevention. https://www.cdc.gov/ncbddd/birthdefects/downsyndrome/data.html#print
2. Ijezie OA, Healy J, Davies P, Balaguer-Ballester E, Heaslip V (2023) Quality of life in adults with Down syndrome: A mixed methods systematic review. PLOS ONE 18(5): e0280014. https://doi.org/10.1371/journal.pone.0280014
3. Scalioni FAR, Carrada CF, Tavares MC, Abreu LG, Ribeiro RA, Paiva SM. Oral health characteristics in children and adolescents with Down syndrome. *Spec Care Dentist*. 2023; 1-8. https://doi.org/10.1111/scd.12883
4. Kaczorowska N, Kaczorowski K, Laskowska J, Mikulewicz M. Down syndrome as a cause of abnormalities in the craniofacial region: A systematic literature review. Adv Clin Exp Med. 2019 Nov;28(11):1587-1592. https://doi.org/10.17219/acem/112785
5. Mubayrik AB. The Dental Needs and Treatment of Patients with Down Syndrome. Dent Clin North Am. 2016 Jul;60(3):613-26. https://doi.org/10.1016/j.cden.2016.02.003
6. Desai SS. Down syndrome: a review of the literature. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 1997 Sep;84(3):279-85. https://doi.org/10.1016/s1079-2104(97)90343-7

Evaluating Google and GPT-4o as Information Sources on Bone Grafting

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Abstract

Objective: As AI models like ChatGPT 4o (GPT-4o) introduce a new source of patient education, concerns arise about the reliability, readability, and credibility of the information generated by these models. This study compares responses to frequently asked questions regarding bone grafting, assessing both the quality of sources and the readability of the content provided.

Methods: Questions were categorized using the Rothwell classification system, and sources were evaluated using the Journal of the American Medical Association (JAMA) benchmark criteria. Readability was assessed using Flesch Reading Ease, Flesch-Kincaid grade level, and Automated Readability Index (ARI) scores. Numerical responses were compared between platforms, and GPT-4o was tested for its ability to simplify medical information upon request.

Results: Google and GPT-4o didn't show a significant difference in JAMA scores, indicating both had relatively reliable information presented. GPT-4o's responses required a more advanced reading level to comprehend, as shown through Reading Ease and ARI scores (P<0.05). Numerical values varied in specificity, and both GPT-4o and Google displayed responses with broad ranges, with Google having more specific ranges than GPT-4o. User-initiated simplified responses through GPT-4o led to significant improvements in readability (p<0.01), indicating a more efficient way to access clear answers.

Conclusion: Although GPT-4o delivered structured, immediate responses with an option to simplify, there was a lack of transparency regarding sources and readability challenges. For those seeking clear and well-supported medical information, Google still remains the more reliable option.

Introduction

AI, projected to surpass $1 trillion in the next decade, is rapidly expanding. ChatGPT has advanced significantly, addressing early issues like "hallucinations" in ChatGPT 3.5 through data filtering in ChatGPT 4. The latest version, GPT-4o, improves accuracy, memory, and integrates real-time web browsing. Bone grafting is a surgical procedure that transplants bone to deficient areas in the mouth, but comes with risks: infection, graft rejection, and delayed healing. Given these concerns, many seek online information from AI tools like ChatGPT and search engines like Google. Despite studies comparing these platforms in medical contexts, research on their reliability in bone grafting information is lacking. This study evaluates the quality, accuracy, readability, and credibility of responses from GPT-4o and Google to determine AI's potential as a reliable patient resource.

Methods

We categorized our questions with the Rothwell classification system, followed by source quality evaluation with JAMA benchmark criteria (0-4 scale). Readability was assessed via Flesch Reading Ease, Flesch-Kincaid grade level, and ARI scores. Numerical responses were also compared for specificity. GPT-4o's ability to simplify medical information was tested by rephrasing Google-derived answers. Interobserver reliability was measured using Cohen's kappa, and t tests were conducted to measure statistical significance.

Rothwell classification	Definition
Fact	Asks for objective information regarding bone grafting
Policy	Asks for information regarding a course of action relating to bone grafting
Value	Asks to evaluate the use of bone grafting
Subclassification	Definition
General Information	Overview of bone grafting surgery, including its purpose, benefits, and side effects
Healing Process	Gum healing, suture reabsorption, and overall healing times.
Pain and Risks	Potential pain and side effects from the procedure.
Effectiveness	Length of time bone graft lasts, success rate, and factors determining how well the graft succeeded.
Costs and Alternatives	Financial cost of the procedure and different solutions for loss of bone.

Results:

The following table lists the top 10 FAQs extracted from Google and GPT-4o.

Google Questions	GPT-4o Questions
How painful is a dental bone graft?	What is bone grafting?
How long does a dental bone graft last?	Why is bone grafting necessary in dental procedures?
What is the downside of a bone graft?	What are the different types of bone grafts?
Does bone grow back after a bone graft?	How does bone grafting promote bone regeneration and healing?
Is dental bone grafting expensive?	What is the success rate of dental bone grafts?
Which is worse, a bone graft or an implant?	What are the risks associated with bone grafting?
Do I really need a bone graft after tooth extraction?	How long does it take for a bone graft to heal?
Is a bone graft major surgery?	Is bone grafting painful?
How soon can I eat after a dental bone graft?	Are there alternatives to bone grafting?
What happens if you don't get a dental bone graft?	What factors affect the success of a bone graft?

