



JOURNAL OF DENTAL RESEARCH

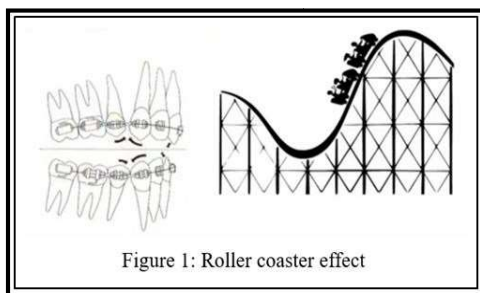
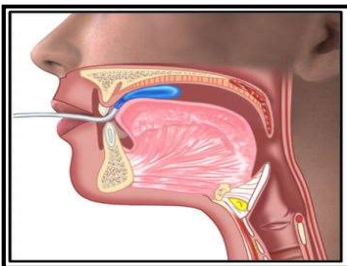
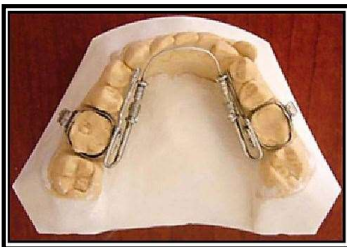


Figure 1: Roller coaster effect

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# From the Desk of Editor-in-Chief

With immense pleasure I would like to announce that we are publishing the Volume 06 (Issue 01 – Jan - June 2024) of MIDSJR Journal of Dental Research after the successful publication of four volumes. *“Everything is possible when you have right people to support”*, I would like to extend my heartfelt thanks to the authors and our management for their constant faith in me and their utter support.

The Volume 05 (Issue 06- Jan- June 2024) has been created with the great efforts of providing the quality manuscripts rather than the quantity, the volume contains original article on Efficacy of Herbal Mouthwash in Maintaining Gingival Health in Patients Undergoing Orthodontic Treatment, case reports on Orthodontic Extrusion of Traumatized Anterior Teeth by Simplistic Approach Also, review articles on Archwire Sequencing for Different Bracket Systems A Clinical Guide for Fixed Orthodontic Treatment.

I dedicate this issue to all the faculty members of MIDSJR Dental College, Latur who immediately responded to the call for manuscripts and submitted their valuable work to the journal.

**Dr. Suresh K. Kangane**  
**Principal,**  
**MIDSJR Dental College, Latur**

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# Efficacy of Herbal Mouthwash in Maintaining Gingival Health in Patients Undergoing Orthodontic Treatment- A Scoping Review

Dr. Yatishkumar Joshi<sup>1</sup>, Dr. Swathilekshmi Nair<sup>2</sup>, Dr. Suresh Kangane<sup>3</sup>, Dr. Payal Bhutada<sup>4</sup>, Dr. Trupti Nakhate<sup>5</sup>, Dr. Siddhant Jadhav<sup>6</sup>

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## Abstract:

**Objective:** This scoping review aims to investigate the evidence about herbal mouthwashes' efficacy in preserving oral health during orthodontic treatment.

**Methodology:** The criteria considered in this review were as follows: population: studies with participants in good health; Intervention: mouthwash composed of natural components; Comparison: herbal mouthwash, placebo, and chlorhexidine; Improvements in oral hygiene, suppression of microorganisms, and plaque and gingival indices are the outcomes. Research publications that are pertinent are chosen from PubMed and Web of Science.

**Introduction:** Reduced use of antibiotics and antibacterial mouth rinses for gingivitis has been the goal of clinicians. Recently, natural items that promote health have received a lot of attention. Because fixed orthodontic appliances are large and encourage the buildup of plaque, patients receiving fixed orthodontic treatment (OT) are more likely to experience gingival inflammation. Chemicals such as triclosan and chlorhexidine are known to be effective at preventing the development of plaque. The antibacterial and anti-inflammatory qualities of herbal medications may increase patient compliance because they don't have any negative side effects.

**Conclusion:** The little data that is currently available suggests that mouthwashes with a herbal component can help individuals receiving fixed orthodontic treatment control their gingivitis. More carefully planned clinical studies are required.

**Keywords:** Mouthwash, chlorhexidine, oral health, gingivitis.

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## INTRODUCTION

Dental health education efforts have been in high demand recently, with the main goal being to increase the adoption of good oral health practices that are expected to transition to better oral health.<sup>1</sup> Furthermore, there have been a rise in the demand for data that can support the decisions that

people and policymakers alike can make regarding their oral health.<sup>1</sup> Orthodontic devices hinder plaque removal and promote bacterial adhesion. As a result, patients who don't practice good dental hygiene are more likely to develop gingival disorders.

Numerous studies have demonstrated that fixed orthodontic devices elevate the risk of gingival

irritation by introducing new sites for plaque retention. Oral biofilm undergoes significant changes during orthodontic treatment, which puts periodontal tissues at risk for clinical and inflammatory changes<sup>3</sup>.

The occurrence significantly rises during puberty, particularly between the ages of 9 and 14, which is significant for orthodontists. Gingivitis is perhaps caused by poor dental hygiene, which is why fixed orthodontic equipment that promote mechanical plaque retention are one of the main causes of greater incidence of marginal gingivitis in orthodontic patients.<sup>4</sup>

Since ancient times, oral rinses produced with ayurvedic medicines have been employed in periodontal therapy<sup>5</sup>. These days, herbal medications, which include active substances that are "naturally occurring," are increasingly popular since they provide a safe, dependable, and long-lasting method for restoring health. Ayurvedic medications use a comprehensive approach to treating the whole person. It can preserve the harmony between both overall and oral wellness as well as the environment, both of which are essential in this day and age for human well-being.

**METHODOLOGY**

This study covered trials with healthy subjects in which the use of natural mouthwash components as an intervention was used. Other oral hygiene-maintaining substances including chlorhexidine and a placebo were compared. Included were studies that reported on changes in bacterial load, impact on dental hygiene, and plaque and gingival indices.

A literature search was done using Google Scholar and PubMed's electronic databases. Boolean operators "AND," "OR," and combinations of MeSH phrases were used to construct a PubMed search strategy. (((("orthodontic treatment"[Title/Abstract] AND "gingival health"[Title/Abstract] AND "maintenance"[Title/Abstract] AND "herbal"[Title/Abstract]) OR "natural"[Title/Abstract]) AND "mouthwash"[Title/Abstract]) filters: from 2018 to 2022. Then, the search approach was modified for use

with different databases. The screening method covered articles published during 2018 onwards. After that, duplicate articles were eliminated by importing the articles into the reference manager program Zotero, version 6.0.15. The papers' complete texts were obtained and assessed before being included in the review. Any data duplication reported in research was acknowledged.

The inclusion and exclusion criteria for admittance in the review are reported in table 1. Table 1 - Study selection criteria

Inclusion criteria	Exclusion criteria
<b>Intervention consisted of the use of natural ingredients as mouthwash</b>	<b>Studies reporting on toothpaste and varnish formulations</b>
<b>In vivo experimental studies, randomized clinical trials</b>	<b>Abstracts</b>
<b>Studies on healthy individuals</b>	<b>opinions, commentaries,</b>
<b>Studies reporting outcomes on gingival and plaque index</b>	<b>review articles</b>
<b>Comparative studies</b>	<b>Studies on animals</b>
<b>Full text articles</b>	<b>Non orthodontic population</b>

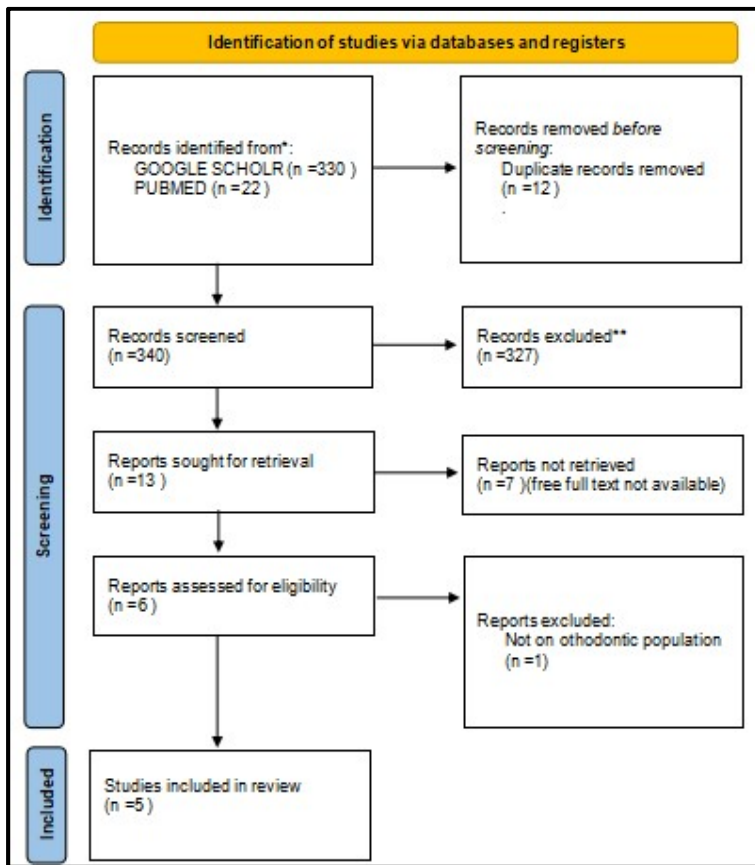
Data extraction from the chosen articles was done using the 'PICOS' technique. Tables that included the characteristics of each study's participants, the kind of intervention, the comparator, the study's outcomes and the design were used to extract data. (Table 2)

**RESULTS**

**Study Selection**

This review's flowchart displays the selection process for the studies. Through the use of electronic databases and a literature search, 352 possibly relevant documents were found. 327 entries were eliminated from the 340 records that were evaluated for title and abstract content after duplicates were eliminated. 7 articles and one article for the population were omitted due to the unavailability of full texts. Based on the inclusion/exclusion criteria, 5 of the articles that were assessed for eligibility evaluation were included in the review. The figure shows the rationale behind the exclusion of eight articles.

**PRISMA flow diagram for scoping reviews which included searches of data bases and registers only**



**Fig1. PRISMA flow chart**

**Study Characteristics**

Table 2 displays the study features of the included studies. The 5 included articles in this review were *in vivo* randomized clinical trials. And populations were patients undergoing orthodontic treatment.

**Plaque and gingival indices**

Plaque and gingival indices were assessed in four studies. When mouthwash with a herbal component was used instead of treatments without, the findings of these investigations showed a substantial improvement in plaque buildup and a decrease in sulcular or papillary gingival bleeding (Table 2).

Author, year	Study design	Population	intervention	Comparison	Duration	Outcome
Aysha et al., 2022 <sup>8</sup>	Randomized clinical trial	90 fixed orthodontic patients	3 groups: chlorhexidine (group I), Aloe vera (group II), and control (group III).	Plaque index (PI) and gingival index (GI).	20 days	Aloe vera could be an alternative to chlorhexidine in patients who are seeking a chemical-free, indigenous, and patient-friendly oral hygiene aid
Goes et al., 2016 <sup>10</sup>	Randomized clinical trial	30 patients (age, 10-40 years)	3 groups: placebo (group 1) Chlorhexidine (group 2) MTC (group 3)	Visual plaque index (VPI) and gingival bleeding index	15 days	1% MTC group did not report side effects commonly associated with CHX. MTC reduced biofilm accumulation and gingival bleeding.
Kawale et al., 2021 <sup>7</sup>	Randomized clinical trial	6 Subjects	2 groups: group 1 (green tea mouthwash) and group 2 (chlorhexidine)	sulcus bleeding index and Turesky-gilmore-glickman modification of quigley hein index	45 days	Green tea mouthwash showed similar efficacy as chlorhexidine in terms of reduction of gingival inflammation and reduction of plaque without any side effects
Asmita et al., 2021 <sup>11</sup>	Randomized clinical trial	60 patients	5 groups: herbal antiseptic mouth rinse (Pomegranate: Group A; Cranberry: Group B; Noni: Group C; Guava: Group D) and sterile water (Group E: Placebo Control).	O'Leary plaque index (PI) using a disclosing agent and Loe and Silness gingival index (GI)	1 week	effective reduction in plaque and gingivitis score

### Changes in Pathogenic Bacterial Load

Herbal mouthwash was found to be beneficial in changing the bacterial load in one investigation. In comparison to other treatments, the results indicated that it assisted in lowering the pathogenic number of bacteria (Table 3).

Abirami et.al., <sup>12</sup>	Randomized clinical trial	20 patients	Group I (experimental group - Herbostra oil pulling mouthwash) and Group II (reference group-0.2% Chlorhexidine mouthwash)	The plaque index and microbial analysis	3 weeks	There was a reduction in plaque scores and <i>S. mutans</i> count with Herbostra oil pulling mouthwash but it was not as effective as Chlorhexidine mouth rinse.
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### DISCUSSION

Based on the current research, it may be suggested that individuals receiving orthodontic treatment benefit from using ayurvedic mouthwashes. It is clear from the study findings shown in the tables that herbal mouthwashes significantly improve oral cleanliness, gingival health, and the decrease of harmful microorganisms.<sup>1</sup> Many beneficial qualities of herbal mouthwashes have been attributed to their peculiar chemical composition.

#### Plaque index, gingival indices, and oral hygiene

Studies revealed that tannins and fluoride both had an inhibiting impact. When compared to chlorhexidine, respondents in the Kawale et al. trial had the highest intended benefit from green tea. At the 45th day, the gingival level scores for Green Tea mouthwash decreased. From poor to good, the state of oral hygiene improved.<sup>7</sup>

A mouth rinse containing extract from fructus mume (FM) and another mouth rinse containing essential oil (EO) were used in a research by Chen Y et al. to examine the effects of natural compounds-containing mouth rinses (NCCM) on patients undergoing fixed orthodontic appliance therapy.

The duration of this trial was six months. It was a parallel-controlled, randomized, single-blinded study. 90 individuals receiving treatment with fixed orthodontic appliances participated in the clinical trial. A control group, an FM group, or an EO group was selected from among the subjects. Plaque index, bleeding index, and modified gingival index were

recorded, and baseline, third, and sixth-month microbiological investigations were carried out. They came to the conclusion that both NCCMs could effectively stop gingival bleeding without changing the microbiological profile.<sup>2</sup>

#### Changes in pathogenic bacterial load

Various products are frequently used to stop the growth of potentially dangerous oral germs, including mouthwashes, irrigating agents, sodium hypochlorite, cetylpyridinium chloride, and amine fluoride. These antimicrobial medications are often utilized; nonetheless, reports of acute hypersensitivity responses, toxicity, tooth discoloration, and other adverse effects have been reported.

A range of antibiotic types with better antimicrobial efficacy and less toxicity have been required because of the possibility of drug-resistant oral bacteria emerging as well as the negative consequences of current antibacterial therapies.

Only one research that used microbiological analysis was found in this review. In the study by Abirami et al.<sup>12</sup> colony morphologies were assessed, numbered, and quantified in colony forming units following the inoculation of a swab containing a sample. This procedure allowed for a calculation of the bacterial count. The antibacterial and anti-plaque properties of a novel, commercially available oil pulling mouth rinse were compared with those of chlorhexidine mouth rinse in a study conducted by Abirami et al. According to the study's findings, oil pulling mouthwash reduced plaque scores just as well as chlorhexidine did, but it had no effect on the number of *S. mutans*.

Many medicinal plants and their compounds are used extensively for the prevention and treatment of oral infections. Out of all of these, Aloe vera is particularly noteworthy and has been used medicinally for a very long time.<sup>8</sup>

According to Haffajee AD et al.'s study, *Veillonella parvula* decreased most in the essential oil and chlorhexidine groups of antimicrobial mouth rinses, whereas streptococcus and *Capnocytophaga* species decreased in the herbal rinse group.<sup>9</sup>

Given the comprehensive outcomes of this analysis, it is suggested that future investigators in this



domain use randomized controlled trials (RCTs) with appropriate sample sizes to enhance the study's power for impact estimation. It will be impossible to create a therapeutic dosage for preserving gingival health in orthodontic patients without this knowledge.

### Limitations and gaps in the literature

It is important to acknowledge several limitations in the research, even with the data indicating the therapeutic effectiveness of herbal mouthwash in preserving dental health. A worry is that earlier research used follow-up times that varied from two weeks to two months. Future research must look at the dosage-benefit relationship and safety concerns, with a focus on determining the therapeutic dose required to eradicate the target bacteria.

### CONCLUSION

Oral health may be initiated, sustained, and maintained with the help of herbal mouthwash, as evidenced by the literature study. The existing gaps in the literature point to the need for more research on the side effects, comparison studies with other conventional products, and studies with bigger sample numbers and longer follow-up periods.

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# Impact of Covid - 19 Pandemic on Academics & Clinics of Dental Students

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## Abstract:

**Aim:** The aim of this study was to evaluate the impact of COVID-19 on the academics & clinics of dental undergraduate students and to explore the efficacy of online education from student's viewpoints. **Material & methods:** An online questionnaire was circulated through Google forms to undergraduate (UG) dental students at MIDSR Dental college, Latur. The questionnaire consisted of total 10 close ended questions.

**Results:** Among the 128 students that participated, 55.3% participants were third year students, 43.8% were final year students of which 11.7% were males and 88.3% were females. The study revealed that 76.3 % students found online classes better than offline, 75.4 % students stated that they faced connection problems while attending online classes. A total of 94.6 % students said that online practical classes have caused loss in terms of their clinical skill training on patients. The psychological issues they faced while attending online classes 56.3 % responded with increased headache. When asked if online teaching had affected their teacher-student bond, 77.7 % responded positively. Students also said that they would prefer offline classes but online as per covid situation if they were given a choice.

**Conclusion:** It appears that the pandemic has had a detrimental effect on the students. While some have adjusted to the sporadic use of technology in the curriculum, the majority do not embrace the change to online learning. Additionally, the underdevelopment of their practical abilities is one of the areas that is most affected.

**Keywords:** online classes, covid 19, dental education, pandemic.

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## INTRODUCTION

The Corona virus Disease (COVID-19), a novel disease that originated in Wuhan, China in 2019 spread globally and was officially recognized as a pandemic by the World Health Organization (WHO) on March 11, 2020<sup>1</sup>. This outbreak has presented significant challenges for healthcare workers worldwide and has certainly impacted dental

practitioners, not just in their day-to-day work but also in their research and dental education efforts<sup>2</sup>.

The pandemic has significantly impacted traditional classroom learning, leading to the shift of courses and assignments online due to the necessity for ongoing curriculum as outlined by DCI guidelines<sup>3,4</sup>. This transition was somewhat unplanned. Restrictions on campus include lockdowns in preclinical and clinical settings, limited access to hands-on clinical education for students, and the

absence of patient treatments, posing significant obstacles in dental education<sup>5</sup>. Consequently, dental programs have been moved entirely online, which was further complicated by the limited skills of educators in online teaching. However, online education has been a topic of practice for quite some time, higher education institutions began offering online courses as early as the 1990s beginning with the start and mid-decades<sup>6</sup>. Technological advancements have made online education more available and varied. To be fair, e-learning has emerged as a valuable supplementary tool, affecting both the educational environment and its students positively and negatively<sup>7</sup>.

There is a paucity of research evaluating the impact of this shift in Indian dentistry schools from in-person to virtual instruction. The purpose of this study is to investigate the effectiveness of online education from the viewpoints of students and to evaluate the effect of COVID-19 on the academics and clinics of undergraduate dental students.

## MATERIAL & METHODS

The cross-sectional clinical study was conducted on 72 final year students and 58 interns at MIDSr Dental College, Latur. Affiliated with Maharashtra University of Health Sciences, Nashik. The study was carried out in the month of February 2022. The participants were split into two groups, one for males and one for females, based on the gender distribution of the population. The Institutional Ethics Committee approved the study once it was presented with its protocol and design. The Helsinki Declaration was followed in the study. Before commencement, the goal of the study was explained to the participants, and each one provided signed informed consent. Third year and final year students were briefed about the study and questionnaire. The students who were willing to take part were included in the study. Students were given an online questionnaire related to the study

## INCLUSION CRITERIA:

1. Both male and female students
2. Third year and final year students of MIDSr Dental college, Latur in academic year 2022

## EXCLUSION CRITERIA:

1. Participants refusing to give consent for the study.

## DATA COLLECTION METHOD:

A cross sectional type of online survey was designed which was approved by the Institutional Ethical Committee.

The online survey consisted of 10 close ended questions with 3 options of which 5 questions had multiple choices & 5 questions were dichotomous type.

The data was collected, tabulated and statistically analyzed.

## RESULTS

According to the demographic data as seen in table no. 1, a total of 128 students participated in the study of which 15 were male and 113 were females. The study population comprised of 72 third year and 56 final year students studying in MIDSr Dental College, Latur, Maharashtra.

A total of 10 close ended questions in a structured questionnaire were asked to the participants of which 5 questions had multiple choices & 5 questions were dichotomous type.

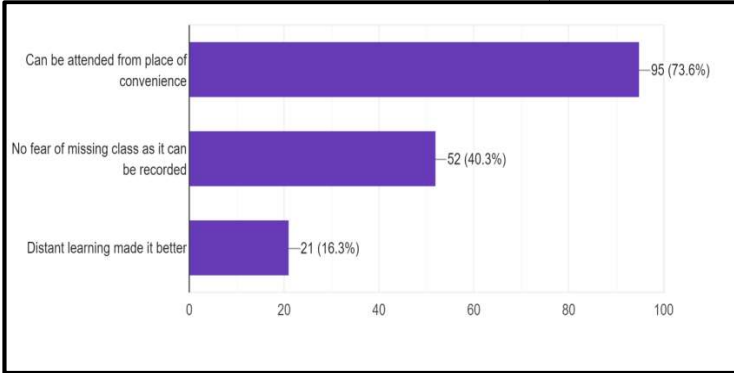
The results of the study are cumulated as follows in the below bar graphs and pie charts.

PROFILE			
GENDER	MALE	15	11.7%
	FEMALE	113	88.3 %
YEAR OF STUDY	THIRD YEAR	72	55.3%
	FINAL YEAR	56	43.8%

Table No. 1: Demographics

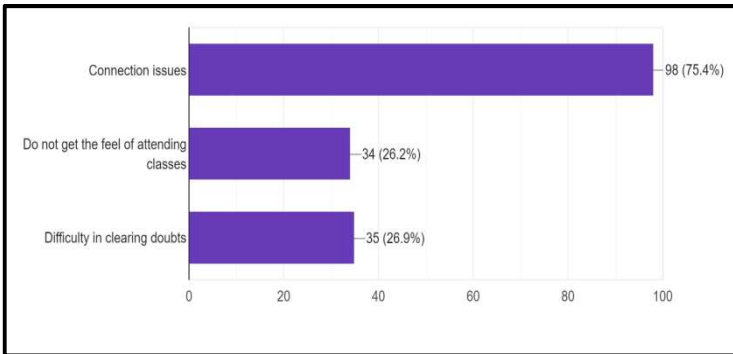
**Questionnaire:**

**1. What do you find good regarding online classes?**



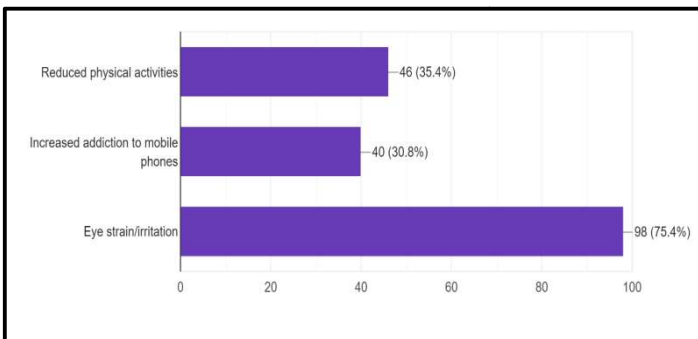
**Fig No. 1**

**2. What are the problems that you have faced during online classes?**



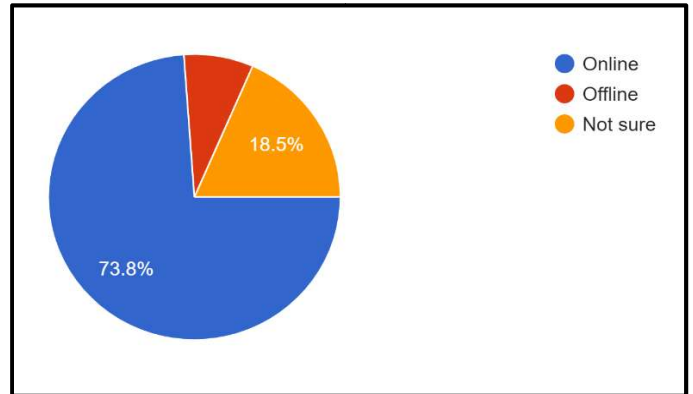
**Fig No. 2**

**3. According to you what are the disadvantages in online classes?**



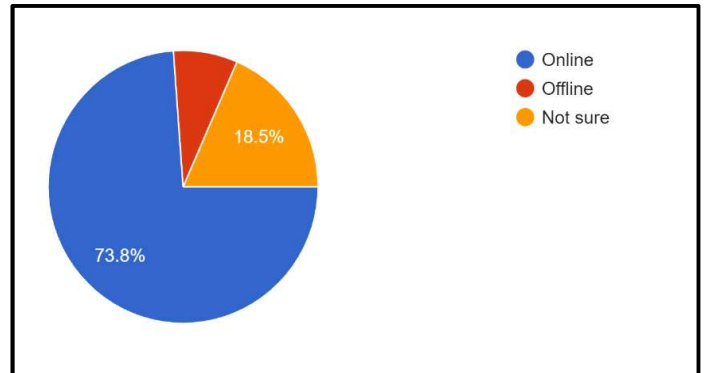
**Fig No. 3**

**4. Which classes according to you have high tendency for distraction?**



**Fig No. 4**

**5. Do you think, online practical classes have caused loss in terms of clinical skill training on patients?**



**Fig No. 5**

**6. What are the psychological issues that you have faced while attending online classes?**

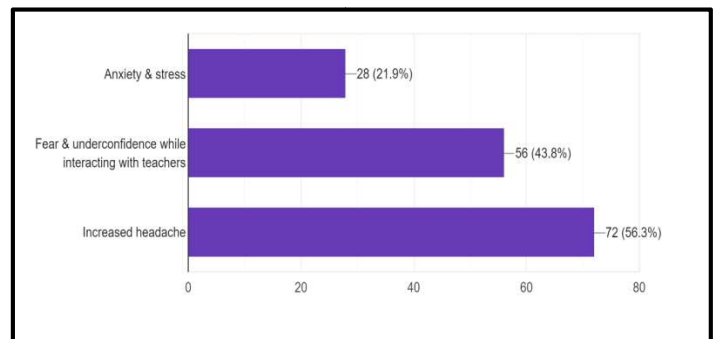


Fig No. 6

7. Which of the following factors make offline classes better?

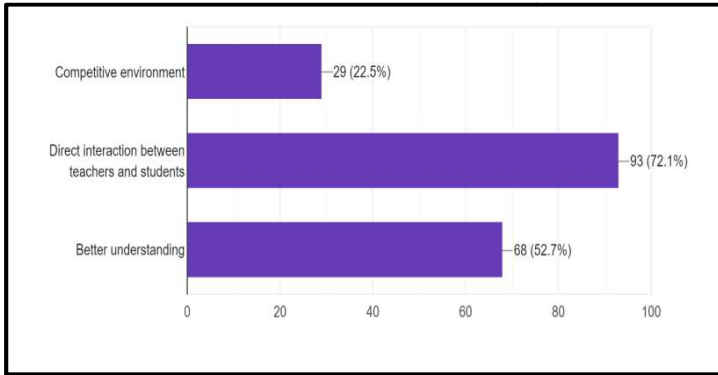


Fig No. 7

8. Which of the following factors make offline practicals better?

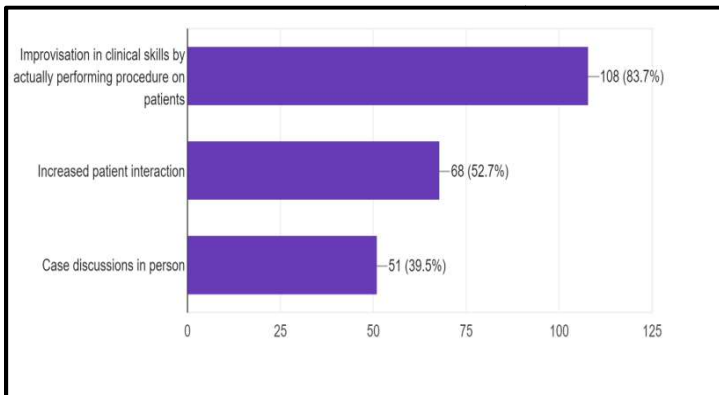
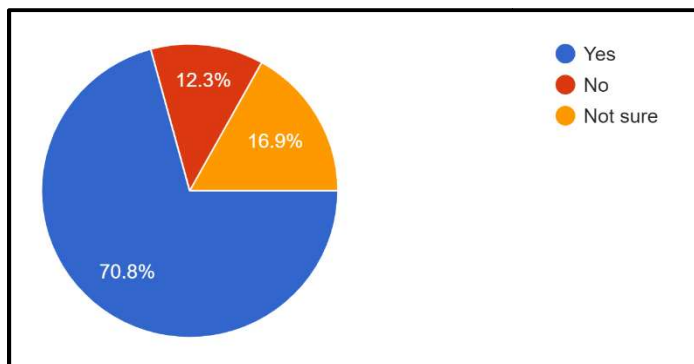


Fig No. 8



9. Do you feel that online classes has affected teacher-student bond?

Fig No. 9

10. If you are given choice regarding attending classes which one will you prefer?

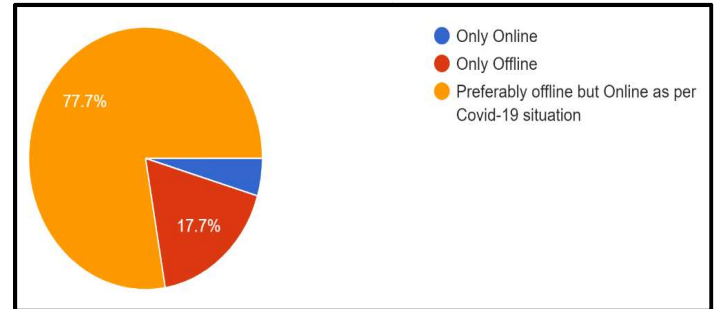


Fig No. 10

**DISCUSSION**

E - Learning was already being used at many universities across the globe, including the majority of Indian medical and dentistry colleges; still it was a novel experience for learning<sup>8</sup>.

This study was designed to investigate the effectiveness of online education from the viewpoints of students and to evaluate the effect of COVID-19 on the academics and clinics of undergraduate dental students.

The study revealed that 76.3 % students found good that online classes can be attended from place of convenience. The fact that online classes have made distant education easy is considerable but it may not provide the atmosphere that is needed for apt learning. When asked about the disadvantage of online classes, 75.4 % students stated that they faced connection problems while attending online classes which can disrupt the continuity of teaching or even leading to missing certain parts while the connection disappeared. A total of 75.4 % student responded that they experienced increased eye strain while attending online classes due to excessive screen time. A research carried out in Rajasthan in 2022 in final year dental students found that their health has been greatly impacted by the online lectures. For 76.8% of kids, increasing screen usage directly resulted in headaches and strained eyes<sup>12</sup>.

When evaluated, 73.8% students stated that online classes had high tendency for distraction as the study

environment was highly impacted due to disturbances from family members or even the student's own thoughts. When asked whether online practical classes have caused loss in terms of their clinical skill training on patients, 94.6 % students responded positively as they did not get the chance their clinical skills on patients which might develop under confidence while practice. The students faced psychological issues while attending online classes of which 56.3 % experienced increased headache which may be due to continuous screen time. Students were asked what made offline classes better, to which 72.1 % responded direct interaction between teachers and students enabled better understanding and doubt clearing sessions. For practicals, 83.7 % responded that gaining confidence in clinical skills by actually performing procedure on patients made offline practicals better as it boosted their confidence. This may not affect in long term as the third and final year students can catch up and improve their skills in internship but it might not be true for interns. In 2021, Ilic et al. did a study on final-year dentistry students, and the results showed that there was a substantial decrease in self-confidence and that the students felt less confident in their clinical skills than the control group<sup>13</sup>. In case of teacher-student bond being affected by online classes, 70.8 % students responded positively as they were not able to communicate with their teachers. Students were asked which type of classes they would prefer between online and offline if given a choice to which 77.7 % student said that they would prefer offline classes but online as per covid situation.

Conversely, students appear to recognize the value of online learning to a certain extent, particularly in relation to theoretical and clinical topics<sup>9</sup>. According to studies evaluating students' experiences with online learning, most of them have a generally positive opinion of it and anticipate that it will be a major factor in their future dentistry education<sup>10</sup>. Students can now listen to lectures and review them anytime, anywhere, thanks to the smart gadgets and apps that are currently available, which promotes educational autonomy. On the other hand, the substantial shift to the internet should also aid in the development of sensible digital laws that are more reasonably priced and secure.

## CONCLUSION

The pandemic's effects on the world brought us to a new understanding that allowed us to discover ways to make up for students' missed classes and guarantee that they gained the required clinical experience. The pandemic's effects were seen in the fields of research, finance, and psychology in addition to education and health care. Even though students understood they would lose out on many learning opportunities, they still believed that in-person clinical practice could not be replaced by the new system with its e-lectures and discussion forums.

**CONFLICTS OF INTERESTS:** Nil

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# Effects of Lockdown on Orthodontic Treatment Outcomes in Cleft Patients: A Retrospective Study

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## Abstract:

**Introduction:** The COVID-19 pandemic led to significant disruptions in orthodontic treatment, including a 6–8 months gap in appointments due to regulations, travel restrictions, and a transportation strike. This study aimed to evaluate the challenges faced by patients and orthodontists during and after the lockdown, particularly regarding treatment outcomes in patients with cleft lip and palate. **Methods:** This retrospective study included 87 ongoing orthodontic patients at a single center, categorized into cleft and non-cleft groups. Data on missed appointments, appliance breakages, and treatment duration was collected from hospital records and analyzed descriptively. **Results:** Among the 87 patients, 62 had cleft deformities. Seven patients dropped out of treatment during the pandemic. A significant number of patients missed appointments, with 17 missing for 5-6 months and 31 missing for 3-4 months. Appliance breakages were reported in 48 patients. The treatment duration increased by 20% in non-cleft patients and by 50% in cleft patients who missed appointments and experienced appliance breakage. **Discussion:** Missed appointments and appliance breakages led to a significant increase in treatment duration and number of visits, particularly for cleft patients. Additionally, lockdown restrictions increased transportation costs for patients attending regular appointments. **Conclusion:** Cleft patients experienced a significantly greater burden of care due to treatment disruptions compared to non-cleft patients during the pandemic lockdown. These findings highlight the need for strategies to mitigate the impact of unforeseen circumstances on orthodontic treatment, especially for vulnerable patient populations

**Keywords:** Pandemic, Cleft lip and palate, Orthodontic treatment.

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## INTRODUCTION

The COVID-19 pandemic, caused by the severe acute respiratory syndrome corona virus 2 (SARS-CoV-2), has significantly affected global health and economies. In late 2019, a sudden increase in pneumonia cases in central China led to the identification of a previously unknown corona virus, now known as SARS-CoV-2.<sup>1</sup> By January 7, 2020; scientists had isolated the virus and sequenced its genome. On March 11, 2020, the World Health Organization (WHO) declared COVID-19 a pandemic. Since then, authorities have recorded more than 458 million cases of COVID-19 worldwide, with over 6 million deaths attributed to the disease.<sup>2</sup>

The pandemic has had a profound effect on global life expectancy. Recent research indicates that it has reversed the trend, causing a decline in life expectancy across 204 countries. Orthodontists, like many other healthcare professionals, face negative impacts on their clinical activity and income due to various factors. These include national restrictions (70.1% of respondents), increased cross-infection measures (59.6%), state-imposed restrictions (55.9%), and social distancing protocols (39.4%).<sup>3</sup>

Delayed appointments were a major concern during the pandemic. Untreated orthodontic problems increased while routine services were suspended. Interestingly, patients with clear aligners reported fewer issues than those with fixed appliances.<sup>4</sup> However, orthodontic treatment requires regular follow-up, which was disrupted during lockdowns. Some procedures are time-consuming and aerosol-producing, posing risks to both patients and orthodontists. For cleft lip and palate patients, multidisciplinary care involving orthodontists, surgeons, speech therapists, and other specialists is crucial. Unfortunately, lockdowns and restrictions led to delayed surgeries, affecting the overall treatment timeline for cleft patients. To adapt, healthcare providers turned to telehealth for follow-up appointments and consultations. Virtual visits allowed orthodontists to assess progress, address concerns, and provide guidance remotely. Challenges persisted for cleft patients. Disruptions in speech therapy services impacted their progress, and regular adjustments for cleft-related appliances were affected due to clinic closures. The emotional impact

of the pandemic was significant, causing stress and anxiety for cleft patients and their families. Isolation and uncertainty further affected mental well-being.<sup>5</sup> In this comprehensive study, we delve into the multifaceted consequences of the pandemic on orthodontic cleft care. We explore how these professionals have adapted to the challenges posed by COVID-19, shedding light on their resilience and determination during these unprecedented times. Our findings contribute to a deeper understanding of the pandemic's impact on healthcare providers and underscore the need for continued support and flexibility in the face of global health crises.

## METHODOLOGY

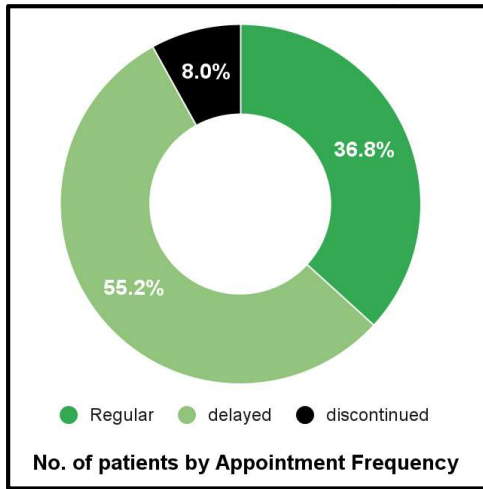
This is a retrospective study that included all ongoing orthodontic patients at a single center. The Institutional Board approved the study. The duration of the study was from March 2020 to June 2020. During this time there was a strict nationwide lockdown for 21 days starting 24th March. Additionally, following the pandemic lockdown, a transport strike in the state further impacted public transport availability for patients, lasting an additional three months. Many patients missed appointments during this period.

The patients were categorized into two groups: cleft and non-cleft based on the deformities observed. Among the 87 patients included in the study, 62 had cleft deformities and 25 were patients without any cleft-related deformities. The following data points were collected for each patient: appointment delays, treatment duration, appliance breakages, and complications during the treatment course, and any other relevant impacting information. All the data was collected from hospital records and analyzed descriptively.