Source Quality

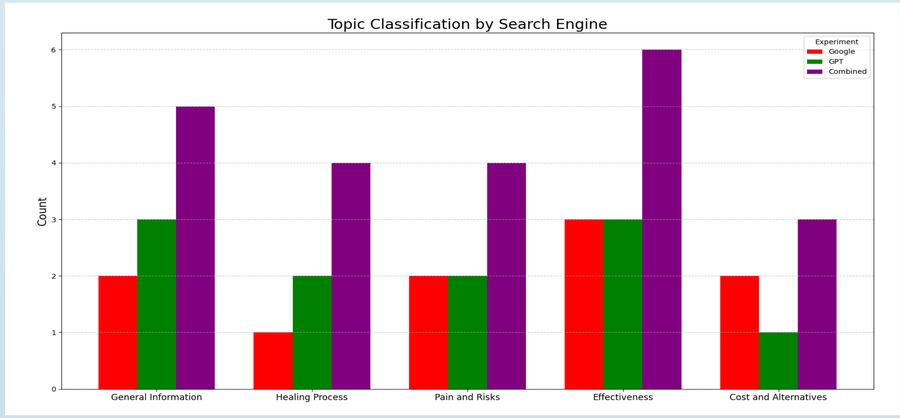
Google results yielded on average lower JAMA source criterion scores than GPT-4o, with a similar standard deviation, leading to an insignificant difference between the two. This indicates that the difference in source quality was insignificant.

JAMA Score	Google	GPT-4o	P-Value
0	0	0	-
1	1	0	-
2	5	3	-
3	4	5	-
4	0	2	-
Average +/- SD:	2.3 +/-0.64	2.9 +/-0.7	P = 0.0608

Numerical Answers

Four questions were found to prompt numerical answers between both Google and GPT-4o, as listed in Table 4. In general, GPT-4o and Google provided similar answers, however ChatGPT 4o tended to be more vague in their response and give a broad range, as shown in response to the questions "What is the success rate of dental bone grafts" and "How long does it take for a bone graft to heal". However, it is also important to note that for the question "How soon can I eat after a dental bone graft", Google answered a range of 2-4 days, which significantly different from GPT-4o answer of 1-2 hours, which is a smaller span of time and more realistic.

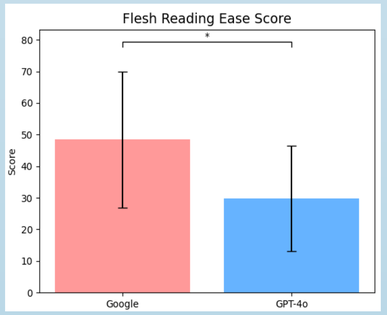
Question	Google Answer	GPT-4oAnswer
How long does a dental bone graft last?	Lifetime	Lifetime
How soon can I eat after a dental bone graft?	2-4 days	1-2 hours
What is the success rate of dental bone grafts?	100%	90%-95%
How long does it take for a bone graft to heal?	3 months	3-12 months

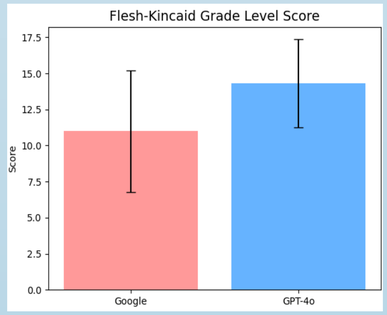


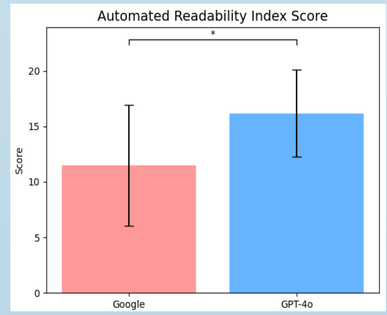
Google and GPT-4o both had an equal number of questions classified as fact. GPT-4o had one more questions classified as value (4 vs 3) and one less questions classified as policy (2 vs 3).

Readability

On average, answers provided by Google had a higher Flesch Reading Ease score than GPT-4o, lower Flesch-Kincaid grade level score than GPT-4o, and a lower ARI score than GPT-4o. Through t-test analysis, it was determined that Google and GPT-4o has significantly different Flesch Reading Ease scores (P<0.04), but not significantly different Flesch-Kincaid grade level scores (P<0.06). ARI scores were also significantly different (P<0.04). These results indicate that responses made by GPT-4o are more difficult to read, generally contain longer sentences, but requires a similar academic level to understand (grade level score), as compared to Google responses.