## RESULTS

### Appointment delays

The hospital observed a discontinuity in appointments for all patients (lasting at least one month). Among the 87 patients, 32 regularly (less than 3 months of delay) visited the clinic, 48 patients delayed their appointments (more than 3 months of delay) due to pandemic restrictions and 7 patients discontinued their treatment.



**Fig.1. Distribution of Patients by Appointment Adherence during Lockdown**

**Treatment Duration**

The treatment duration increased by 20% in non-cleft patients and by 50% in cleft patients who delayed their appointments by more than 3 months. 2 of 25 non-cleft and 5 of 62 cleft patients discontinued their treatment.

Patient type	Treatment	Planned duration (avg in years)	Actual	Difference (%)
Non-cleft (25)	Regular (10)	1.8	1.9	5.56%
	Delayed (13)	1.6	1.93	20.63%
	Discontinued (2)	2	-	-
Cleft (62)	Regular (22)	2	2.05	2.50%
	Delayed (35)	1.8	2.72	51.11%
	Discontinued (5)	1.9	-	-

**Table 1: Impact of Appointment Adherence on Treatment Duration**

**Issues with Appliances**

The appliances used in the treatment were categorized as fixed or removable appliances. The issues for each type were identified, eg. broken brackets or wires for fixed appliances, and deboned

or loose removable appliances. 48 (57%) Patients out of 87 total patients had some issue with the appliance. The most common issues were broken brackets or wires & loosening of the appliance.

Appliance type	Issues	Non-cleft group	Cleft group		
		Permanent dentition (25)	Mixed dentition (36)	Permanent dentition (18)	Retention (8)
Fixed	Broken brackets or wires	28.00%	47.22%	61.11%	
	Loose band and bite blocks or ramps	8.00%	30.56%	50.00%	12.50%
	Debonded Expansion devices		38.89%	5.56%	
Removable	Broken wire or acrylic components	12.00%			12.50%
	Loose removable appliances	8.00%			25.00%

**Table 2: Issues with Orthodontic Appliances**

**DISCUSSION**

The COVID-19 pandemic significantly disrupted orthodontic treatment, especially for patients with cleft lip and palate. Lockdowns led to missed appointments, unchecked appliance breakages, and prolonged treatment duration. In our study, 48 out of 87 patients missed appointments, with cleft patients being more affected. This aligns with other research, which reports increased treatment time and missed appointments during the pandemic. The disruption highlighted appliance breakages, particularly in cleft patients with complex appliances, further complicating treatment. Other studies similarly highlight increased appliance-related complications during the pandemic.<sup>6</sup>

Despite these challenges, the resilience and adaptability of patients and healthcare providers were evident. The rapid adaptation of telehealth services provided a crucial solution for continuity of care. Virtual consultations allowed orthodontists to monitor treatment progress, address urgent issues, and maintain communication with patients, mitigating some adverse effects of the lockdown. This shift towards digital healthcare solutions reflects a broader trend observed during the pandemic, where telehealth played a crucial role in maintaining healthcare services.<sup>7</sup>

The findings underscore the need for better preparedness and strategic planning in orthodontic care to manage future crises effectively. Developing robust telehealth protocols, ensuring access to emergency care, and creating flexible treatment plans are essential to mitigate the impact of such disruptions. Additionally, targeted support for vulnerable patient populations, like those with cleft lip and palate, can help reduce the burden of care during challenging times. These measures will enhance the resilience of orthodontic services and improve patient outcomes in the face of future health emergencies.<sup>8</sup>

### CONCLUSION

The COVID-19 pandemic has significantly impacted orthodontic treatment outcomes, particularly for patients with cleft deformities. The study highlights delays in appointments, increased treatment durations, and unchecked appliance breakages. These findings emphasize the importance of adaptive strategies, including telehealth, to ensure continuity of care in future crises. By addressing the challenges identified in this study, healthcare providers can better support their patients and enhance the resilience of orthodontic services in the face of unforeseen disruptions.

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# Orthodontic Extrusion of Traumatized Anterior Teeth by Simplistic Approach: A Case Report

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## Abstract:

A crucial aspect of dentistry practice is the management of patients who underwent severe traumatic injuries of the anterior teeth. Treatment for anterior teeth with subgingivally extended fractures is complex and treatment should be done keeping biologic, aesthetic, and functional aspects, including speech and mastication into consideration. Crown fractures frequently require a multidisciplinary approach to treatment. Restorative challenges arise; however, from crown-root fractures with a fracture line below the gingival attachment or alveolar bone crest so orthodontic extrusion should be done in order to better prosthetic rehabilitation. This case report is of 11-year old boy that resulted in fractures to his upper right and left central incisors in road traffic accident. During a clinical examination, it was discovered that the fracture line extended horizontally in the upper right and left central incisors, resulting in an oblique fracture at the cervical one-third level exposing pulp. This case report explains the simplistic approach to orthodontic extrusion of traumatized anterior teeth.

**Keywords:** Traumatic injuries, Orthodontic extrusion, anterior teeth, fixed orthodontic treatment

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## INTRODUCTION

General restorative dentists and orthodontists face significant challenges when treating patients with traumatized teeth in the aesthetic region of the face. Because the upper anterior teeth are visible on smile it is important role to maintain the delicate contour of the teeth through micro esthetics. Extraction is still the most often used treatment option given to the patient followed by dental implant placement; but preservation of natural tooth structure followed by restoration is the best treatment option to be chosen, extraction should be considered as a last option.

A multidisciplinary approach is used in these treatment modalities, which include orthodontic

extrusion, crown lengthening by gingivectomy, root canal treatment by endodontics, followed by prosthetic rehabilitation. When undergoing orthodontic intervention, the tooth is forcibly extruded, resulting in resorption of alveolar bone and periodontal crown lengthening. In both cases, the goal is to extrude coronal tooth structure to support an appropriate prosthetic restoration.

Extrusion of the teeth by orthodontic treatment is a method to avoid the potential for compromised aesthetic results from crown lengthening procedures that indicates excess root material.[1-4] Two main approaches for orthodontic extrusion of traumatic teeth are commonly used they are:

(1) Using brackets and archwires as a component of fixed orthodontic treatment.

2) Application of tractional forces to the fractured tooth via the attachment of a stiff wire stretched across the neighbouring teeth.

Fixed appliances are mostly used to achieve orthodontic extrusion. Extrusion in orthodontic treatment requires 20–30 g of force. This paper aims to provide an overview of the multidisciplinary treatment plan to extrude the traumatized maxillary central incisor; its management by restoration of tooth structure, bone structure and its periodontal health.

**CASE REPORT:**

This is a case-report of 11-year-old male patient reported to the department with a chief complain of fractured teeth in the upper front region of jaw after road traffic accident. On clinical examination patient had Ellis Class III fracture in maxillary right and left central incisors. On clinical examination there was oblique fracture of upper left and right central incisor 11 and 21. The fractured fragment of the traumatized teeth was embedded into the lower lip during trauma it was removed.



**Fig 1: Orthopantomogram**

Orthopantomogram reveals that patient is having mixed dentition with Ellis Class III with intruded 11 21 due to trauma. (Fig. 1)

**Treatment progress:**

Lingual buttons were bonded to both the central incisors 11,21. Bondable molar tube with 16,26 MBT 0.022 bracket were bonded on 12,22 and Begg's

bracket were bonded on the upper first premolars of both the side to avoid slippage and to support the archwire. 0.019' X 0.05' SS archwire was placed as a base wire in the upper arch with archwire sleeves to reduce irritation and maintain space wherever desired.

At the beginning of treatment extrusive force was applied by tying elastomeric chain from the archwire to the lingual button. (Fig 2) After 2 weeks of extrusive force elastomeric module was inserted into the archwire and engaged into the lingual button of teeth 11, 21. (Fig 3)



**Fig 2: Extrusion using elastomeric chain**



**Fig 3: Extrusion using elastomeric module (a) Right lateral (b) frontal (c) Left lateral**

A Dontrix gauge was used to measure the force level upto 30 g.

The elastomeric module was changed after 15 days. In the subsequent visits, piggyback technique was used in which archwire using 0.014" NiTi archwire was passed above the incisor for extrusive force and ligated to the adjacent brackets with ligature wire to 12 22. (Fig. 4)



**Fig 4: Extrusion using 0.014" NiTi piggyback archwire**

Extrusion was achieved after 2 months and labial retainer was placed for retention purpose. (Fig 5) After extrusion patient was referred to the department of Pedodontics for root canal treatment (apexification). After endodontic treatment patient was recalled for 6 months follow-up and checked for the treatment outcome were stable and symptomless. (Fig 6)



**Fig 5: Labial retainer**



**Fig 6: Labial retainer 6- month follow-up**

Intraoral photographs of patient after 1 year follow-up (Fig 7)



**Fig 7: Labial retainer 1 year follow-up (a) right Lateal (b) frontal (c) Left lateal**



**Fig 8: RVG after root canal**

**DISCUSSION**

Orthodontic extrusion (OE) is the movement of an orthodontic tooth in a the coronal direction to change the tooth's position and cause modifications to the surrounding soft tissues and bone for therapeutic purposes. Tractional forces are imposed throughout the periodontal ligament during tooth extrusion in order to promote the marginal apposition of crestal bone. Because connective tissue attaches gingival tissue to the root, the gingiva follows the vertical movement of the root during extrusion. The alveolus, connected to the root by the periodontal ligament, is pulled along with the root.[5] In cases where the fracture line is situated below the gingival margin, alveolar bone and if the root segment is sufficiently

long to accommodate a coronal restoration, the root may be treated endodontically after being orthodontically extruded to elevate the fracture plane above the gingival margin.

When extrusion of teeth occurs, traction forces are applied throughout the periodontal ligament, stimulating the crestal bone's marginal apposition. Traction of the impacted teeth and tooth exposure to allow for restorative procedures are common indications, to modify the position of tooth due to malalignment or trauma.

If orthodontic extrusion is planned for a tooth that has intruded, it should begin as soon as possible and not be delayed for longer than 3-4 weeks after trauma as signs of ankylosis can be seen 11-13 days post trauma. By ensuring that enough tooth structure is extruded for good sealing and aesthetics prosthodontic coronal restoration can be given to the patient thus maintaining the health of the periodontal tissues, these procedures make it possible for the restoration to function better.[6] Teeth can be slowly extruded with forces up to 30 g.

Root movement usually extends over a 4-8-weeks resulting in about 1 mm of movement every 1-2 weeks by application of 15-30 g of orthodontic force. A slow movement does not require force more than 30 g, according to some authors[7,8], more than 50 g of force is required for extrusion of the teeth.[9] Higher forces are required for orthodontic extrusion, the tooth must be stabilized for the periodontium to remodel and adjust to the newly acquired tooth position. This requires longer retention periods. Two studies, Ulusoy et al. [10] and Fidel et al. [11], reported a method of extrusion of teeth by orthodontic treatment by bonding brackets on the adjacent teeth followed by extrusive forces on the intruded teeth.

Ankylosis or hypercementosis, vertical root fracture, premature closure of embrasures, root proximity are the common complications of orthodontic extrusion.[12,13] This fixed orthodontic treatment of orthodontic treatment is a simplistic approach which involves minimal bonding of brackets to the teeth and is easier to perform by orthodontists for extrusion of the intruded traumatic teeth.

## CONCLUSION

A multidisciplinary approach is required for the treatment of traumatized teeth so that restoration of the teeth can be done after extrusive movement by endodontic and prosthodontic treatment if required. This clinical report described a forced eruption therapy treatment modality that reduces treatment time and is comfortable and aesthetically acceptable to the patient. Using this forced eruption technique could benefit general dentists by improving patient satisfaction and aesthetic outcomes.

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# Assessment of Oral Hygiene and Dental Plaque In Patient Undergoing Orthodontic Treatment Using Propolis: A Scoping Review

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## Abstract:

Background: Usage of brackets during orthodontic treatment helps in the retention of biofilm due to plaque accumulation, and change in pH to overcome different negative pharmacological problems natural products have been used nowadays. propolis is a bioproduct derived from bees because of its various pharmacological properties and its effects on topical products, it is beneficial to be used which has strong fungal, bactericidal, antiviral and antiparasitic antioxidative properties. Aim: the purpose of this research is to know and understand the effect of propolis in preventing dental plaque and maintaining oral hygiene in patients undergoing orthodontic treatment. Methods: an online search was done using databases from PubMed and Google Scholar to find the articles. database search was done with the following string propolis [Title/Abstract] AND(orthodontic [Title/Abstract]. results: 8 articles were included in the review to evaluate the better effect of propolis while undergoing fixed or removable orthodontic treatment. Conclusion: Propolis has a significant effect on oral hygiene and preventing dental plaque in patients undergoing orthodontic treatment. Short running title: propolis in orthodontics

**Keywords:** propolis, orthodontic treatment

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## INTRODUCTION

Orthodontic goals involve a stable and proper occlusion, aesthetically pleasing facial features, and a good relationship between their periodontal supportive system.<sup>1</sup> Orthodontic treatment hampers oral hygiene and normal cleansing action of the oral cavity against teeth due to brackets, and appliances leading to accumulation of dental plaque while addressing different types of malocclusion.<sup>2</sup> Orthodontic treatment favours an increase in several

oral microbial flora and harbours favourable environment for growth.<sup>3</sup>

Gingivitis is the most common inflammatory disease affecting periodontium due to the retention of biofilm and changes in the pH of the oral cavity. dental caries is another disease affecting teeth and starting demineralization.<sup>4</sup> Gingivitis is the most common inflammatory disease affecting periodontium due to the retention of biofilm and changes in the pH of the oral cavity. dental caries is another disease affecting teeth and starting demineralization.<sup>5</sup> Use of brackets during

orthodontic treatment helps in the retention of biofilm due to plaque accumulation, and change in pH to overcome different negative pharmacological problems natural products have been used nowadays.<sup>6</sup>propolis is a bioproduct that is derived from bees because of various pharmacological properties and its effects on topical products its beneficial to be used.

Propolis has been derived from the plant *Apis mellifera*. propolis is a nontoxic and resinous substance. it's classified into different groups. Plant balsams, volatile oils, acids of phenols, acids of esters, flavonoids, aromatic alcohols and aldehydes, terpenes, fats, -steroids, mineral salts, and vitamins form a dense and sticky mixture of wax and resin which is known as propolis.<sup>7-9</sup>

Propolis has strong fungal, bactericidal, antiviral, and antiparasitic antioxidative properties. Various studies show the anti-inflammatory effects of propolis and its strong anti-immunomodulating effect. Through the reduction of IL-1 mRNA expression, activation of nitric oxide synthase (iONS), and scavenging of free radicals generated by neutrophils and macrophages, It was found that extracts of ethanol with propolis had anti-inflammatory activities.<sup>10</sup>

**SEARCH STRATEGY:** propolis [Title/Abstract] AND (orthodontic [Title/Abstract]) from Google Scholar and PubMed.

**INCLUSION CRITERIA:**

**Population:** All data consisting of RCT, comparative studies, prospective studies, non randomized control trial etc. used propolis as an active ingredient.

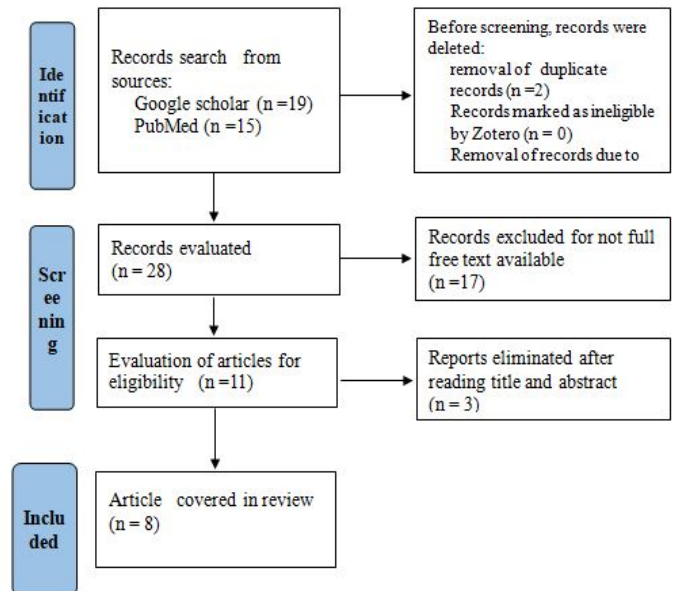
**Intervention:** Propolis containing mouthwash, dentrifice, lozenges etc.

**Control:** toothpaste, mouthwashes etc. containing other than propolis.

**Outcome:** potent agent in reducing plaque and improving oral hygiene.

**EXCLUSION CRITERIA:** articles available in languages other than English.

**MATERIAL AND METHOD:**



RESULT

Lactobacillus spp. It was a clinical experiment with a

Author	Comparator		Sample size	Outcome	Results
Agnieszka et al 2021 <sup>3</sup>	Propolis	Without Propolis	Propolis group =21 control=20	The Gingival and periodontal scores were statistically decreased in the propolis group when viewed alongside the control group. ( $P < .05$ )	An enhancement in oral cleanliness was seen in group A. The gingival bleeding index (GBI) for the whole gingival condition, along with the incisors and molars, all decreased.
Mara et al 2022 <sup>11</sup>	Brp	Without Brp	BRP=21 WITHOUT BRP =21	There is a decrease in the number of Lactobacillus species in the group that used the BRP dentifrice.	
Joao et al 2020 <sup>12</sup>	Brp	Fluoride without	EACH GROUP =46	BRP-containing toothpaste showed improved clinical and microbiological efficacy.	Two groups reduced GBI significantly.
Farhadifard et al 2021 <sup>13</sup>	Brushing+denture cleansing tablets (intervention 1) Brushing+propolis mouth wash (intervention group 2)	Brushing (control)	Sample size =32 Triple blind cross-over trial in between switching for 1 month.	Cleansing with a denture cleansing tablet has reduced the microbial plaque significantly on removable orthodontic appliances than doing it with a brush alone.	Intervention group 1 and the comparator group were statistically significant. Intervention group 2 and the comparator group were statistically insignificant. Statistics showed that intervention groups one and two were significant.
Carolina et al 2020 <sup>14</sup>	Green propolis extract		In vitro study on dentistry materials against the formation of different candida species.	This study supports the notion that green propolis inhibits the pathogenic ability of species of Candida and has antifungal activity.	
Deghnani Et al 2021 <sup>15-16</sup>	Propolis mouthwash	Chlorohedine Mouthwash	SAMPLE SIZE =37	Propolis can be used as a suitable alternative for chlorhexidine without advertising the effects caused by chlorhexidine.	p values for plaque, gingival, and periodontal and are statistically significant before and after using propolis. p values for the 2 intervention groups are not significant.
Agnieszka Et al 2016	Brazilian propolis toothpaste	Control	Sample Size= 96 Randomized between 2 groups for 35 days	There is a reduction in plaque while using propolis toothpaste.	Plaque and gingival index are assessed for 35 days and there is a reduction in p values significantly in propolis group than the control group.
Agnieszka et al 2013	Polish propolis	Placebo	EACH GROUP =25	The biological efficacy of toothpaste containing Polish propolis is supported by the study.	OPI, GI, and the proportion of Actinomyces and Capnocytophaga. It decreased statistically significantly in the propolis subject compared to the baseline.

DISCUSSION

Propolis has strong fungal, bactericidal, antiviral, and antiparasitic antioxidative properties. Propolis has been shown in numerous studies to have anti-inflammatory properties as well as potent immune-suppressing properties. Agnieszka et al (2021)<sup>3</sup> suggested how the antibacterial and anti-inflammatory action of propolis is important in patients with cleft lip and palate in 50 { both control and intervention } individual through RCT. They compare the polish propolis with plant oil. polish propolis contains ethanol extract of flavonoid compounds. There are also acids of phenols including p-coumarin, caffeic and esters, and micronutrients in it. It also contains tectochrysin, chrysin, pinostrobin, and apigenin. Contain in plant oil. Tea Tree Oil (TTO) is a component of plant oil. Terpinen-4-ol, -terpinene, α-terpinene, p-cymene terpinolene, and 1, 8-cineole were the major components of TTO. By using steam distillation, Mentha piperita oil (menthol) was produced from fresh, carefully chosen leaves. Menthol, menton, and Somerton were the three main ingredients. Mara et al (2022)<sup>11</sup> checked the efficacy of Brazilian red propolis to prevent plaque development and salivary

double randomization. 42 participants were allocated into two groups G1 AND G2. Joao et al (2020)<sup>12</sup> evaluated the effectiveness of Brazilian red propolis (BRP)-containing toothpaste in teenagers undergoing orthodontic treatment through a double randomized trial. 92 participants were allocated into 2 groups .2 groups Brazilian red propolis and the second one fluoride dentifrice with BRP. Based on the outcome of the gingival bleeding score, denitrifies containing BRP have better clinical action. Farhadifard et al in (2020)<sup>13</sup> compares denture tablets and ethanol extract of propolis in cleansing removable orthodontic appliances to assess the protective nature against biofilm and caries activity. Carolina et al (2020)<sup>14</sup> this study assessed the effect of green propolis extract on the adhesion and biofilm formation of Candida species in various materials used in dentistry. By using high-performance liquid chromatography, green propolis extract's phytochemical analysis was carried out. By counting the amount of yeast cells clinging to pieces of tooth material in a Neubauer chamber, adhesion was measured. Colony-forming units that were extracted from dental material pieces were counted to determine the production of biofilm. It was determined whether the biofilm adherence was poor,

moderate, strong, or extremely strong. Deghnani et al (2020)<sup>15-16</sup> did a comparative study between propolis and chlorohexidine. 30 grams of propolis were used to make the preparation, which was then mixed using 100 ml and then heated at 30 ° C for two hours. As the base concentration, the propolis aqueous extract was purified by 30%. Propolis was mixed in a 1% solution with 0.25% salt concentration and flavourings such as saffron essential oil. Agnieszka et al (2016)<sup>4</sup> have done the Brazilian red propolis comparison research on dental plaque and gingiva in patients receiving treatment under removable and multibracket appliances. Plaque and gingival indices have been assessed over some time. Results showed it is clinically beneficial to enhance infectious illness prevention and management in patients with mouth clefts. In this review, 8 studies have been included and 5 randomized control trials have been included. there are 3 studies have been done in patients undergoing orthodontic treatment for cleft palate and lip. Studies done by Agnieszka et al<sup>3-6</sup> and Farhadifard et al have been done on orthodontic patients treated with removable appliances. Dentifrice containing BRP (Brazilian redpropolis) has been used in 3 studies in comparison to some other control groups. There is only 1 study with green propolis extract that has been done by Carolina et al<sup>14</sup>. Polish propolis with ethanol extract is done by Agnieszka et al. Parameters checked for evaluating the antiplaque effect of propolis are gingival index plaque index periodontal index and (OHI-S) oral hygiene index over some time. The study done by Mara et al evaluated the anti-plaque effect of caries preventing activity by examining the activity of lactobacillus in dilution on follow-up visits. Jao et al<sup>12</sup> evaluated the oral microflora by salivary examination of *S.mutans* and concluded the gingival health of the individual undergoing orthodontic treatment.

### LIMITATIONS

Data search was done on only 2 standard databases. Data search has not been done on grey literature. The quality of Studies included in the research is poor so meta-analysis cannot be done properly. Standard systematic reviews and meta-analyses are not available so they are not included.

### SCOPE OF WORK

All 8 studies have been done on different sample groups which differ in the allocation of subjects. There is no standardized percentage of propolis preparation mentioned in the literature gathered through databases. A study based on standard proportion and concentration should be done.

### CONCLUSION

Maintaining good oral hygiene in patients undergoing orthodontic treatment is of utmost importance. Propolis significantly affects oral hygiene and prevents dental plaque in patients undergoing orthodontic treatment. There is no standardized percentage of propolis preparation mentioned in the literature gathered through databases. The concentration varies for different propolis preparations. It needs more randomized control trial studies on a large scale to statistically quantify the effect of propolis.

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# Orthodontic Analogies: Simplifying Complex Concept In Orthodontics

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## Abstract:

The treatment of malocclusion of teeth requires fabrication of orthodontic appliances to activate force system. There are many variables involved in the structural and material properties of each component. It is important to understand these variables for construction of an efficient and tissue friendly appliance. Orthodontic analogies are comparisons that draw parallels between orthodontic concepts and other aspects of life. These analogies help to explain orthodontic procedures and principles in a more relatable and understandable manner. Various orthodontic analogies are roller coaster effect, Row-boat effect, Wagon-wheel effect, Drawbridge effect, Trampoline effect, Bowing effect. These analogies describe various phenomenon that occur during orthodontic treatment in which some of them are unwanted effects of orthodontic tooth movement like roller coaster effect, rowboat effect and some of them are effective phenomena of tooth movement like drawbridge effect.

**Keywords:** words: orthodontics, analogies, malocclusion, orthodontic treatment

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## INTRODUCTION:

Successful treatment of the adult patient with an in order to correct malocclusion, orthodontic equipment must be made in order to activate the force system.<sup>1</sup> An appliance is composed of several components. The arch wires coil springs, and elastic modules apply the actual forces when the brackets are banded or bonded to the teeth. Each component's structural and material qualities are influenced by a wide range of factors.<sup>2</sup> Understanding these characteristics is crucial for designing an effective and tissue-friendly appliance.<sup>3</sup>

Orthodontic analogies are comparisons that draw parallels between orthodontic concepts and other aspects of life. For example, comparing the process of adjusting brackets to refining a skill over time or likening the alignment of teeth to the organization of

thoughts in writing. These analogies help to explain orthodontic procedures and principles in a more relatable and understandable manner.

## VARIOUS ORTHODONTIC ANALOGIES ARE:

- Roller coaster effect
- Row-boat effect
- Wagon-wheel effect
- Drawbridge effect
- Trampoline effect
- Bowing effect

**ORTHODONTIC ANALOGIES:**

**1) ROLLER COASTER EFFECT -**

In the early years, various problems occurred during orthodontic treatment mechanics because of heavy forces and increased tip in anterior brackets.<sup>4</sup>

At the time of space closure sometimes there is occurrence of lateral open bite, rotation of molars in counter-clockwise direction and deepening of anterior bite such effect is known as **roller coaster effect**. (fig.1)<sup>5</sup>

Retraction can occasionally result in negative outcomes like anterior teeth extrusion or anterior torque expression failure.

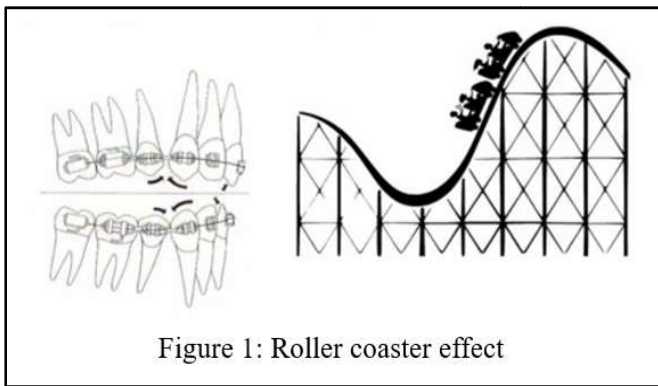


Figure 1: Roller coaster effect

**Causes: -**

- Applying strong pressure to soft arch wire
- Anchorage loss
- Improper ligation method

**Prevention: -**

- Avoid heavy forces during initial appointments
- Anchorage preparation early in the treatment
- Proper ligation technique using ligature wire
- Space closure on heavy rectangular stainless-steel wire only

**Management of roller coaster effect:**

1. Deep bite correction -
  - In class 2 hypodivergent patients - true intrusion of incisors with help of temporary anchorage devices (TADs) mini-implants with accentuated curve of spee arch wire.<sup>6,7</sup>
  - In other malocclusion - intrusion of anterior and extrusion of posterior teeth - reverse curve of spee arch wire, intrusion utility arch, three-piece utility arch etc.<sup>8</sup>

**2) ROW-BOAT EFFECT-**

If the canines are mesially tipped, regardless of presence of the space distal to them, full engagement of the brackets results in a tendency of the incisors teeth to procline.

Considering apex of canine root is tip of arc, when arc is pushed the boat will be shoot forward so canine and other tooth move forward.(fig.2)

Rowboat effects can also be seen after engaging distally orientated canines in a continuous wire, which results in extrusion and proclination of incisors

The row boat effect is caused by the maxillary teeth's susceptibility to migrate forward during anterior lingual root torque.<sup>9</sup>

When such tension is applied, there is a tendency for class II relapse after headgear or class II elastics.

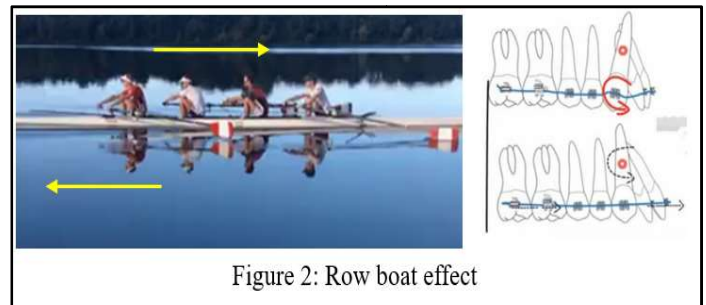


Figure 2: Row boat effect

**Causes:**

Excessive mesial root inclination of canine

**Prevention:**

This can be prevented by avoiding full arch engagement, laceback on canine, segmental retraction of the canine, by-passing canine brackets or by-passing incisors, until enough spaces are provided for anterior alignment.<sup>10</sup>

Strong anchors must be used to stabilize the canine crown in order to avoid the rowboat effect. An ideal substitute for extraoral anchorage in situations where molar anchorage is crucial is a microimplant. A laceback is applied directly to the canine bracket, and the TAD is positioned between the roots of the second premolar and the first molar.

3) **WAGON-WHEEL EFFECT:**

Andrew described this phenomenon as **wagon wheel effect**, represents relationship between torque applied by arch wire and tip.

The mesial convergence of the central and lateral incisor crowns at the gingival region occurs once per 4° in lingual crown torque. About a 4:1 ratio applies here. (fig.3)

In the straight wire appliance, adding palatal root torque to the anterior segment approximates the anterior roots. Therefore, adding torque negates the pre-existing incisors' tip by a ratio of 4 to 1. For example, adding 4° of palatal torque on the incisors will decrease tip by 1°.<sup>11</sup>

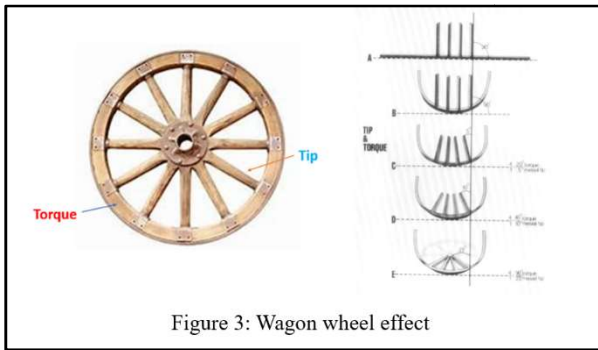


Figure 3: Wagon wheel effect

4) **DRAWBRIDGE EFFECT:**

When comparing incisors as two movable bridge and descent of bridge is comparable to retraction of teeth, which will lead to up righting and extrusion of incisors to close open bite.(fig.4).<sup>12</sup>

This occurs by rotating teeth around centre of resistance, beneficial to close open bite but sometime unwanted effects occur by proclination of teeth leading to open bite.

In situations where orthodontic treatment is used to correct anterior open bite after maxillary and mandibular incisor retraction, uprighing, and extrusion, this phenomenon is called as the **drawbridge effect**.<sup>13</sup>

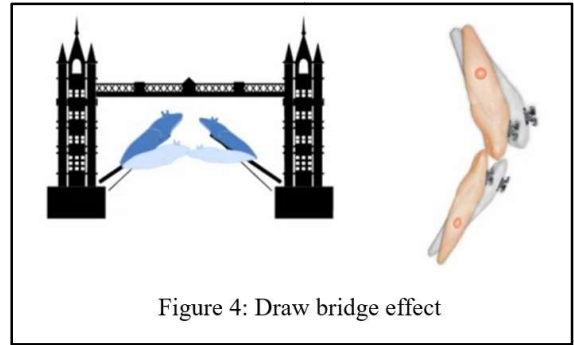


Figure 4: Draw bridge effect

5) **TRAMPOLINE EFFECT:**

When a patient misses regular adjustments, space closure can persist for several months despite the elastomeric module's poor quality and consequently low force delivery. This could be the result of an intermittent pumping activation brought on by the trampoline effect that occurs during mastication. (fig.5)<sup>14</sup>

In patients with stronger masticatory forces, this jiggling action is more pronounced in the lower arch and in low-angle conditions. These assumed variations would easily satisfy clinical criteria because low angle cases and lower space closure typically call for greater stresses. The passive laceback leverages occlusal pressures to retract a canine through the trampoline effect. Biting forces cause the dentition (trampoline) to shift microvertically, which causes the laceback to loosen temporarily.<sup>15</sup> The bending of the lace back retracts the canine and shortens its anteroposterior length. This chewing procedure is repeated numerous times.

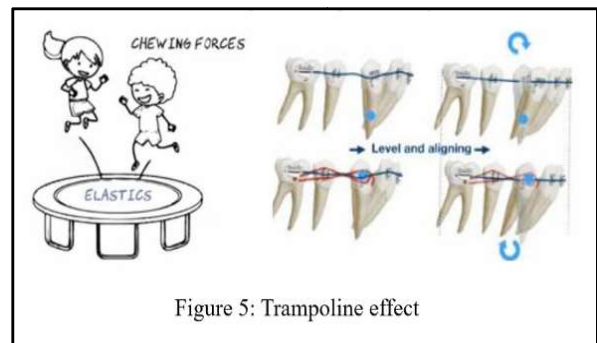


Figure 5: Trampoline effect



## 6) BOWING EFFECT:

Increased overbite caused by incisor extrusion following the placement of a straight wire in the angulated canine brackets and incisor brackets. (fig.6)

Unless it is necessary to repair an anterior open bite with maxillary incisor extrusion, deepening of the bite during treatment is typically not a desired outcome.

Before ligating it, insert the archwire into the canine bracket slot to diagnose or predict the effect. To prevent incisor extrusion, the anterior portion of the wire should not be tied to the brackets if it passes below them. Step-up can be bent to avoid gingivally bypassing the incisors if a bendable wire is utilized. Installing a continuous intrusion arch in addition to the straight wire is an additional technique. Thus, the intrusion arch would counteract the straight wire's extrusive effect.<sup>16</sup>

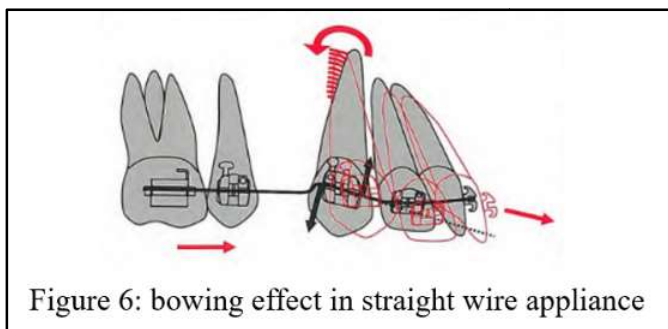


Figure 6: bowing effect in straight wire appliance

In particular, the "bowing effect"—unwanted lingual inclination, anterior tooth extrusion, inter-bicuspid width expansion, and inter-molar width contraction occurs during the space closure stage of lingual orthodontics. The application of a single palatal force resulted in unintended dental movement patterns, such as anterior teeth inclination, premolar expansion, and molar intrusion (also known as the "bowing effect").(fig.7) Thus, the "bowing effects" can be prevented by application of "double cable" mechanics.<sup>17</sup>

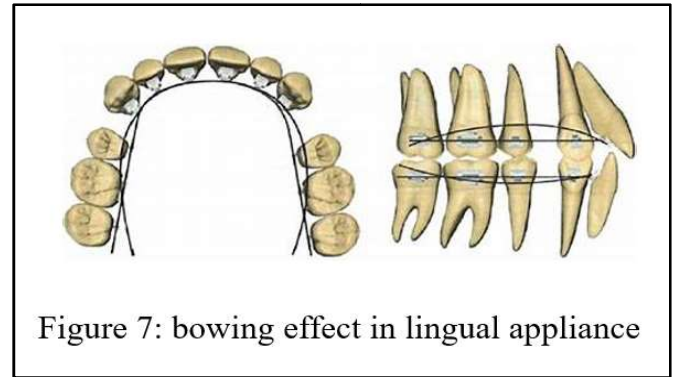


Figure 7: bowing effect in lingual appliance

## CONCLUSION

Orthodontic analogies serve as an invaluable tool for elucidating intricate concepts in orthodontic biomechanics. Treatment mechanics used during orthodontic treatment plays important role to reduce the treatment time and achieve predictable results. Even if some complications occur during the treatment, it is manageable if orthodontists are aware of the cause and mechanics of the effect caused during treatment. By harnessing the relatable imagery of orthodontic procedures can effectively bridge the gap between tangible experiences and relatable ideas.

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# Dentoalveolar Expansion In Mandible - A Review Article

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## Abstract:

Malocclusion, in particular the tooth size-arch length disparity (TSALD), is a typical orthodontic treatment difficulty that has important consequences for extraction choices, particularly when it comes to the mandibular arch. In line with current conservative treatment trends, more conservative techniques such distalization, arch expansion space gaining, and interproximal reduction are now recommended over extractions. Mandibular expansion largely affects the alveolar bone, and unlike the maxillary arch, where rapid expansion can separate sutures, it frequently results in tooth inclinations rather than persistent transverse dimension alterations. In spite of this, new research challenges long-held notions regarding the instability of mandibular arch widening and suggests that it can be achieved permanently. In order to fill a vacuum in the orthodontic literature and advance knowledgeable clinical practices, this review attempts to clarify the numerous mandibular expansion devices and their activation mechanisms.

**Keywords:** Dentoalveolar expansion, Mandible, Malocclusion

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## INTRODUCTION:

For many orthodontic patients, a tooth size-arch length discrepancy is the most prevalent kind of malocclusion. The decision to extract is greatly affected by this discrepancy, particularly in the mandibular arch. It is preferred to utilize techniques like distalization, arch expansion space gaining, and interproximal reduction given the current move toward more conservative treatment modalities.<sup>1</sup>

Edward Angle was the one who was against extractions as an essential part of treating orthodontic patients, and the controversy continues till today with no clear a potential remedy. The absence of sutures in the mandible sparked a contentious debate regarding extraction vs non-extraction. Contrasting to the rapid expansion of the

maxillary arch, that separates the sutures, the effects of mandibular expansion tend to be restricted to the alveolar bone and primarily result in tooth inclinations if there is an increase in transverse dimension. Nonetheless, some researchers contend that appliance therapy is unable to alter the form of the mandibular arch and that mandibular expansion is not conceptually stable. This is being demonstrated through certain studies that it is possible to permanently widen the mandibular arch.<sup>2</sup>

According to Hadelman, the mandibular arch's contemporaneous rule of expansion was used when the inter-premolar and inter-molar widths were less than 25 and 34 mm, respectively.