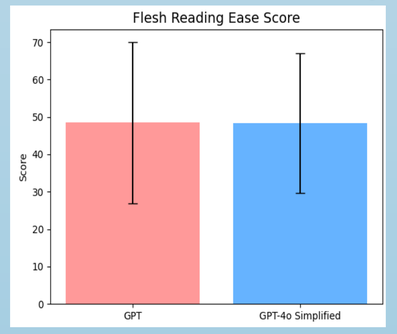


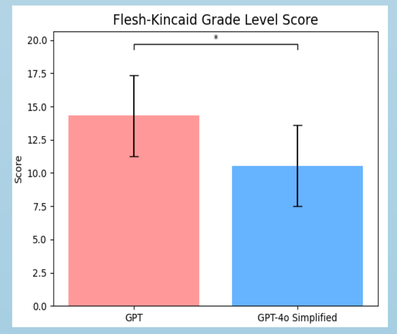


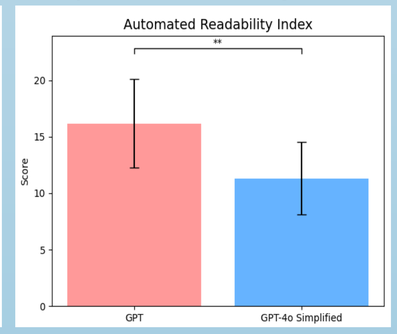


GPT Simplification

On average, simplified answers provided by GPT-4o had a similar Flesch Reading Ease score, lower Flesch-Kincaid grade level score, and a lower ARI score than those of GPT-4o. Through t-test analysis, it was determined that Google and GPT-4o has insignificantly different Flesch Reading Ease scores (P<1), but significantly different Flesch-Kincaid grade level scores (P<0.01) and ARI scores (P<0.007). These results indicate that requested simplified responses from GPT-4o significantly lowered the academic level needed to understand responses and shortened sentences, but did not necessarily make it easier to comprehend.







Discussion

As AI becomes a new source of patient information and medical education, we need to evaluate the quality of information that is being presented to viewers. In our study, we found certain patterns when comparing Google and GPT-4o. For both sources of information, there was no significant difference in JAMA scores, indicating both had relatively reliable information presented. GPT-4o's responses also required a more advanced reading level to comprehend, as shown through Flesch-Kincaid Reading Ease and ARI scores (P<0.05). However, the Flesh-Kincaid Grade Level score had no significant different indicating that the minimum grade level required to understand the responses was the same. Numerical values varied in specificity, and both GPT-4o and Google displayed responses with ranges, with Google having more specific ranges than GPT-4o. User-initiated simplified responses through GPT-4o led to significant improvements in readability (p<0.01), indicating a more efficient way to access clear answers. Although GPT-4o delivered structured, immediate responses with an option to simplify, there was a lack of transparency regarding sources and readability challenges. For those seeking clear and well-supported medical information, Google still remains the more reliable option.

References

Mastrokostas PG, Mastrokostas LE, Emara AK, Wellington IJ, Ginalis E, Houten JK, et al. GPT-4 as a Source of Patient Information for Anterior Cervical Discectomy and Fusion: A Comparative Analysis Against Google Web Search. Global Spine Journal. 2024 Nov;14(8):2389–98. Ferrari-Light D, Merritt RE, D'Souza D, Ferguson MK, Harrison S, Madariaga ML, et al. Evaluating ChatGPT as a patient resource for frequently asked questions about lung cancer surgery-a pilot study. J Thorac Cardiovasc Surg. 2024 Sep 24;S0022-5223(24)00837-7.

Disclaimer

Therapy Dogs Impact on Built Environment Burden In Pediatric Dental Setting

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Julie L. Marshall, PhD, Michael G. Schmidt, PhD, Deirdre S. Williams, DDS, MS, Mathew Gregoski, MS,PhD, Mary Elizabeth Shue, Cathy Bennett, Jackson Algiers, DMD, Robert Griffeth, DMD
L.

OBJECTIVE

The intent of the study was to assess whether the introduction of a certified therapy dog would significantly increase the microbial burden associated with surfaces within the built clinical environment sufficient to warrant changes to the existing infection control bundle employed by the college to limit the risk of healthcare-associated infections (HAI). Specifically, this study pragmatically evaluated the microbial burden associated with fourteen patient-occupied dental operatories, in the pediatric dental clinic at the Medical University of South Carolina.

BACKGROUND

The results of a survey of pediatric dentists published in 2023 found that while respondents were supportive of therapy animals in the dental office, the most common concern was hygiene (Guram et al., 2023). To address this, we incorporated an aim into a clinical trial to assess whether the presence of a therapy dog increased the microbial burden in the dental operatory.

The microbial burden limits that minimize the risk of HAI are well-documented (Dancer, 2004) as are the guidelines on reducing the risks of using animals in healthcare settings (Murthy et al., 2015). There are few studies, however, that specifically measure the effects of a therapy dog on the microbial burden in a healthcare setting, and none related to dentistry.

Patient Animal Wellness Service (PAWS)

PAWS is an Animal-Assisted Activity (AAA) and Animal-Assisted Therapy (AAT) program at MUSC. Each therapy dog must pass extensive screening and be certified by a nationally accredited therapy animal organization. Volunteer handlers agree to comply with the following guidelines regarding their therapy animals: an annual veterinary exam and current vaccinations; animal must be bathed/groomed in the 24 hours prior to visits; carry hand sanitizer for patients to use before and after petting the dog; and both handler and therapy dog must wear an MUSC-issued photo identification badge.