Walter claims that it is possible to permanently alter the mandibular arch's width. Mandibular expansion as grown becoming more prevalent over the last few

years. There was a discernible decrease in crowding, a discernible rise in dental arch widths, and even long-term stability following mandibular expansion therapy. Not all orthodontists are aware of the existence of orthodontic appliances, despite the lack of evidence in the current orthodontic literature promoting their use to achieve mandibular expansion. This article's goal is to list these appliances along with their activation processes.<sup>1-3</sup>

The few mandibular expansion tools or appliances used to alter the mandibular arch's transverse discrepancy are listed below.

**1) Schwartz appliance<sup>4,5</sup>**

In 1966, Shwartz introduced the Shwartz appliance. It is mostly located in the mandible and is a detachable expansion plate. It is recommended to use the appliance in the mixed dentition stage. The appliance is basically an acrylic plate with a midline split that includes one or two expansion screws; neither the occlusal surface nor the incisal borders are covered by the acrylic.

Additionally, the appliance features a labial bow and is fastened with either an Adam's or a ball end clasp. Patients with aberrant lingual inclination in their posterior teeth or those with inadequacies in arch length can benefit from the use of the Schwarz appliance.

Activating the midline screw causes the Schwarz appliance to gradually expand, which only tilts the posterior teeth laterally. Rapid maxillary expansion then ensues, stabilizing mandibular dentoalveolar position for the duration of the retention period.



**Fig.1 Schwartz appliance**

**Activation protocol** Until the screw reaches its maximum extension before the completion of the

treatment, the activation is done at a rate of roughly 1/4 turn each week. It is advised to wear the appliance for at least 14 hours per day.

**2) Lip bumper<sup>6,7</sup>**

The mandibular dental arch can extend transversely and anterior-posterior thanks to the lip bumper. It is made of 0.04500 stainless steel wire and usually extends from molar to molar in the mandibular dentition.

The wire is normally placed close to the gingival margin, and slightly away from the labial tooth surface, and it may or may not be covered anteriorly with acrylic or plastic. The appliance has adjustment loops directly above the lower molar tubes, which it is made to fit into.



**Fig.2 Lip bumper**

**Activation protocol**

The lip bumper prevents the tongue's pressures on the lingual surface of teeth to remain unbalanced, which leads to mandibular dental arch forward and lateral expansion. Additionally, it moves the facial muscles so that they are not in contact with the lower teeth.

The basic idea behind the lip bumper is to upset the balance that surrounds the teeth.

**3) Williams' expander<sup>3</sup>**

Williams created this fixed appliance to address early mixed dentition crowding. This device is made up of two long stainless-steel tubes this stainless-tube were soldered to the lower primary second molar bands on each side. The tubes extend back to link the first permanent molars' linguals. By extending the wire over the front of the jaw, an expansion screw is fastened to the molar bands. The 0.016 NiTi arch wire is inserted anterior ends of the stainless-steel tubes, and upon activation of

the expansion screw, the NiTi wire is automatically drawn forward to alleviate incisor crowding.

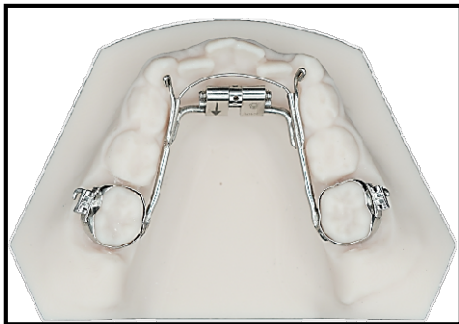
**Modifications:**

a. **Modified williams expander**

The 0.016 NiTi archwire arc is absent in the modified Williams expander, which else resembles the original design. The arms of the expansion appliance are in line with the occlusal line on the cervical third of the premolars.

b. **2-arm mandibular fixed lateral expansion appliance (FLEA).**

According to Leone, Italy, the expansion screw contains two 0.060-inch extension arms and two first molar bands. A 0.035-inch wire was soldered to these arms to give it the required length, allowing the wire to protrude 2.0 mm from the alveolus. The wire reaches below the mid-crown level of the first and second premolars in order to minimize tissue injury.



**Fig.3 William’s expander**

**Protocol of Activation**

A quarter turn of the screw, or around 0.25 mm, should be applied once every two weeks to achieve 0.5 mm of weekly growth.

**4) Trombone appliance<sup>8-10</sup>**

Purpose of the trombone appliance is to support the development of the antero-posterior dimension in the mandible and maxilla. The trombone appliance has great potential for adult treatment because it doesn't impede speech and can be incorporated with traditional fixed appliances.

The appliance's construction is works on the slide principle, in which an innermost tube slides free in an outermost tube to change the device's length. This mechanism is reminiscent of the slide trombone, from which the appliance gets the name. The appliance's molar section is held in place by double lingual supports, and it has a vertical tube attachment that allows the trombone piece to be inserted.



**Fig.4 Trombone appliance**

**Activation protocol**

For accomplishing the necessary first expansion, the device is to be preactivated. Every four to six weeks, the mechanism is reactivated by inserting a new, suitably longer silicone tube in place of the old one. Until the arch's shape is fixed.

In order to contact the anterior region of the lingual arch, the distal portion of the wire is recurved and held in a horizontal sheath on the molar band, which extends mesially at the gingival level. Using light, controlled lingual forces, rapid tooth movement is possible due to the lack of frictional forces.

**5) TORKO Appliance<sup>11</sup>**

This particular micro expansion screw is intended for use in orthodontic therapy. "TORKO" appliances were LEONE's first mono guide, sanitary expansion. TORKO screws are designed to keep food particles, debris, and plaque out of mandibular hygiene equipment since they have a precise torque and don't have any welding marks



**Fig.5 TORKO appliance**



**Fig.6 Mandibular Arnold expander**

#### **Activation protocol**

The appliance encouraged sagittal and transverse dentoalveolar expansion by applying the proper amount of translingual tension. In the morning and evening, the appliance is turned on for one-quarter of a turn. It causes a daily enlargement of 0.4 mm. To reach 11 mm of growth, this method is done every day for an additional 28 days.

#### **6) Mandibular Arnold Expander<sup>1,12,13</sup>**

Berkowitz made the Arnold appliance widely known. In order to accomplish gradual, orthopaedic maxillary growth in patients with cleft palates, a fixed coil-spring device was developed in the 1970s. By tilting the buccal teeth and distalizing the first molars, the Arnold appliance can provide a 4e5 mm gap in the mandibular arch. The apparatus consists of a split lingual frame with a wire insert and a 0.04000 tube on opposite sides. An open-coil spring composed of 0.01000 Elgiloy or 0.040" nickel titanium connects the two sides.

#### **Modification**

Dr. James Thacker's adaptation of the classic mandibular Arnold expander, with a mesial stop for an open-coil spring and an occlusal rest for deciduous molar teeth.

#### **6.a For distalization**

Instead of producing transverse expansion, the lingual frame of the expander is raised above the occlusal table, resulting in molar distalization.

#### **Protocol for Activation**

When the device is seated, the spring is compressed and ready to expand. No additional modifications or turning of the expansion key are required.

#### **7) TransForce Arch Developer<sup>9,14</sup>**

TransForce is a collection of preassembled, undetectable lingual devices used to develop the transverse and sagittal arches. Encapsulated nickel titanium springs produce light, biological forces that produce positive outcomes for patients of all ages, from adult therapy to targeted treatment in a dentition that is mixed.

Throughout the course of therapy, this gadget can be used in tandem with any conventional fixed appliances. This approach reduces the amount of time spent in a stationary appliance and is efficient and economical, especially for adult patient therapy.



**Fig.7 TransForce arch developer**

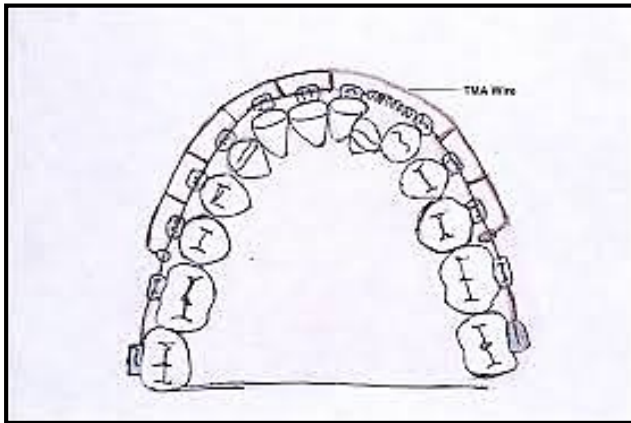
### Activation protocol

This method is applied to many appliances for the development of the sagittal and transverse arches, and it is not necessary to activate the appliance after it is put.

### 8) Beta-titanium auxiliary expansion arch wire<sup>9,15</sup>

The mechanical characteristics of betatitanium wires, such as their low stiffness and resilience, were used to develop an additional overlay arch in the maxillary and mandibular arches for dentoalveolar expansion.

In order to fit within the 0.016 X 0.022" NiTi thermo arch wire, a straight 0.03200 beta-titanium wire with tear-form hooks on both ends was used to make the TMA-EA. In order to cause the dentoalveolar process and the NiTi thermo arch wire to retract in the buccal region, the TMA-EA was kept as a straight segment rather than curled into an arch shape. To determine the length of the TMA-EA, the circumference between each mesial entrance of the molar tubes was measured.



**Fig. 8 Beta-titanium Auxiliary Expansion arch Wire**

### Protocol for Activation

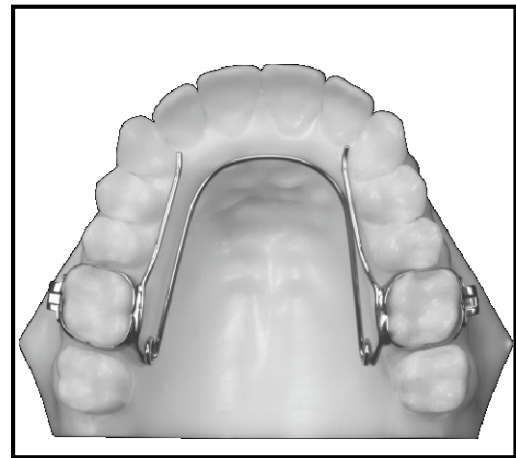
To strengthen the TMA-EA, three stainless steel ligatures were positioned in the premolar and central incisor areas. At every visit, the gadget was taken out and adjusted. The TMA-EA was used for sixty days, or until the transverse relationship was overcorrected.

### 9) Bi-helix expander<sup>1,3,9,16</sup>

The lower arch's Bi-Helix Expander works well to develop the arch and bring the molars into an upright position at the same time. It is a practical and efficient tool that opens up the lower jaw. The most noticeable posterior teeth are bonded to the helix coils, which are used and positioned lingual to the molars to achieve this. Patients are also more comfortable when the anterior helixes are absent.

### Modification

9.a A 0.9 mm-diameter cobalt-chromium wire was utilized to increase the anterior arm's stiffness. The mandibular arch was forced using the Bi-helix appliance, causing a shift of 2.0 mm every three months.



**Fig.9 Bi-helix expander**

### Protocol for Activation

Before cementation, the 2-M band can be stretched apart to pre-activate the bi helix. Alternatively, three-prong pliers can be used once cementation has occurred at the expander's lingual bridge.

### DISCUSSION

When a growing person experiences TSALD or mandibular constriction, a mandibular expansion is frequently carried out. However, the early fusion of the mid-symphyseal area limits it. This essay made an effort to showcase the several mandibular dental arch extension devices that are available. With the Schawrz appliance, dental crowding in the

permanent teeth is addressed. Commonly, severe deficit arch length is used to specify it.<sup>17-21</sup>

Since frequent activation is necessary, the outcome primarily depends on the patient's cooperation. When a late mixed dentition patient exhibits hyperactive mentalis activity, lip bumper enlargement is more appropriate. Additionally, it aids in lip trap correction. Even prior to the eruption of the first permanent molars, crowding in the early mixed dentition is substantially corrected by William's expander. It will result in weekly enlargement of roughly 0.5 mm.<sup>21,22</sup>

Trombone appliances are more helpful whenever expansion is required in three spatial directions, like in Class II division 2, to correct maxillary and mandibular arches. The circumference of the mandibular dental arch grows by 7.4 mm. For patients who are growing or adolescent, any collapse in the inter-canine width makes the TORCO device more appropriate. Its principal mechanism of action is dentoalveolar enlargement. Patients with moderate TSALD are typically treated with Arnold expander from early interceptive to late adolescence. All in all, Arch development using trans-force lingual appliances are typically patient-friendly because they don't need to be activated once they are installed.<sup>9,21</sup> The degree of malocclusion, patient compliance, and age all play a role in the appliance choice for mandibular expansion.

#### **Retention protocol<sup>9,17</sup>**

- A fixed lingual arch appliance or the same appliance used for mandibular expansion can be employed as a retention tool.
- Three to six months is the recommended retention period after reaching the optimal expansion.
- This nonsurgical expansion method can successfully accomplish mandibular expansion in a large number of adult patients with transverse mandibular insufficiency.

#### **CONCLUSION**

There are multiple appliances that can be used for mandibular arch expansion. Every one, nonetheless, has unique benefits and indications. Every patient has a different appliance preference, which is crucial for a successful course of treatment.

The type of appliance selected and the dentition's stage of development were the primary determinants of the amount of expansion attained.

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# Archwire Sequencing for Different Bracket Systems: A Clinical Guide for Fixed Orthodontic Treatment

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## Abstract:

Successful orthodontic therapy is dependent on a variety of factors, including material selection and understanding in addition to manual skills and treatment processes. The selection of wires is a crucial aspect of fixed orthodontic therapy. Orthodontic wires are devices made of wire that fit to the alveolar or dental arch and are used as anchors to straighten out teeth that are positioned irregularly. Practitioners that possess adequate general knowledge can distinguish between different wires and apply the appropriate wire sequence for each patient. This may improve the standard of care. In order to simplify wire selection during fixed orthodontic mechanotherapy, this article aims to analyse the relevant literature regarding the wide variety of orthodontic archwires that are currently available and to collect the information about which wire can be used at various stages of treatment in different bracket systems. The article has received a copyright. The copyright registration number is - L-147877/2024.

**Keywords:** orthodontic Archwire, sequence preference, Brackets systems

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## INTRODUCTION

The primary goal of orthodontics is to correct malocclusion and produce post-treatment outcomes that are both aesthetically pleasing and functionally stable. In order to attain the greatest outcomes, the movement of the teeth must be optimally controlled. This can be accomplished by employing fixed orthodontic appliances, which include brackets, orthodontic archwires, and other attachments, to provide an ideal amount of orthodontic force.<sup>1</sup>

With novel biomaterials being developed on a regular basis, orthodontics is a science that is always changing. In order to apply the forces required to cause biological tooth movement, orthodontic brackets and archwires are essential components of orthodontic fixed equipment. There are a lot of new

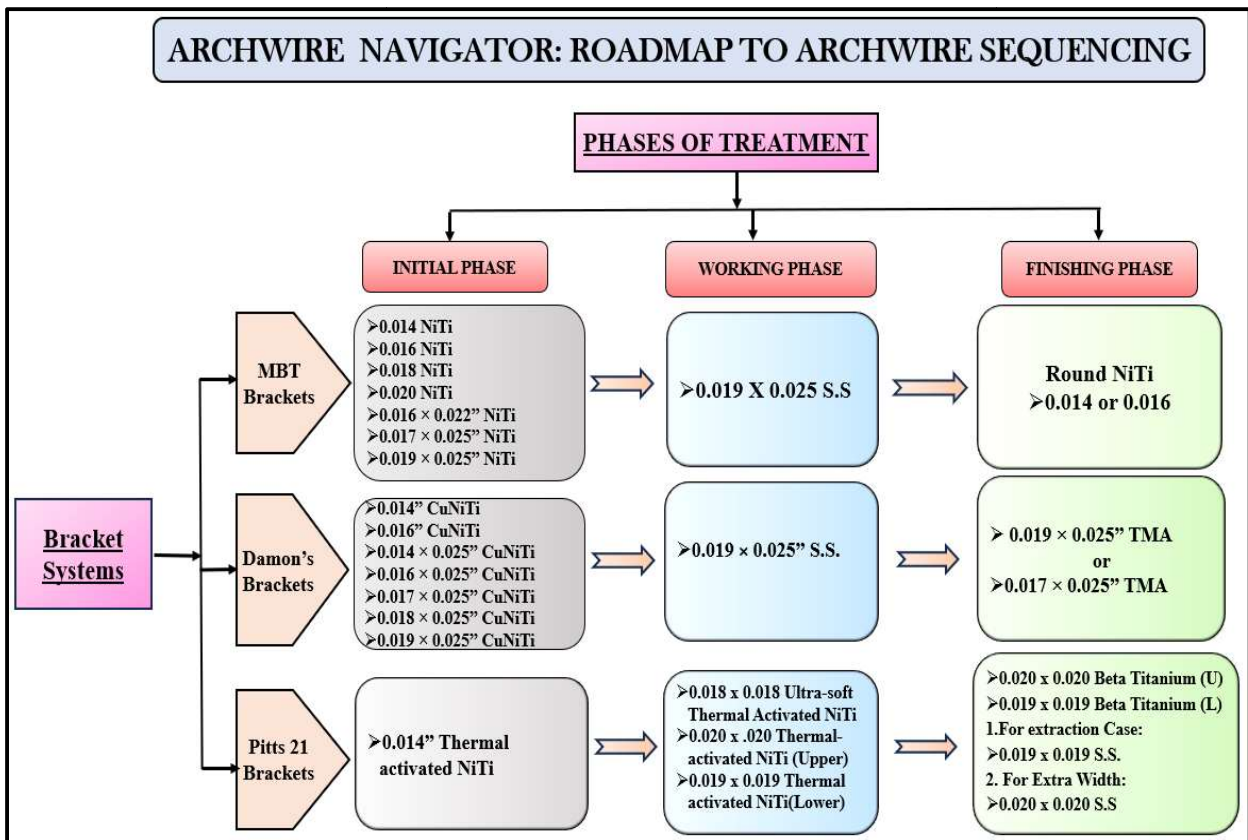
generation brackets available on the market. These brackets' popularity has grown quickly.<sup>2</sup> Orthodontic bracket technology has improved greatly over the years, starting with the McLaughlin, Bennett, and Trevisi (MBT) bracket system and continuing with lingual bracket systems, self-ligating brackets like Damon's, and Pitts 21 bracket system. These braces have made life much easier for orthodontists.<sup>3,4,5</sup>

The goal of orthodontic therapy is to apply forces on teeth in order to move them into desired positions. A force that moves teeth quickly without harming periodontal or dental tissues is excellent. A variety of biological and non-biological elements, such as tooth size and movement type, should be considered when applying force. Lower force applications yield the best effects, while higher force applications that are

greater than vascular blood pressure decrease periodontal tissue cellular activity and slow down or stop tooth movement, at least temporarily. Orthodontic wires are fixed equipment that are used to apply forces to teeth during orthodontic treatment. By exerting force and torque on teeth via the appliances bonded to them, they release the energy that was stored during installation.<sup>6</sup>

Archwires come in a variety of alloy combinations, including titanium molybdenum alloy, copper nickel-titanium cobalt-chromium, nickel-titanium, and stainless steel. Better and more recent biocompatible alloys are being created by the ongoing advancement of metallurgy. To move teeth more effectively without harming the tooth or the tissues that support it and to design the treatment plan, orthodontists should possess a thorough knowledge of the many types of orthodontic archwires.<sup>7</sup>

In past decades archwires have been classified (1) based on material constituents and (2) based on cross sections.<sup>8</sup> However, there is no classification based on phases of treatment and based on different bracket systems. This sequencing of archwire includes the three commonly used bracket systems, (1) McLaughlin, Bennett, and Trevisi (MBT) brackets, (2) Damon's bracket, and (3) Pitts 21 brackets, which is divided into three phases, (1) Initial phase, (2) Working phase, (3) Finishing phase. In order to simplify wire selection during fixed orthodontic mechanotherapy, this article aims to analyze the relevant literature regarding the wide variety of orthodontic archwires that are currently available and to collect the information about which wire can be used at various stages of treatment in different bracket systems.



## CONCLUSION

This archwire sequencing will guide an orthodontist to select archwire appropriately for different bracket systems at different phases of treatment. It will help orthodontists in limiting the inventory of archwires for various bracket systems. Ultimately it will assist an orthodontist, in having a thorough understanding of the various biomaterials available to make maximum use of these and achieve clinical success.

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# Lip Muscle Training Exercises for Orthodontic Patients: A Review Article

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## Abstract:

Lip exercises are an adjunctive approach in orthodontics, designed to improve muscle tone, function, and balance around the oral cavity. These exercises specifically target the orbicularis oris and other orofacial muscles, contributing to better overall treatment outcomes. The primary benefits of lip exercises include functional improvement, enhanced stability of orthodontic results, and aesthetic enhancement. By strengthening the lip muscles, these exercises can correct dysfunctional swallowing patterns, improve speech articulation, and help maintain proper tooth positioning, thus reducing the risk of relapse. Implementation of lip exercises involves routine practices such as lip presses, resistance training with lip trainers, and stretching exercises. Consistent practice, often under the guidance of an orthodontist or speech therapist, is crucial for achieving noticeable improvements. When combined with comprehensive orthodontic treatment and myofunctional therapy, lip exercises can significantly contribute to both the functional and aesthetic success of orthodontic interventions. In summary, lip exercises are a valuable component of orthodontic care, offering support in achieving stable and lasting treatment outcomes. Their integration into a holistic treatment plan ensures that patients receive comprehensive care that addresses both muscular function and dental alignment.

**Keywords:** Lip exercises, Lip training, Lip lengthening exercises.

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## INTRODUCTION

The enhancement of dentofacial aesthetics is the most common motivation for pursuing orthodontic procedures. It is currently acknowledged that in order to achieve ideal occlusions with novel orthodontic treatments, one must move from the Angle model of optimal occlusion attainment to a more aesthetically focused paradigm of the soft tissues, which has been predicated upon the patient's total benefit. "Smile represents a very important means through which the people convey the emotions," according to Hulse. The majority of

orthodontic literature and diagnoses have been made using the patient's profile and lips at rest.<sup>1</sup>

The relationship between the lip structure, gingival scaffold, and teeth can be characterised as a "perfect smile." Teeth must be perfectly aligned and the gingival margins must be healthy and in harmony with the lip for there to be an ideal smile aesthetic zone.<sup>2</sup>

The excessive gingival display is brought on by gingival hypertrophy, a short upper lip, or a combination of the aforementioned conditions. Treatment options for the short lip range from injections of type A botulinum toxin, lip

repositioning, hyaluronic injection, myectomy, or combinations of many of those, all of which are primarily focused on limiting muscle movements<sup>2</sup> A contemporary muscle-training system has been created, and the use of devices known as exercises which are partially orthodontic has facilitated myofunctional treatment. This apparatus has been used to exercise the perioral muscles isometrically, and it will be covered in detail in the study.

**Historical aspect:** The incorporation of lip exercises into orthodontic practice has evolved over several decades, reflecting broader trends in understanding orofacial muscle function and its impact on dental health and orthodontic treatment outcomes.

### Early Developments

**1)1900s - Early 20th Century:** The initial focus in orthodontics was primarily on mechanical adjustments of teeth without much consideration of muscle function. However, pioneers like Edward Angle began to explore the role of facial musculature in orthodontic treatment.

### 2) Mid-20th Century:

The relationship between orofacial muscles and dental alignment gained attention. Researchers and clinicians started recognizing that improper muscle function could lead to malocclusions and treatment relapse. Myofunctional therapy emerged, emphasizing the importance of correct oral and facial muscle function in overall oral health. This period saw the development of various exercises aimed at improving tongue posture, swallowing patterns, and lip strength

### 3)1950s - 1970s:

Scholars like Dr. Walter Straub and Dr. Daniel Garliner significantly contributed to the field by promoting myofunctional therapy, which included lip exercises. The concept of the "oral screen," a device used to train the lips and associated muscles, was introduced and gained popularity among orthodontists as an adjunctive tool.

### 4)1980s - 1990s:

Advances in understanding muscle function and its impact on orthodontic stability led to more structured programs integrating lip exercises into

orthodontic treatment plans. Studies by Graber and others highlighted the importance of muscle training in preventing orthodontic relapse, emphasizing the need for long-term retention and stability.

### 5)2000s - Present:

Contemporary orthodontics increasingly incorporates a multidisciplinary approach, combining mechanical tooth movement with functional training of the orofacial muscles. Advances in imaging and diagnostic tools have provided better insights into muscle function, allowing for more personalized and effective myofunctional therapies, including lip exercises. Evidence-based practices have been developed, supporting the efficacy of lip exercises in enhancing treatment outcomes and stability.

### 6) Technological Integration:

The development of specific devices and tools, such as resistance trainers and digital monitoring systems, has made the implementation of lip exercises more accessible and measurable.

**Lip Exercises:** Simply put, lip exercises are therapies that make use of gymnastic or neuromuscular re-education exercises.<sup>3</sup>A. P. Rogers, a Canadian student of Angle who tried to apply the modelling impact of the functional stimuli to orthodontics, proposed the myo-functional therapy to the American Society of Orthodontists in 1918. Since the 1930s, Roger has created an exercise routine that is still used today to treat hypertonicity in the orofacial musculatures: salted hot water exercise. This exercise dilates blood vessels and also improves appearance by causing the facial muscles to relax. Ingervall conducted a study on the impact of lip training in 1982 and discovered that it had a positive effect on the morphology of the lips, increasing both lip height and decreasing the inter-labial gap.<sup>4</sup>

### Why Perform Lip Exercises?

Lip exercises were beneficial in the following ways: (a) improving the patient's posture; (b) helping the patient develop good habits; and (c) strengthening and thickening the muscles, which aids in the formation of a lip seal.<sup>5</sup> (b) expanding the lip's size and enhancing its functionality in people with small, uncooperative lips. (d) greatly reduces obstructive

sleep apnea by strengthening the lip muscles and increasing the lip closure force; (c) corrects short upper lips, which is one of the primary reasons of gummy smiles.<sup>6</sup>

### Indications of Lip Exercises in Orthodontics

Lip exercises are utilized in orthodontics to address various functional and structural issues related to the orofacial muscles and their impact on dental and facial structures. Here are the primary indications for incorporating lip exercises into orthodontic treatment:

#### 1. Malocclusions Related to Orofacial Muscle Imbalance

**Deep Bite:** Lip exercises can help manage and prevent the relapse of deep bite by strengthening the orbicularis oris muscle, thus aiding in the proper positioning of the anterior teeth.



**Fig 1: Incompetency of lips seen in deep bite**

#### 2. Incorrect Swallowing Patterns

**Tongue Thrust:** Lip exercises are often used in conjunction with other myofunctional therapies to correct tongue thrust swallowing patterns, which can contribute to malocclusions and instability of orthodontic corrections.

#### 3. Lip Incompetence

**Habitual Mouth Breathing:** Strengthening the lip muscles helps in achieving and maintaining lip competence, which is essential for proper nasal breathing and overall oral health.

**Short Lip Length:** Improving lip closure and muscle tone can enhance facial aesthetics by achieving a more harmonious and balanced facial profile. (fig. 2)



**Fig.2: Short Upper lip length**

#### 4. Prevention and Management of Orthodontic Issues in Growing Children

**Guidance of Normal Growth and Development:** In growing children, lip exercises can aid in guiding the proper development of the jaws and dental arches, potentially reducing the need for more extensive orthodontic interventions later.

#### Development of the Lips

The age of the person is one factor that must be taken into account before resolving a lip incompetency issue. The lips' vertical growth in the mixed dentition phase lags behind the facial skeleton's vertical growth. The lower lip grows more quickly between the ages of nine and thirteen, finishing its growth by the age of eighteen-nine. In contrast, the upper lip grows more steadily and reaches its full capacity by the age of seventeen to nineteen. The thickness of the lips rises in adolescents and gradually decreases in adulthood. An essential component of treatment is learning to distinguish between real lip incompetence and normal lip separation associated with mixed dentition<sup>7</sup>. According to Lehman's 2019 observations of men and women's natural smiles, we can see that women's lip lines are on average 1.5 mm higher than men's, with an average of 1-2 mm of gingival display, which is regarded as normal.<sup>7</sup> Any amount more than 2 mm might be regarded as a "gummy smile" and could be a cause of the lips' poor seal. The average length of the philtrum at full growth is 23 mm for males and 20 mm for females. Despite their age difference, males appear to have stronger lips than females.

### Anatomy of the Lip

The insertions, origins, and placements of the muscles in the perioral region have been classified according to major structures.<sup>9</sup>

Group 1 consists of the muscles that insert into the modiolus, which is the fibrous junction site where seven muscles are joined. It is situated lateral to each mouth angle and slightly superior to them.

- i. Orbicularis oris: this muscle contracts to compress lips and force them against teeth; the deep orbicularis oris is what gives lips their sphincter function.
- ii. Zygomaticus major: it elevates during contraction and then moves commissure laterally.
- iii. Levatorangulioris: responsible for elevation of commissures.
- iii. Risorius: draws a lateral commissure before smiling sardonically.
- v. Buccinator: presses lips and cheeks up against teeth.
- vi. Depressor angulioris: these cause the commissure to move laterally and depress.
- vii. Platysma pars: It is conceivable that this is among the major muscles which cause depression of the lips.

**Group 2:** Upper lip insertion muscles: these muscles come from the maxilla below the infraorbital foramen and insert into the orbicularis muscle of the upper lip. These muscles are used to elevate the upper lip.

**Group 3:** Lower lip insertion muscles: these muscles come from the border of the lower jaw and insert into the skin of the lower lip. They depress the lower lip.

- i. Levatorlabii superioris: raise your upper lip and evert it.
- ii. Levatorlabii superioris alaeque nasi: this lifts the upper lip and dilates the nostril.
- iii. Zygomaticus minor: this muscle elevates and pulls the commissure laterally, which helps to create the nasolabial fold.

### Different Lip Exercises

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### Different Lip Exercises

#### 1. Lip Puffing exercise

This exercise is pushing liquid or air between the upper and lower lips while maximally pouting the lips (Figure 3). It needs to be done five to ten times every day<sup>5</sup>, or after four to five pumps of hot salt water back and forth behind the lips, spit the water out and repeat. One half glass of water at a time is used. The lip puffer has a beneficial effect on hypertonicity and can be used without the use of water by inhaling. As much air as possible is forced behind the lips, kept there for a brief period of time, and then released.<sup>3</sup>



Fig.3: Lip puffing exercise

#### 2. Orbicularis oris and circum oral muscle exercise

The patient is asked to close their mouth and extend their upper lip over their lower lip. The holding period of 30 seconds, applied 15-20 times per day, will increase the tonicity of the upper lip.<sup>5</sup>

#### 3. The gum drop exercise

One huge gum drop roughly one ounce is taken. Taking an 18- to 20-inch string depending on the patient's height. The string ends are held by lips and one is fastened to the drop. The other end is behind the teeth. The patient is asked to bend forward with their hands behind their backs until their face is parallel to the floor and a string is stretched. The patient is then asked to expand their mouth and extend their lips as far down as they can. This procedure is performed five to ten times a day.<sup>5</sup>

#### 4. The card pull exercise

The patient tries to pull a card while holding it with one hand. They try to firmly grasp the card between their upper and lower lips at the same time.<sup>5</sup>

#### 5. Exercise with button pulls

After taking a button with a diameter of between one and two inches, a thread is threaded through the button's holes (Figure 4). The patient is asked to place the button under their lips, pull the thread out, then firmly seal their lips to resist it.<sup>3,5</sup>



Fig. 4: Button pull exercise

#### 6. Tug of war with buttons

A thick thread is threaded between the two 1.5-inch flat buttons that is available. The patient is holding one button, and the other person is holding the other button. Suction must be used to hold the button in place. You can increase pressure gradually. It is not

advisable to tilt the patient or give them rapid movements as this could cause injury.<sup>3</sup>

**7. Holding cotton rolls**

Cotton rolls are used to create a lip bumper behind the lip that is bothering you. Which has been recommended for fully everted lips, excessively developed mentalis, and in situations where the short, retruded upper lip is unresponsive to other exercises.<sup>3</sup>

**8. Oral screen**

It can be characterised as a myo-functional device used for muscular exercise. An acrylic screen that is custom-made and extends below the user's upper and lower lips as well as in front of their teeth is known as an oral screen (Figure 5). The metal loop that is linked to this lip-training tool encourages the user to physically draw it against their lips. Additionally, it was applied to the rehabilitation of individuals with oral motor dysfunctions. For the study and clinical applications, various-size oral screens were used; nonetheless, the majority of studies haven't established the exercise's intensity.

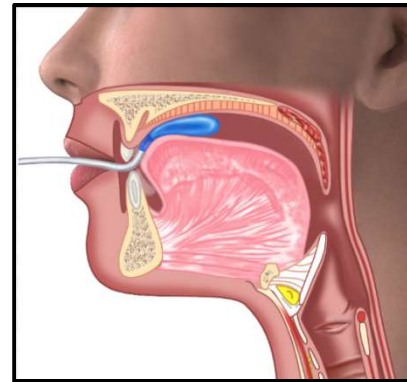


**Fig. 5: Oral Screen**

**9. The Iowa Oral Performance Instrument (IOPI)**

This instrument was created in 2001 and is used to evaluate the strength of the tongue, cheek, and lip muscles. This means that, unlike the previously stated devices, this one digitally offers the bio-feedback in kilo-pascal units. As a result, it may be used to develop the lip muscles via the bio-feedback features for oral motor exercise. For this reason, unlike lip trainers, this device can prescribe a specific intensity for lip strength training. A similar tool was

used in the study for the lip strengthening regimens and evaluations. IOPI employs a tongue bulb to measure force. An procedure that was used to measure lip muscle strength involved sandwiching the bulb between two wood blades. With this arrangement, pressure applied by the lips may be evenly distributed over the whole surface of the bulb.<sup>8</sup>(Figure 6)



**Fig.6: The Iowa Oral Performance Instrument (IOPI 10. Lip muscle strength fixation device Patakara® lip trainer**

Rubber and plastic that are flexible and durable were used to make this device. Considering the shutting of both the lips against that force, set to lower and upper lips loads a force that expands those lips. The attachment handle is attached to the bottom and top of the device so that users can gently pull it. This generates force towards the lip muscles in proportion to the instructions given. The training consisted of four sessions per day, lasting five minutes each, for a total of two months. The results showed an improvement in lip-closing strength, but it immediately returned to the baseline values after the participant stopped the programme.

**11. Hypoxic training of the lip**

A traction plate is placed within the upper and lower vestibules of the mouth and fastened with strings to a weight equivalent to 80% of the orbicularis oris's maximum tensile strength. The practioners ask the subjects to bite with their teeth rather than their lips as they stand and tilt their heads forward. This exercise is hanging the weight for five seconds with only your lips supporting it, then doing it five times with your hands supporting it (Figure 7). The

subjects completed this type of training each day for a period of four weeks. A weight equal to 80% of the new value was used in place of the previous one in the instance when it had increased two weeks into the training. Each participant was given a check-list to ensure they had completed the training each day and maintained their enthusiasm to do it.



Fig 7: Hypoxic lip training

**12. Myobrace lip trainer**

The goal of this device's design is to strengthen the lip's muscles and create a tight enough lip seal. Lip incompetence and symptoms of inadequate muscular tone around the orbicularis oris muscles have been observed in a number of cases. It is required to use this trainer for five minutes twice a day.

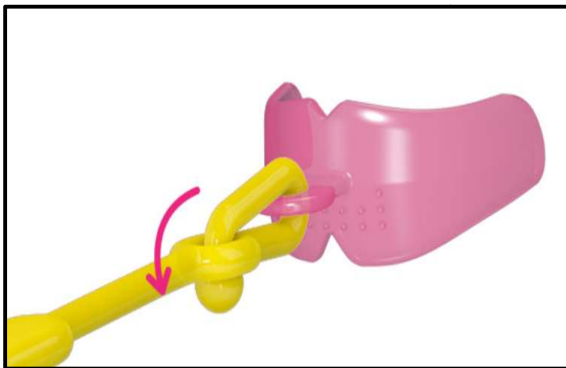


Fig. 8: Myobrace lip trainer

1. The strap is fastened to this apparatus by pushing it upward through an opening on the Myobrace tab.(figure 8)
2. It is forced down through the strap's hole. To secure the strap in place, it is pulled at the end.

3. Lip bumpers are inserted on the lower side of the appliance.
4. The lips are pressed together tightly over the Lip Trainer, and the strap is pushed on it while being held horizontally.
5. If the device slips out, it is reinserted into the mouth with the lips applying just enough pressure to keep it there.
6. To vary this workout and strengthen both the upper and lower lips independently, pull the strap slightly higher and then downward.
7. Continuation of this exercise is done for five minutes.

**DISCUSSION**

The development of several malocclusion types, such as the open bite and maxillary protrusion, as well as articulation errors and periodontal disease brought on by dry mouth are all consequences of lip incompetence. On the other hand, the growth and development of the craniofacial complex is significantly influenced by the lips' proficiency. Thus, addressing those problems may benefit from lip incompetence improvement. One method of training for correcting lip incompetence is lip exercises. Changes in the muscle's cross-sectional area, muscle mass, and fibre type composition, in addition to variations in neural adaptations and shifts in task proficiency, have been identified as the cause of the increase in skeletal muscle strength that has resulted from training. Neural adaptation has been proposed as the cause of the strength improvements made during the early training stages, even in the absence of obvious hypertrophy<sup>15</sup>. The type II muscular fibres that make up 71.80% of the orbicularis oris muscle are fast-twitch fibres appropriate for activities involving instantaneous muscle contractions associated to muscle strength. Furthermore, the muscle is composed of 28.20% type I muscle fibres, which are slow-twitch fibre types appropriate for aerobic exercise linked to muscle endurance. These two factors could be the cause of an increase in the sealed lip ratio associated with hypoxic orbicular oris muscle training. One of the possible causes is the type I muscle fibre reinforcement, which increases the orbicular oris's muscular endurance rather than its strength during aerobic exercise. An additional

plausible explanation for elevating the sealed lip ratio through hypoxic muscle training could be the strengthening of the type II muscular fibres, improving the orbicularis oris muscle's strength and endurance.

## CONCLUSION

Lip exercises in orthodontics aim to improve muscle tone, function, and balance around the oral cavity, contributing to better orthodontic outcomes. These exercises target the orofacial muscles, particularly the orbicularis oris, to enhance lip strength and coordination.

### Benefits:

1. **Functional Improvement:** By strengthening the lip muscles, these exercises can help correct dysfunctional swallowing patterns and improve speech articulation.
2. **Enhanced Stability:** Improved lip muscle tone can contribute to the stability of orthodontic results by maintaining proper tooth positioning and reducing the risk of relapse.
3. **Aesthetic Enhancement:** Stronger lip muscles can lead to better lip posture and aesthetics, contributing to an improved facial profile.