Figure 1. PAWS & CDM Collaboration Logo

Figure 2. Assessment of the introduction of a certified therapy dog to the resident microbial burden

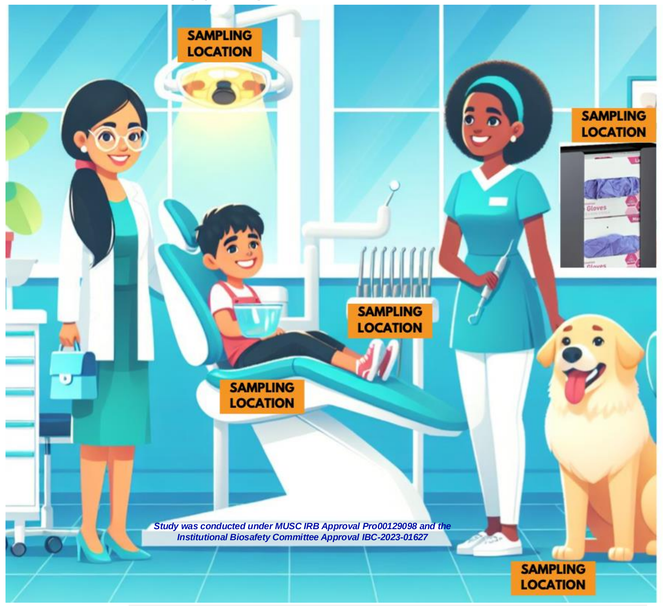

Table 1: Descriptives

	Pre	Post
Median	0	0
Interquartile Range	0.8	0.4
Minimum	0	0
Maximum	179.2	225.6
All values are reported as CFU/cm^2		

METHODS

This study pragmatically evaluated the microbial burden associated with 14 patient-occupied dental operatories, rigorously following the established infection control bundle for routine disinfection.

- Total aerobic colony-forming units within an area of 100cm^2 (CFU/cm^2) were measured from 5 distinct locations, shown in Figure 2.
- To ensure that sampling would not skew the results, a different location was sampled pre and post introduction of the certified therapy dog. Each template-assisted area was sampled by rolling the swab over each surface for five repetitions up and down and five repetitions left and right.
- Specimens were vortexed for 30 seconds and 100 µl from each sample was placed onto Trypticase Soy Agar supplemented with 5% sheep erythrocytes; plates were incubated inverted at 37°C for 48 hours.
- The colonies were enumerated and the concentration per area sampled was computed and expressed as total aerobic colony-forming units 100 cm^2 (CFU/cm^2)
- The data were recoded into three categories: Below the Limit of Detection (LoD), Acceptable (< 5 CFU/cm^2), and Unacceptable (> 5 CFU/cm^2). We used Fisher's exact test to assess the relationship between the category of CFU/cm^2 and whether a therapy dog was present or not.

RESULTS

For all surfaces combined, Fisher's exact test indicates that there is no difference in the microbial burden due to the presence of the therapy dog (p=.67). These results hold when each surface was analyzed separately.

Table 2: Test of Independence, All Surfaces

Treatment		Below LoD	Acceptable	Unacceptable	Total
Dog	**Count**	30	7	3	40
	Within Treatment %	75.0	17.0	7.5	100.0
No Dog					
	Count	20	7	3	30
	Within Treatment %	66.7	23.3	10.0	100.0
TOTAL		50	14	6	70

Fisher-Freeman-Halton exact test p=0.67

CONCLUSIONS

The conclusion is:

- **Introduction of a certified therapy dog into a dental operatory, during the provision of restorative dental procedures to pediatric patients, had no effect on the microbial burden present in the built environment of the operatory.**

ACKNOWLEDGMENTS

1. The Medical University of South Carolina – CDM
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4. Department of Microbiology & Immunology
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REFERENCES

Guram JS, Williams DS, Marshall JL. Considerations for Utilization of Animal-Assisted Therapy in Pediatric Dentistry Practice. J Dent Child (Chic). 2023 May 15;90(2):70-75. PMID: 37621045.

Dancer SJ. How do we assess hospital cleaning? A proposal for microbiological standards for surface hygiene in hospitals. J Hosp Infect. 2004 Jan; 56(1):10-5. doi: 10.1016/j.jhin.2003.09.017. PMID: 14706265; PMCID: PMC7134512.

Murthy R, Bearman G, Brown S, Bryant K, Chinn R, Hewlett A, George BG, Goldstein EJ, Holzmann-Pazgal G, Rupp ME, Wiemken T, Weese JS, Weber DJ. Animals in healthcare facilities: recommendations to minimize potential risks. Infect Control Hosp Epidemiol. 2015 May;36(5):495-516. doi: 10.1017/ice.2015.15. PMID: 25998315.

Survey of Army dentists using CADCAM software for quality evaluations

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OBJECTIVE

Army dentistry has embraced Computer-aided Design and Manufacturing (CAD/CAM) technology to provide same-day crowns, enhancing operational dental readiness, expediting care, reducing lab turnaround times, and potentially minimizing dental emergencies through fewer provisional restorations. This integration has improved patient care efficiency, allowing dental practitioners to meet the military's evolving demands. However, same-day crown delivery bypasses traditional visual quality control protocols, raising concerns about accountability in crown preparation quality. While CAD/CAM software includes preparation analysis features for parameters like occlusal clearance and margins, it is unclear whether military providers routinely use these tools. This study investigates how active-duty dental providers assess crown preparations when utilizing CAD/CAM technology.

HYPOTHESIS

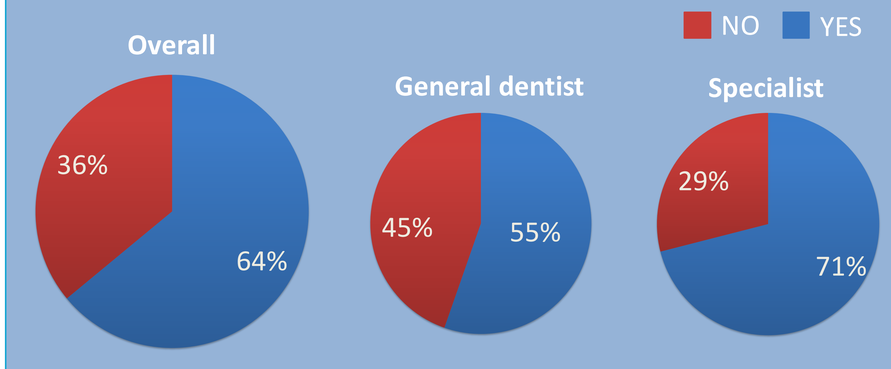
There is a difference in how crown preparations are analyzed among military providers using CAD/CAM technology. Providers may not adequately execute quality assessments with CAD/CAM tools.

METHODS

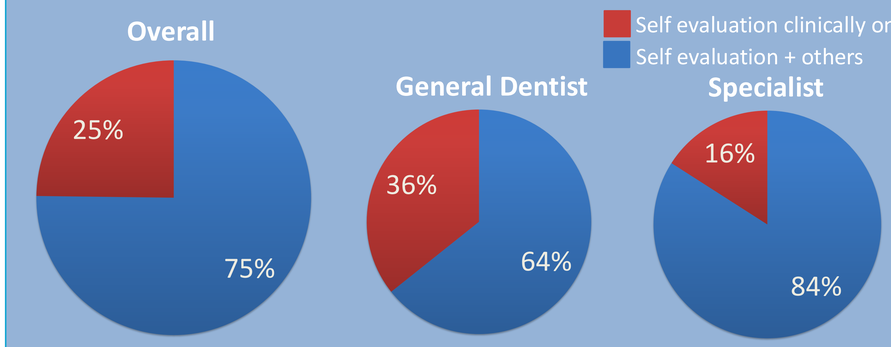
A survey was conducted using Microsoft Forms, targeting active-duty general dentists, comprehensive dentists, prosthodontists, AEGD residents, and prosthodontic residents in the Army Dental Corps. The survey covered demographic information (age, experience, residency), CAD/CAM usage (frequency, proficiency), and methods of crown preparation evaluation. Responses were analyzed to identify variations among specialties and general dentists.

RESULT

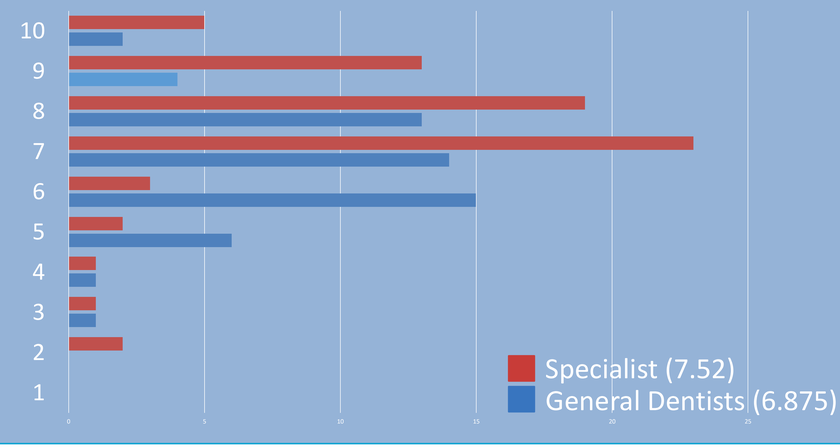
Do you use the Preparation Analysis Feature on the CAD/CAM software to evaluate your crown prep?



How do you evaluate your crown preparation during chair-side CAD/CAM preparation?



CAD/CAM Proficiency Rating



DISCUSSION

Overall, 36% of respondents do not use CAD/CAM analysis for quality control, while 25% rely solely on self-evaluation. Among 69 specialists and 56 general dentists surveyed, 29% of specialists and 45% of general dentists do not utilize CAD/CAM analysis, while 16% of specialists and 36% of general dentists depend exclusively on self-evaluation.

CONCLUSION

The findings reveal a significant gap in CAD/CAM utilization for quality control among Army dentists. More than a third of providers bypass software analysis, with general dentists exhibiting lower adoption rates compared to specialists. This points to a need for increased training and implementation of CAD/CAM software for crown preparation quality control.