### Implementation:

1. **Routine Exercises:** Incorporating simple exercises like lip presses, resistance training with a lip trainer, and stretching can be effective.
2. **Consistency:** Regular practice, often guided by an orthodontist or a speech therapist, is essential for noticeable improvements.
3. **Holistic Approach:** Combining lip exercises with other orthodontic treatments and myofunctional therapy ensures comprehensive care.

In conclusion, lip exercises play a supportive role in orthodontics, enhancing both functional and aesthetic outcomes. When integrated into a holistic treatment plan, they can significantly contribute to the long-term success and stability of orthodontic corrections.

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# From Digital Designs to Dazzling Similes: Unveiling The Potential of 3d Printing In Pediatric Dentistry

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## Abstract:

Advances in dental technology have improved diagnostic accuracy, reduced treatment delivery and reduced seat time allowing dentist to provide more effective treatment. 3D printing allows the dentist to visualize, record hard and very soft tissue in a precise scale and print models. 3D printing can be helpful in a variety of treatments. The implications of 3D printing for pediatric dentists include implants for artificial insemination, small oriented endodontics, cutting and cutting machines, pre-operative treatment planning, cavities and restoration, crowns, veneers, bridges, space-regainers, operating equipment, oral protectors and other oral materials with great skill. In this article, we have also discussed and summarized various 3D imaging technologies and the latest developments in 3D digital imaging techniques in an attempt to provide a new perspective and greater understanding of the current construction of 3D dental printing technology. It is expected that this article will explore why 3D printing is important for pediatric dentists, and why dentistry promotes advances in 3D printing systems.

**Keywords:** 3D Printing, Rapid prototyping, Additive manufacturing, Stereolithography, Computer Aided Designing.

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## INTRODUCTION:

Over the past few decades, there has been an increase in the utilization of 3D printing in the field of pediatric dentistry. This technology involves the creation of objects by systematically adding layers under the control of a computer. It is considered an additive manufacturing process, also known as rapid prototyping technology or stereolithography. The public has taken interest in 3D printing due to its precise automated procedures and the use of standardized materials to produce personalized 3D objects based on computer-aided designs

Charles Hull is credited with the invention of 3D printing back in 1983, originally referred to as 'stereolithography'. The technology quickly gained significant public attention for its exceptional precision and performance. The technology of 3D printing is characterized by its remarkable attributes of material efficiency, creative freedom, and the ability to personalize designs. It is a promising innovation that is rapidly gaining traction across a range of sectors including defense, art, design, aerospace, architecture, engineering, medicine, and dentistry<sup>1</sup>

During the early 2000s, 3D printing technology was initially utilized in the field of dentistry to fabricate dental implants, customized prosthetics, and anatomical models. The combination of 3D printing technology and 3D visual models has led to the development of a practical and user-friendly technique that benefits dentists in terms of diagnosis. The dental industry has greatly benefited from 3D printing and is currently embracing the latest trends in digital dentistry. This technology has proven to be valuable in creating precise and realistic models for educational, training, and research purposes, as well as treatment planning. Furthermore, 3D printing designed specifically for dental applications has the potential to provide dentists with more personalized service for patients, while significantly reducing costs. It also has the capability to simplify the complex workflows associated with the production of dental prostheses. The demand for 3D printing in dentistry continues to increase as technology advances, allowing dentists to perform dental procedures with greater efficiency and effectiveness.<sup>2</sup>

### 3D Printing Technology

Most restorations and equipment used to restore and protect your mouth are highly customizable. Traditionally, working hours in a dental laboratory have been invested in producing just one crown. With the adoption of more technology by the dentist, CAD / CAM continues to grow in value with unparalleled benefits to the dentist. 3D dental printing encompasses a combination of computer-assisted design and production (CAD/CAM), oral scanning, design, and 3D printing.

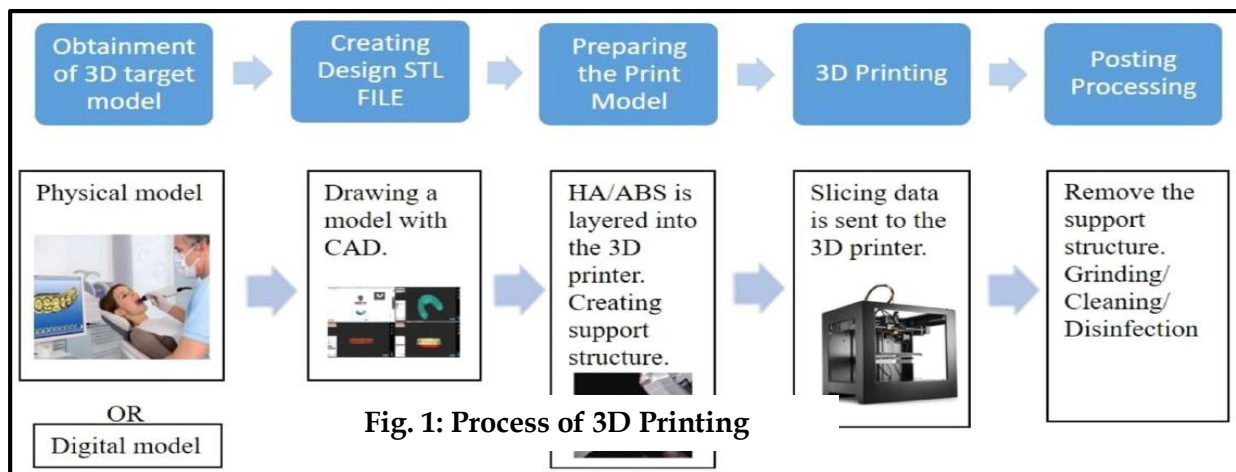
Technically, 3D printers are robotic devices where their tools are nothing but computer-assisted software (design CAD) that allows objects to be built in a visible environment. CAD incorporates the design and construction of 3D models for services such as crowns, veneers, onlays, inlays, bridges, dentures, spacecraft, space-regainers, work equipment, mouth protector and other oral materials with great craftsmanship.<sup>3</sup>

The advancement of computer technology and software applications plays a significant role in the ongoing technological revolution that has propelled

3D printing to its current state. In order for 3D printing to be truly valuable, it is imperative that we have the capability to create printable objects. CAD software enables us to build objects from scratch, while access to volumetric data, such as computed tomography (CT) data, cone beam computed tomography (CBCT) data, and intraoral or laboratory visual area scan data is essential for dentistry and prosthetics applications. Notably, recent advancements in CBCT technology and scanning techniques have brought about substantial changes to various aspects of dental restoration and replacement<sup>4</sup>

The utilization of Computer-Aided Design and Computer-Aided Manufacturing (CAD CAM) for the grinding of crown carriers and bridge structures has become comparable to contemporary dental technology. In the present day, dentists are well-acquainted with the construction materials employed in conjunction with CAD CAM systems, thereby replacing the conventional cast iron tools that have experienced a notable surge in prices in recent times. This technological implementation not only simplifies the handling of materials that would otherwise be troublesome, but also eliminates labor-intensive production techniques, affording the dentist the opportunity to concentrate their craftsmanship on various creative aspects of the production process, such as porcelain aesthetic design.<sup>5</sup>

Each time a dentist performs a rehabilitation or reconstruction procedure, it is customized based on the specific patient, jaw, tooth, or implant. The reconstruction or remodeling process requires accurately replicating the identified geometry, which can be quite complex. While CAD CAM axis grinding processes can achieve this, they are slower and result in waste as material is extracted from a solid block. Additionally, precision is influenced by factors such as the size of the tools used and the properties of the object. On the other hand, 3D printing offers the unique advantage of automating the production of complex structures with a range of desirable properties for dentistry and surgery<sup>6</sup>



### Uses of 3D printing in Pediatric Dentistry Oral surgery procedures:

Incorporating the utilization of 3D printing techniques enables the creation of anatomical models, which serve as a novel approach in the planning and simulation of surgical treatment. This innovative method grants dentists with a comprehensive understanding of intricate structures prior to the commencement of the operation. An illustration of the efficacy of this approach was provided by Anderl et al in the early 1990s, where they successfully employed CT-guided stereo lithography to produce an acrylic model. This model was instrumental in facilitating accurate pre-surgical planning and intra operative management for the surgical repair of a wide midline craniofacial fracture in an 8-month-old baby.<sup>7</sup>

In the context of reconstructing maxillofacial defects, it is crucial to not only prioritize anatomical similarity and appearance, but also the restoration of tissue functions. Autologous bone graft, known for its osteoconductive and osteo-inductive structures, remains the preferred method for reconstructing maxillofacial deformities. However, a major

drawback of autologous bone graft is the requirement for manual facial manipulation.

Therefore, there is a need for a less aggressive treatment option for osteoporosis. One potential solution is the creation of an animated computer model and fast production, which involves designing a computer-generated 3-dimensional visual image that can be transformed into a solid model for clinical applications. 3D printing technology can be utilized to produce customized building plates and facilitate morphological reconstruction in cases of fractures and reconstructive surgery. Additionally, it can aid in the design and construction of a protective barrier that can absorb titanium mesh<sup>8</sup>

Markers were applied to the models, and CT scans were integrated into the software to produce a visual distortion of the model. Subsequently, a process of smoothing and distraction was carried out. An accurate debugging surgical method was developed to align with the preoperative system. To transfer information regarding pin position and alignment from the computer model to the patient, a 3D printing printer (stereolithographic) was utilized. A simulated surgery was conducted on the 3D printed models, and the outcomes were compared with the predictions made by the computer. The recorded data reveals the disparity between the current state and the anticipated state. The findings indicate that the integration of the surgical techniques with the planning process yielded highly precise results. If



implemented in clinical practice, this approach holds the potential to enhance clinical outcomes for patients undergoing traumatic osteogenesis treatment.

#### **Maxillofacial prosthesis:**

Maxillofacial prostheses are commonly used to replace missing parts of the outer ear, which can be attributed to both congenital anomalies and acquired conditions. To ensure optimal functionality and aesthetic appearance, the design of the prosthesis should take into consideration the intricate nature of the surrounding anatomy. In cases where the missing part cannot be accurately replicated, a technique of scanning the opposite side and replicating it on the affected side has proven to be effective. In addition to ear prostheses, advancements in tissue engineering have enabled the printing of cartilage and blood cells.<sup>9</sup>

#### **Dental Implants:**

The utilization of dental implants has undergone significant advancements in the last two decades. Researchers in the domain of oral implantology have made great strides in providing dependable solutions for patients who are partially or completely missing teeth. Incorrect placement of implants can lead to decreased stability of the prosthetic structure supported by the implant. The adoption of 3D printing technology has become increasingly popular in the field of dental implants, primarily due to the development of precise surgical guidelines for implant placement. Rapid design techniques enable efficient mass production or personalized fabrication of 3D objects using computer-generated data<sup>10</sup>

According to research findings, 3D printers have the capability to produce bone tissue tailored to a patient's requirements. These printed tissues can be utilized as screws that mimic the properties of natural bone, facilitating the development of bone cells and promoting tissue growth and differentiation. Moreover, in bone rehabilitation procedures, novel alginate-peptide hybrid scaffolds can be created using 3D printing technology. Scientific studies have indicated that scaffolds made from alginate offer a stable environment for the growth of stem cells. Additionally, composite powders can be formulated to create printable scaffolding. By combining calcium phosphate (CaP)

powders with 3D printing powder based on calcium sulphate (CaSO<sub>4</sub>), scaffolding materials that enhance bone formation can be produced.<sup>11</sup>

#### **Restorative Procedures:**

As photo-polymerization has been utilized in long-term dental treatments, methods involving UV or light in 3D printing have emerged as the initial options. Frames, therefore, have become the most commonly utilized materials in 3D printing; however, they have displayed some limitations in terms of their structured and simplistic editing properties. Consequently, further testing is required for printed 3D frames. In a conducted study, the availability of temporary resin crowns produced through photopolymer jetting, grinding, and compression methods was assessed (in three groups). Twelve study models were created using the image of the mandibular 1st molar mandibular model. Additionally, a visible crown with a cementation space of 60 micrometers was incorporated in all three groups. The design files were subsequently converted into a Poly-jet 3D printer, and the biocompatible photopolymer was printed with a setting size of 5 micrometers. The study's findings indicate that both Poly-jet and Milling techniques yield more precise temporary crowns in the adjacent and lateral regions compared to the molding group. There were no significant differences observed between Milling and Poly-jet ( $p < 0.001$ ). Further research has concluded that 3D printing offers the potential for producing temporary crowns with greater accuracy than traditional methods. However, it should be noted that despite being deemed clinically acceptable in the literature, 3D printed frames for restoration purposes still encounter issues related to shrinkage.<sup>12</sup>

#### **Advantages and disadvantages of 3D printing**

Comparing the advantages and disadvantages of 3D printing, it can be said that 3D print restoration is more advanced when compared to standard restoration or CAD/CAM. It offers high-quality recovery opportunities with fast and easy craftsmanship. The quality of this restoration has been proven in various studies, although cost remains a significant concern. On the downside, stereo lithography and digital light processing are limited to light polymers that need to be stretched,

and supporting materials must be removed. Moreover, the resin used can cause skin irritation and inflammation upon contact with odors. Additionally, the technology has a limited shelf life and vat life, and it cannot withstand high temperatures. Furthermore, it is an expensive technology. Similarly, opting for laser melt also has the disadvantage of being a more expensive technology with a slower process.

## DISCUSSION

This work has already integrated digital production technology, resulting in a shift from traditional art processes to digital production for laboratory work. Only the final stages of restoration require manual intervention. The utilization of CAD CAM technology has become prevalent in dental laboratories and is particularly evident in dental surgery. The process of initiating digital scanning and production varies based on the availability of scanning and production facilities. However, numerous laboratories now possess their own scanners and processing units. In the dental practice field, intraoral scanners and CBCT are progressively becoming more commonplace.

All of this indicates that dentists possess extensive knowledge and proficiency in handling substantial amounts of digital data. Additionally, 3D Printing serves as a valuable tool in CAD dental software, allowing for the integration of intricate objects and various materials. This proves advantageous in situations where the structures are distinct, customized; possess intricate geometries, and when 3D scanning data is readily accessible.

In the field of dentistry, the utilization of 3D printing is already prevalent and holds significant potential for the advancement of various innovative treatments and techniques for dental restoration. However, it is worth noting that national regulatory authorities have not yet established specific guidelines pertaining to the application of 3D printing in surgical procedures or dental practices. Nonetheless, there may arise a need for regulatory bodies to direct their attention towards this technology in order to establish suitable standards.<sup>13</sup> Despite the fact that 3D printing tools and technology have been easily accessible for over a

decade, it is the advancement and availability of scanner technology, compliant-powered software, and computational technology that have made a significant impact. This has led to increased awareness and improved access to resources, fueled by both commercial and public interest.

With the advent of milling technology, a plethora of novel material choices became accessible for the fabrication of dental restorations. In a similar vein, ongoing advancements are being made in the field of 3D printing for dental implants, resulting in the emergence of successive generations. Given the extensive application of 3D printing in dentistry, combined with the extensive history of scanning and grinding technology, it can be argued that dentists possess a greater understanding of these additive manufacturing techniques than any other professional group.

CAD software continues to be predominantly utilized by individuals who are well-trained and experienced in operating computers. However, this reliance on skilled operators may not resonate with younger generations. Additionally, the software itself is constantly evolving to become more intelligent and user-friendly. Exciting future advancements in technology that go beyond the obvious benefits of cost reduction, performance improvement, and faster treatments, which are not frequently encountered in our patients, include the capability of 3D printing on digitally colored pottery and incorporating staining techniques. Furthermore, there are developments aimed at reducing the post-processing requirements for metal parts and integrating machining/milling techniques with the workflow of 3D printing metal parts.

All of these factors indicate that the increasing use of digital technology in dentistry has gained significant traction. In the authors' opinion, we have surpassed the stage of early adoption and now have the potential to widely apply 3D dental printing technology in dental laboratories and patient care. The rate of development in this field is notably high, with a focus on not only individual resources but also the integration of equipment and software planning. This comprehensive approach is crucial in creating a seamless, efficient, and well-organized workflow, which will ultimately determine the

successful adoption and integration of this disruptive technology.

With the advent of this new technology, a fresh opportunity presents itself. However, our challenge lies in refraining from viewing 3D printing as a mere replacement for traditional methods, but rather as a means to foster creativity, innovation, and the development of new, cost-effective procedures for our patients. It is crucial for us to resist the temptation of assuming that digital technology is inherently superior, and instead conduct thorough research to establish standards and ensure that the tools entering our laboratories and surgeries can at least replicate the most commonly utilized "analog" procedures.

### CONCLUSION

3D imaging, modeling, and CAD technology have had a significant impact on all aspects of dentistry. The advancements in 3D printing allow for the creation of unique and intricate geometric forms using digital data and a variety of materials, regardless of location or industrial setting. Currently, a wide range of dental procedures can be performed using a 3D printer, although there is still a need for further technological development to meet all patient requirements. Orthodontics, for example, already fully utilizes high-resolution printing on resin, and the same technology is employed in printing dental restoration models and patterns for the lost wax process, which are vital in internal scanning procedures. In the field of high-performance and implantation, the use of anatomical models made through various 3D printing methods has become commonplace and essential for the design of complex dental procedures. The importance of a reliable supply chain is widely acknowledged.

Despite the affordability of 3D printers, it is crucial to carefully consider the expenses associated with their operation, equipment, maintenance, and the necessity of skilled operators. Additionally, the need for background processing and compliance with rigorous health and safety protocols must be taken into account. However, beyond these considerations, it is evident that 3D printing will have a significant impact on the realm of pediatric dentistry.

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# Pregnancy and Dental Considerations

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## Abstract:

Pregnancy induces dynamic alterations in various physiological aspects of the body, encompassing transient changes within the oral cavity and its associated systems. These can give rise to a range of physical signs and symptoms that have the potential to influence the health, perceptions, and interactions of individuals in their surrounding environment. Special considerations are essential in the dental management of pregnant patients. This review article explores the prevalent dental issues encountered by pregnant women, delving into their associated treatment implications, potential risks of various medications for both the mother and foetus, and the common dental challenges faced during pregnancy. Furthermore, the article addresses the management of dental issues related to pregnancy and provides insights into the appropriate scheduling of dental surgical procedures during this period.

**Keywords:** Pregnancy, Dental considerations, FDA category, Oral care, Drug safety, Management, Teratogenicity.

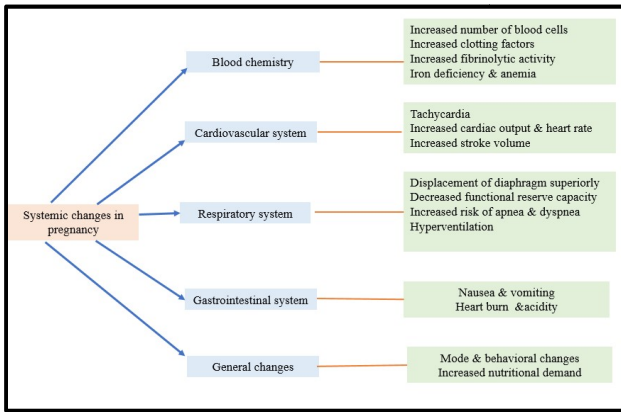
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## INTRODUCTION

Pregnancy is a distinctive and life-changing experience for women. The mother's health is closely linked to the well-being of the fetus throughout pregnancy<sup>1</sup>. Promoting optimal health is essential for a successful gestation period and beneficial outcomes for both the maternal and fetal well-being<sup>2</sup>. Hormonal changes during pregnancy are essential for the correct development of pregnancy and lead to physiological alterations in the maternal body, including the oral cavity<sup>3</sup>. The primary hormones responsible for these modifications are estrogen and progesterone. A significant rise in the synthesis of the female sex hormones, estrogen by a factor of 10 and progesterone by a factor of 30, is essential for the successful progression of a pregnancy<sup>4</sup>. The process of pregnancy elicits a range of systemic, local, physiological, and physical alterations within the female body as a result of increased hormone secretion and the growth of the fetus. These changes

are crucial for aiding the developing fetus and preparing the mother for birthing. Hormonal fluctuations cause numerous alterations in the mouth cavity and other regions of the female body.