REFERENCES

1. Mitchener T, Hwang Y, Qureshi I, Sarwar T, McIntosh Z, Colthirst P, Simecek J. Comparison Of The Most Common Dental Emergencies Seen At Dental Treatment Facilities And The Most Common Oral Facial Disease Requiring Medical Evacuations Of U.S. Army Personnel In Deployed Theaters Since 2000. NAMRU-SA Report #22- 633.
2. Wojcik BE, Szeszel-Fedorowicz W, Humphrey RJ, Colthirst P, Guerrero AC, Simecek JW, Fedorowicz A, Eikenberg S, Rogers GG, DeNicolo P. Risk of dental disease non-battle injuries and severity of dental disease in deployed U.S. Army personnel. Mil Med. 2015 May;180(5):570-7. doi: 10.7205/MILMED-D-14-00364. PMID: 25939113.
3. Hodd, Jeffrey A. "CAD/CAM dentistry for today's on-the-go military." *U.S. Army Medical Department Journal*, Jan.-Mar. 2011, pp. 26+. *Gale Academic OneFile*, link.gale.com/apps/doc/A253627595/AONE?u=anon~817aef06&sid=googleScholar&xid=71d970a5. Accessed 30 Dec. 2023.
4. Schweyen R, Beuer F, Bochskanl M, Hey J. Implementing a new curriculum for computer-assisted restorations in prosthetic dentistry. Eur J Dent Educ. 2018 May;22(2):e237-e247. doi: 10.1111/eje.12278. Epub 2017 Jun 27. PMID: 28653464.
5. Nassani MZ, Ibraheem S, Shamsy E, Darwish M, Faden A, Kujan O. A Survey of Dentists' Perception of Chair-Side CAD/CAM Technology. Healthcare (Basel). 2021 Jan 13;9(1):68. doi: 10.3390/healthcare9010068. PMID: 33451003; PMCID: PMC7828474.
6. Dickens N, Haider H, Lien W, Simecek J, Stahl J. Longitudinal Analysis of CAD/CAM Restoration Incorporation Rates into Navy Dentistry. Mil Med. 2019 May 1;184(5-6):e365-e372. doi: 10.1093/milmed/usy260. PMID: 30371810.

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Outcome Assessment of Protective Dental Treatment for Patients with Enamel Defects

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Abstract

Backgrounds: Patients with developmental defects of enamel is common, with a prevalence of 24-49% in primary dentition and 9-63% in permanent dentition in developed countries. Developmental enamel defects are alterations that occur during the mineralization or amelogenesis process. The ameloblast has little reparative capacity; thus any disruption to enamel formation results in permanent changes. Conditions such as Amelogenesis Imperfecta and hypo-mineralization weaken enamel, making teeth more susceptible to attrition, erosion, sensitivity, and caries, thus increasing the risk of premature extractions and subsequent malocclusions. This study aims to evaluate the impact of early protective interventions, such as stainless steel crowns (SSCs), in reducing extractions and orthodontic treatment needs in pediatric patients with enamel defects. **Methods:** A retrospective cohort study was conducted at Boston Children's Hospital, analyzing dental and orthodontic records of patients with defective enamel between January 2010 and February 2024. Data collected included SSC placement, premature extractions, malocclusion patterns, and orthodontic referrals. **Results:** Of the 48 patients we reviewed, 70.83% received protective interventions, with 60.42% involving SSCs, primarily placed on primary molars before age 8. Malocclusion patterns included were deep bite (28.57%), Class II malocclusion (47.62%), Class III malocclusion (14.29%) and anterior crossbite (19.05%), which are all higher than typical population. For patients who received protective interventions at age 5 or younger, the average time between SSC placement and extractions was 43.1 months. For patients who received the SSCs after age 5, the average time decreased to 18.5 months. This suggests that earlier protective interventions delays the incidence of premature extractions. Most of the patients who received protective SSCs (79.31%) had them placed in the operating room under general anesthesia, which allows for extensive treatment at a young age, with an average of 11.83 teeth treated per visit.. **Conclusions:** Early protective interventions help preserve dentition and delay premature extractions in patients with enamel defects. When young patients with enamel defects are identified, general dentists should consider referring children to facilities with general anesthesia where they could receive protective interventions that help maintain their teeth. Given the high prevalence of malocclusion, early interdisciplinary collaboration is essential for effective treatment planning.

Introduction

Developmental enamel defects are increasingly recognized, with prevalence rates ranging from 24-49% in primary dentition and 9-63% in permanent dentition in developed countries.[1] These defects result from disruptions in the mineralization or amelogenesis process, leading to irreversible structural weaknesses due to the limited reparative capacity of ameloblasts.[2] Conditions such as Amelogenesis Imperfecta and hypo-mineralization compromise enamel integrity, making teeth more prone to attrition, erosion, sensitivity, and decay. Without appropriate intervention, these patients are at increased risk for premature extractions, which then contribute to the development of malocclusions and increased orthodontic treatment needs. Ensuring optimal dental care for patients with enamel defects is essential for preserving their oral health and overall well-being.[3] Raising awareness among dental providers about effective management strategies is crucial for improving long-term outcomes in this population. Effective protective treatments includes the use of stainless steel crowns (SSCs) in children with primary and early mixed dentition. These restorations provide full coronal coverage, effectively managing tooth sensitivity and reinforcing structurally compromised molars.[4]

This study evaluates the role of early protective interventions, particularly SSC placement, in minimizing the need for extractions and mitigating subsequent orthodontic complications in patients with enamel defects. By analyzing protective measures and malocclusion patterns, we aim to provide insights that encourage early dental management and orthodontic evaluation. Ultimately, our findings underscore the importance of interdisciplinary collaboration in developing timely, effective treatment strategies for this high-risk patient population.

Methods

This study was a retrospective cohort study of previously rendered dental and orthodontic treatments for pediatric patients with enamel defects. Patient charts from January 2010 to February 2024 were screened to identify patients of record at the BCH Dental Clinic with a medical diagnosis of amelogenesis imperfecta or enamel hypoplasia. The inclusion criteria of the study were: (1) a diagnosis of amelogenesis imperfecta and/or enamel hypoplasia, (2) at least 2 years of age, (3) an initial comprehensive or periodic evaluation performed. Patient charts were retrospectively analyzed for comprehensive initial or periodic examinations, consultations, evaluations, and treatment appointments with a pediatric dentist, orthodontist, or prosthodontist, as well as records of composite crowns, stainless steel crowns, operating room visits, and clinical notes. Demographic variables included the patient's date of birth and gender. Additional patient characteristics, such as patient age at treatment received in the operating room, age at premature extractions, and medical history, were documented. Information regarding orthodontic treatment, including referral date and patient age at referral, was noted.

Results

Our study examined 48 patients who were diagnosed with an enamel defect. 34 patients (70.83%) underwent procedures to protect their teeth, including SSCs, strip crowns, Zirconia crowns, composite build-up, and resin-modified glass ionomer restorations. 29 patients (60.42%) received SSCs as a protective measure. 23 of the patients who received SSCs (79.31%), underwent this treatment in the OR under general anesthesia. An average of 11.83 teeth were treated per OR visit.

Figure 1. SSC placement by tooth type. 187 stainless steel crowns were placed in total. 144 of these SSCs (77.01%) were placed on primary molars

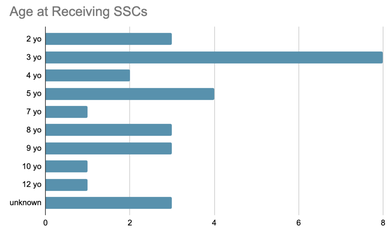
Tooth Type	# of Maxillary SSCs	# of Mandibular SSCs	Total # of SSCs
Primary incisors	3	2	5
Primary canines	4	6	10
Primary 1st molars	33	36	69
Primary 2nd molars	37	38	75
Total primary teeth	77	82	159
Permanent 1st molars	10	16	26
Permanent 2nd molars	0	2	2
Total permanent teeth	10	18	28
Total	87	100	187

Our study defined "premature extractions" as the extraction of a tooth before the normal expected period of exfoliation.[5] Reasons include caries or root resorption.

Figure 3. Premature extractions by Tooth Type. 26 patients (54.17%) underwent premature extractions. 119 total teeth were extracted. 83 (69.75%) of the teeth were primary teeth and 36 (30.25%) were permanent teeth.

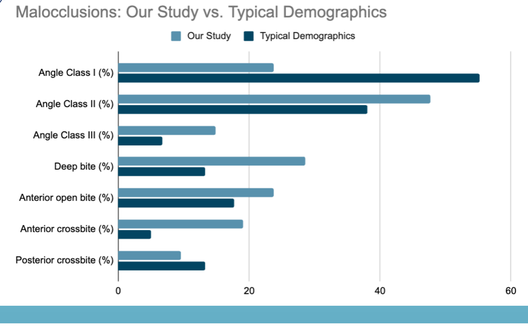
Tooth Type	# of Max. Extractions	# of Mand. Extractions	Total # Extractions
Primary incisors	16	4	20
Primary canines	12	6	18
Primary 1st molars	10	10	20
Primary 2nd molars	10	15	25
Total primary teeth	48	35	83
Permanent 1st premolars	0	2	2
Permanent 2nd premolars	2	0	2
Permanent 1st molars	14	12	26
Permanent 2nd molars	2	4	6
Total permanent teeth	18	18	36
Total	66	53	119

Figure 2. SSC placement by age. 21 SSC patients (72.41%) had them placed at or before age 8.



12 patients received protective measures, such as SSCs, and underwent premature extractions. 4 of these patients had these procedures done on different teeth in a single OR visit under general anesthesia. The other 8 patients underwent extractions after protective measures were taken. For patients who received protective measures at 5 years old or younger, the average time between SSC placement and extractions was 43.1 months. For patients who received the SSCs after the age of 5, the average time decreased to 18.5 months.

Figure 4. Malocclusion distribution compared to typical demographics.[6] The following malocclusion demographics include overlapping diagnoses: 5 cases of Angle Class I (23.81%), 10 cases of Angle Class II (47.62%), 3 cases of Angle Class III (14.29%), 6 cases of deep bite (28.57%), 5 cases of anterior open bite (23.81%), 4 cases of anterior crossbite (19.05%), and 2 cases of posterior crossbite (9.52%).



Discussion

This study highlights the importance of early protective interventions in managing enamel defects, such as those seen in patients with Amelogenesis Imperfecta (AI). The high prevalence of SSC placement (60.42%) reinforces their role as an effective treatment for preserving compromised dentition, particularly in primary molars (77.01%). Maintaining primary dentition is critical in preventing premature extractions and associated malocclusions, which may necessitate orthodontic treatment. The significant number of patients (79.31%) receiving SSCs under general anesthesia, with an average of 11.83 teeth treated per visit, demonstrates the efficiency of managing extensive enamel defects in an operating room (OR) setting. 72.41% of SSCs placed at or before age 8 reinforces the need for early intervention. SSC placement also appears to delay premature extractions. Patients receiving SSCs at age 5 or younger experienced an average delay of 43.1 months before extraction, compared to 18.5 months for those treated after age 5. This demonstrates the importance of early intervention in preserving dentition and reducing space loss. Malocclusion patterns in this population further highlight the need for early intervention. Excessive enamel wear contributes to a reduced vertical dimension of occlusion, with a higher prevalence of Class II malocclusion (47.62%), deep bite (28.57%), anterior crossbite (19.05%), and Class III malocclusion (14.29%), compared to typical demographics. The reduced prevalence of Class I malocclusion (23.81%) underscores the impact of enamel defects on dental development. However, SSC placement may help preserve occlusal stability over time. Future research should explore methods to enhance SSC durability and investigate alternative protective materials to improve treatment strategies. By prioritizing early intervention and working closely with pediatric dentists and orthodontists, general dentists can play a crucial role in improving long-term oral health outcomes for patients with enamel defects, minimizing the need for extractions and orthodontic treatment, while preserving long-term function and esthetics throughout childhood and into adulthood.

Clinical Recommendations

1. Prioritize Early Protective Intervention

- Initiate restorative treatment as early as possible for patients with enamel defects.
- Consider SSCs and space maintainers for primary molars to preserve tooth structure, prevent premature extractions, and maintain arch integrity.
- SSC placement before age 5 extends the average time before extraction to 43.1 months, compared to 18.5 months for those receiving SSCs later.
- Early intervention helps maintain primary dentition, preventing space loss and reducing the severity of developing malocclusions.

2. Utilize the OR for Extensive Treatment

- Operating Room-Based SSC placement under general anesthesia is an effective approach for young patients with extensive enamel defects.
- Treating multiple teeth in a single OR visit (11.83 teeth per visit) minimizes progressive enamel breakdown and reduces the need for multiple treatment sessions.

3. Monitor for SSC Failures and Space Maintenance

- Patients with enamel defects are at higher risk for SSC failure, recurrent decay, and premature tooth loss.
- Implement frequent follow-ups and oral hygiene education for patients and caregivers.
- Use space maintainers when extractions are unavoidable to prevent unwanted tooth movement and preserve occlusal stability.

4. Evaluate Occlusion and Collaborate with Specialists

- Enamel defects often lead to reduced vertical dimension of occlusion, increased Class II and III malocclusions, deep bite, and anterior crossbite.
- Close collaboration between general dentists, pediatric dentists, and orthodontists ensures optimal long-term occlusal development and oral-health outcomes.

By implementing these recommendations, general dentists can play a pivotal role in preserving dentition, maintaining occlusal function, and improving long-term outcomes for patients with enamel defects.

References

1. Alvarez, Jorge O., and Inger K. Navia. 2013. "Nutritional Status and Dental Fluorosis: A Study of Children in a Rural Area of Mexico." *Revista Panamericana de Salud Pública* 33(5):337–45. Retrieved March 28, 2025 (https://pmc.ncbi.nlm.nih.gov/articles/PMC3613868/).
2. Dental Journal. 2024. "Title of Article." *Dent. J.* 12(4):84. Retrieved March 28, 2025 (https://doi.org/10.3390/dj12040084).
3. Trentesaux, T., Rousset, M.M., Dehayin, E., Laumaille, M., Delfosse, C. 15-year follow-up of a case of amelogenesis imperfecta: importance of psychological aspect and impact on quality of life. European Archives of Pediatric Dentistry, 2013, 14(1): 47-51. https://pubmed.ncbi.nlm.nih.gov/23532814/.
4. Marquezin, M. C. S., Zancopé, B. R., Pacheco, L. F., Gavião, M. B. D., & Pascon, F. M. (2015). Aesthetic and functional rehabilitation of the primary dentition affected by amelogenesis imperfecta. *Case Reports in Dentistry*, 2015, Article 790890. https://doi.org/10.1155/2015/790890.
5. Spodzieja, K., & Olczak-Kowalczyk, D. (2022). Premature loss of deciduous teeth as a symptom of systemic disease: A narrative literature review. *International Journal of Environmental Research and Public Health, 19*(6), 3386.
6. Almeida, M. R. de, Pereira, A. L. P., Almeida, R. R. de, Almeida-Pedrin, R. R., & Silva Filho, O. G. da. (2011). Prevalence of malocclusion in children aged 7 to 12 years. *Dental Press Journal of Orthodontics, 16*(4), 123–131. https://doi.org/10.1590/S2176-94512011000400019.