Pregnancy can cause oral health changes such as gingival changes including gingivitis, gingival hyperplasia, pyogenic granulomas, and changes in salivary composition, these alterations are commonly observed in pregnant mothers. Elevated levels of estrogen are widely recognized for their strong connection to the increased occurrence of gingivitis and gingival hyperplasia in pregnant individuals<sup>5</sup>. Estrogen, a primary female sex hormone, has a substantial impact on regulating different physiological functions in the body, including those related to the mouth<sup>6</sup>. Progesterone, a crucial female sex hormone, is linked to the onset of melasma, a dermatological condition characterized by the manifestation of brown or Gray-brown patches on the facial region, particularly in the mid-facial region<sup>7</sup>.



**An overview of the physiological alterations on bodily systems that occur during pregnancy is shown in (Fig 1)**

Numerous research has presented empirical data indicating a correlation between poor maternal oral health, pregnancy outcomes, and the dental well-being of the kids. Potential results could involve premature birth, reduced birth weight, and a higher chance of early tooth decay in babies<sup>8</sup>.

Pregnant women may encounter obstacles when striving to attain ideal dental health. Pregnant women come across a number of challenges that make it difficult for them to maintain good dental hygiene on their own<sup>9</sup>. Lack of understanding and value, bad experiences with oral health, and negative attitudes towards oral health experts are some of the obstacles that people face while trying to get dental care. Dentists' reluctance to treat pregnant women's teeth is typically due to misconceptions, ignorance, or lack of experience. Preventing diseases, promoting good oral health, identifying problems early, and acting quickly are all crucial for the oral health of mothers and children. It is widely known that, with the right measures taken, many common and preventative dental procedures can be safely performed during pregnancy.

**The following things can make your oral and tooth health worse during pregnancy:**

1. During early pregnancy, some mothers may experience a strong desire for specific foods, especially carbs, which could result in a lack of attention to dental hygiene after eating these items<sup>10</sup>.

2. Pregnant women may suffer heightened bleeding due to pregnancy hormones (oestrogen, progesterone), which may cause them to perhaps refrain from brushing their teeth. This can lead to increased amounts of bacterial plaque, highlighting the significance of taking extra care during pregnancy<sup>9</sup>.

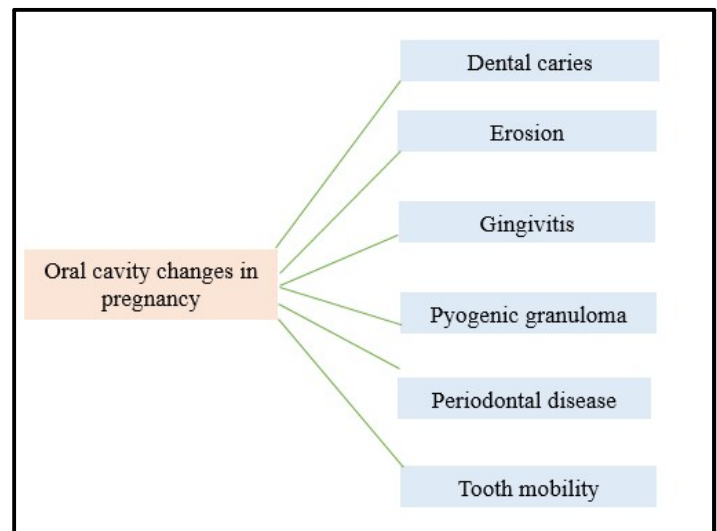
3. The act of vomiting, particularly in the initial phases of pregnancy, leads to an elevation in oral acidity levels. After experiencing vomiting in the early months, mothers may not focus on maintaining proper oral hygiene. Insufficient tooth brushing might result in the formation of an acidic environment in the mouth.

4. Salivary flow reduces. Therefore, caries formation rises throughout this period<sup>10</sup>.

5. Mothers may unintentionally overlook their own oral and dental care while prioritising the baby's health, resulting in a deterioration of their own health.

**Treatment of common oral problems that can arise during gestation**

The oral cavity undergoes several changes during pregnancy and necessitates specific care from dental specialists. (fig.2) Some of the most frequent dental issues that pregnant women encounter is listed below.



**Oral cavity changes during pregnancy (fig.2)**

### 1. DENTAL DECAY:

Increased risk of dental decay is often found during pregnancy. Dental caries is a chronic, complex infection induced by bacterial fermentation of dietary carbohydrates causing tooth damage locally<sup>10</sup>. There is no scientific evidence that foetal calcium needs for intrauterine growth come from the mother's teeth, and the assumption that tooth loss occurs during pregnancy is unfounded. According to research, some types of bacteria, such as Mutans streptococci, Lactobacilli, and Actinomyces, are pivotal in the onset and advancement of dental caries. It is not believed that pregnancy directly affects carcinogenicity or changes tooth structure, making teeth more vulnerable to caries. Increased Mutans streptococci and Lactobacilli levels are observed during late pregnancy and lactation. Regular eating of sugary snacks and drinks during pregnancy can raise the risk of dental caries if oral hygiene is not prioritised. The situation becomes more problematic if the pregnant woman experiences severe nausea and illness, compromising tooth brushing. Untreated carious sores can lead to abscesses and cellulitis.

### 2. EROSION:

Enamel loss can occur in over 70% of pregnant women who experience hyperemesis gravidarum, a severe nausea and vomiting condition<sup>11</sup>. Acid erosion mostly affects the palatal surfaces of the canines and upper incisors. The woman frequently expresses her discomfort from being exposed to dentine.



**Dental Erosion (fig.3)**

### 3. Gingivitis:

Gingivitis, an inflammation of the oral mucosa surrounding the tooth, is caused by plaque. An elevated inflammatory response to tooth plaque during pregnancy might cause swelling gingival bleed when brushed. Gingivitis worsened by pregnancy hormones is called pregnancy gingivitis, however it is not significantly different histologically from non-pregnant gingivitis<sup>12</sup>. Clinical characteristics of pregnant gingivitis might be localized or generalized. Gingivitis is often attributed to plaque, although Raber-Durlacher et al. found that pregnancy does not increase the amount of plaque in the mouth. Pregnancy may cause gingival inflammation by affecting estrogen and progesterone receptors, but the specific mechanism is uncertain. The gingival changes that occur during pregnancy can be attributed to heightened vascularity, increased blood flow, alterations in the immune system, and changes in connective tissue metabolism.



**Gingivitis (fig.4)**

### 4. Pregnancy Epulis:

Pregnancy epulis is a localised, soft hyperplastic lesion that occurs on the gingiva in up to 5% of pregnancies<sup>13</sup>. A pedunculated, bright red, highly vascularized lesion with minute white specks may be up to 2 cm in diameter. While it can occur anywhere on the gums, interdental papillary gingiva is where it most frequently occurs, especially on the labial aspect and upper jaw more frequently than the lower. Although teeth close to the pregnant epulis may drift and become more mobile, bone damage rarely occurs around the directly affected teeth. Although it can occur at any time, it is most frequent in early pregnancy. This lesion may originate from an irritated gingival papilla, making plaque an essential beginning element. Furthermore, hormonal changes

associated with pregnancy may enhance the gingival response to plaque, resulting in the development of the pregnant epulis. Both in men and in non-pregnant women, it shares histological and clinical similarities with pyogenic granuloma.



**Pregnancy Epulis (fig.5)**

### 5. Periodontal disease:

The destructive processes of periodontal disease, including bone and ligament degeneration, are mostly caused by the host's response to plaque bacteria. To colonize subgingival locations and enter connective tissue, germs must circumvent various host responses. Pregnancy may impact various aspects of the immunological response to the periodontium, resulting in decreased activity and efficiency. Less neutrophils, decreased phagocytosis and chemotaxis, as well as a decline in cell-mediated immunity and antibody responses, are the principal alterations. Because periodontal tissues contain progesterone and oestrogen receptors, the increase in hormone levels during pregnancy affects tissue reactivity. Fibroblasts, gingival vessels, and extracellular matrix are all affected.

In addition to stimulating matrix synthesis, oestrogen plays a role in cellular proliferation, differentiation, and keratinisation. It also enhances the production of localised inflammatory mediators, especially PGE 2, which, in conjunction with progesterone, produces osteoclastic activity. By lowering PAI-2 levels, which stop tissue proteolysis, altering collagen production, and decreasing fibroblast proliferation, progesterone disturbs tissue homeostasis.

Gram-negative anaerobic bacteria cause periodontal disease. *P. intermedia*, *Tannerella forsythensis*, *P. gingivalis*, *Treponema denticola*, and *Actinobacillus actinomycetemcomitans* are examples<sup>14</sup>. While the

cause of pregnancy-related gingivitis remains unclear, increased Gram-negative rods have been linked to gingival bleeding and inflammation. *P. intermedia*, *P. gingivalis*, and *Tannerella* species (previously *Bacteroides*) have been found to grow more selectively in subgingival plaque during pregnant gingivitis. This can be attributed to the species' capacity to utilise pregnancy hormones, particularly progesterone, for sustenance. Pregnancy-induced selective growth can be influenced by immune system alterations, bleeding gingiva, and heightened pocket depths, which create a conducive habitat for anaerobic microorganisms.

### 6. Tooth mobility:

Pregnancy has been found to result in increased tooth movement; even in women with normal periodontal health. The mobility of the upper incisors is highest during the final month of pregnancy. The observed increase in mobility may be attributed to mineral displacements inside the lamina dura, rather than alterations in the alveolar bone. The observed mobility is thought to be affected by the severity of periodontal disease and the disruption of the tissues that support the attachment. This movement often resolves after child birth.

### Suitable timings and Pregnancy Dental Care Guidelines:

#### The first trimester (1-12 weeks):

The process of cell division and organogenesis reaches its maximum during the second to eight weeks following conception. Higher vulnerability to stress and teratogens develops during this period, accounting for 50-75% of spontaneous abortions. Drugs and infections during this time can disrupt the process and cause severe birth abnormalities. Patients should arrange dental assessments in the first trimester to examine their present dental health, discuss expected changes, and prevent any dental issues during pregnancy. Performing the operations now is not advised. Two concerns arise while considering procedures during the first trimester. First, teratogens represent the highest risk to growing children during organogenesis. Additionally, one in five first-trimester pregnancies result in spontaneous abortions. Dental operations near the period of spontaneous abortion may be suspected, raising



worries for both patient and practitioner about potential prevention<sup>15</sup>.

**The Current suggestions are:**

1. To provide patients with information regarding the oral changes that takes place in mothers during pregnancy.
2. To emphasize the importance of adhering to rigorous oral hygiene guidelines and, consequently, managing plaque.
3. To limit dental intervention to emergency care and periodontal prophylaxis only.
4. To circumvent unnecessary radiography. They should be taken selectively and only when necessary.

**The second trimester (13-24 weeks):**

The process of organogenesis is completed, resulting in a little risk to the fetus. This is the most secure timeframe for administering dental treatment while pregnant. Proper posture is crucial for pregnant patients, particularly in the third trimester. The expanding fetus and placenta cause the uterus to directly cover the inferior vena cava, femoral arteries, and aorta. When a mother lies supine during procedures, the weight of the uterus might block blood flow via major vessels, causing supine hypotension. In this state, insufficient blood flow produces a drop in blood pressure, leading to syncope or near-syncope episodes. Simply putting the patient on their left side and elevating the chair head can prevent compression of major blood arteries. Dental practitioners should communicate with obstetricians if there are concerns regarding the safety of a procedure, especially if there are unusual conditions related to pregnancy<sup>16</sup>.

**The Current suggestions are:**

1. Instructions for maintaining oral hygiene and controlling plaque.
2. Scaling, polishing, and curettage can be carried out if deemed necessary.
3. The management of any current oral health conditions.
4. Elective dental care is considered to be safe.
5. Minimize the use of regular radiography. Use only when required

**The third trimester (25-40 weeks):**

The parturient's blood volume peaks about the thirtieth week and remains increased till delivery.

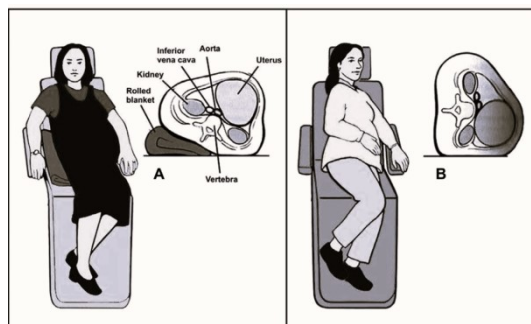
The fetus is not at risk during this trimester, but the expectant woman may feel increased discomfort. Schedule short dentist sessions with proper chair placement to avoid supine hypotension. While basic dental treatment is safe in the early third trimester, it should be avoided in the middle of the trimester.

**The Current suggestions are:**

1. Instructions on oral hygiene and plaque management.
2. If necessary, scaling, polishing, and curetting can be done.
3. In the latter half of the third trimester, refrain from getting elective dental care.
4. Avoid routine radiographs. Use selectively and when they are needed.

**Dental chair positioning and pregnancy**

When doing chair side activities, it is essential to make sure that expectant patients are seated in a safe and appropriate position. By implementing this approach, the occurrence of complications such as supine hypertensive syndrome in the dentist chair can be mitigated. For instance, if a pregnant woman is lying on her stomach, there is a high likelihood of her developing moderate hypoxemia and an irregular arterial oxygen gradient. Likewise, the presence of a pregnant uterus poses a potential hazard of vena cava and aorta compression, which can result in postural hypotension. Hence, it is crucial for the dentist to ensure that the patient is seated in the correct posture. This can be achieved by either elevating the right hip by 10-12 cm to alleviate pressure on the vena cava, or by tilting the patient's left side by 5-15%. If the hypotension persists, it is recommended that the patient assume a complete left lateral position. However, it is advisable to make these alterations during the third trimester.



**Dental chair positioning and pregnancy (Fig 6)**

### **Radiographs, pregnancy and the foetus:**

The electromagnetic radiation known as X-rays can ionize the substance it passes through. Ionizing living materials damages cells and DNA. Damage to the foetus cells depends on radiation dose and pregnancy stage may cause miscarriages, birth abnormalities, or mental illness. Radiation teratogeneity varies by fetal age and dose. The greatest risk of foetal teratogeneity and death occurs in the first 10 days following conception. Fetal development is most pivotal between 4-18 weeks post-conception<sup>17</sup>. The foetus receives little dental radiation. As embryos and fetuses are more radiosensitive than adults, they are more susceptible to negative effects from radiography exposure. In the first two weeks after fertilization, physicians should inquire about the patient's last menstrual period before obtaining a radiographic imaging, as the patient may not be aware of being pregnant. General inquiry cannot provide a reliable pregnancy status diagnosis, hence lead shielding is recommended for all women in their childbearing years. Mutations and bad consequences are directly linked to radiation dose, which increases when excessive radiation is utilized to compensate for poor processing quality. Depending on the view, exposure might be increased. Radiation from maxillary anterior views can penetrate the abdomen area, both from the original beam and scatter/radiation. A comparable exposure may also occur with posterior views, depending on head position. Precautions can be made to minimize fetal exposure during radiography. To minimize fetal exposure, use a lead shield over the patient's abdomen, carefully collimated beam, and high-speed film.

The National Commission for Radiation Protection (NCRP) recommends limiting cumulative fetal radiation exposure to 0.20 Gy to prevent microcephaly and mental retardation<sup>18</sup>. CT is the preferred modality for locating deep-seated infections and imaging lateral pharyngeal infections. Compared to routine film radiographs, internal anatomy is better defined and bony changes are evident. CT dosages are higher than simple radiography but lower than polytomography's many slices. CT doses vary based on scanner type, technique, exposure settings, number of slices, and

slice thickness. CT machines typically produce skin doses between 2.5 and 4.7 rads, ranging from 0.4 to 4.7 rads. Combining axial and coronal pictures requires 3.5 to 5.0 rads. However, the gonadal dose for a whole scan is lower, ranging from 0.1 to 0.3mrad. To reduce foetal exposure, use shielding devices judiciously. Diagnostic irradiation can provide vital information for maintaining maternal and fetal viability, outweighing the dangers of exposure. Consider MRI as an alternative to CT for fetal irradiation. MRI has superior soft tissue sensitivity and contrast compared to CT, perhaps aiding with challenging infections. MRI creates images using magnetic field-assisted nuclear alignment without ionizing radiation.

However, the dangers of fetal exposure to intense magnetic fields remain unclear. Fetus radiation exposure exceeding 10 rads is dangerous and can cause mutation, mental retardation, and eye abnormalities. X-rays rarely exceed 5 rads in a single or multiple investigations. A baby's exposure to radiation from a mother's dental X-ray is only 0.01 millirads. For a baby to receive one rad, it would require 100,000 dental X-rays, as one rad is 1000 millirads.

The diagnostic X-ray risk is modest. Many specialists advise postponing radiation exposure until birth. Dentists must ensure that X-rays for specific conditions are safe for the growing fetus. To minimize radiation exposure, use protective thyroid collars and aprons whenever possible.

### **Pharmacodynamics and pregnancy**

Another contentious aspect of treating pregnant dental patients is medication administration. Toxic or teratogenic drugs may reach the placenta, posing a major problem. Furthermore, any medication that depresses breathing might induce hypoxia in the mother, which can harm to the foetus. Avoid administering drugs during pregnancy, especially in the first trimester. Sometimes this guideline is impossible.

The FDA provides clear criteria for prescription medications during pregnancy by classifying the probability that a medicine may result in birth abnormalities. They are listed as follows:

*FDA risk categories of drug used during pregnancy and their potential risk factors.*

Category	Risk factors	Antibiotics	Analgesics	Sedative Hypnotics	Local Anaesthetics
A	Satisfactory well controlled studies on humans showing no hazard to the fetus				
B	Studies on animals demonstrating no fetal risk whereas no well controlled and adequate studies done on pregnant women	Amoxicillin Cephalexin Chlorhexidine Clindamycin Erythromycin Metronidazole Penicillin	Acetaminophen Ibuprofen		Lidocaine  Prilocaine  Prednisolone
C	Studies on animals establishing fetal hazards no controlled studies on human beings	Ciprofloxacin	Codeine with acetaminophen Hydrocodone+ acetaminophen Propoxyphene		Mepivacaine
D	Evidence of risk to the fetus, can be used in exceptional cases or circumstances	Doxycycline Tetracycline	Ibuprofen	Barbiturates Benzodiazepines	
X	The hazards of using the drug in pregnant women far more than the benefits	Nitrous oxide (avoided in the first trimester as it may result in neonatal depression and spontaneous abortion)			

**FDA risk categories of drug used and their potential risk factor during pregnancy (Fig 7)**

**Teratogenicity**

Teratogens are agents that permanently affect offspring's form or function after exposure to the foetus. Numerous drugs can produce teratogenic effects including functional and structural birth abnormalities. Alcohol, smoke, cocaine, thalidomide, methyl mercury, anticonvulsants, warfarin compounds, ACE inhibitors, some antimicrobials, retinoids, penicillamine tetracycline, trimethadione, valproic acid, and phenytoin may be Potential teratogenic medications. First trimester embryos are especially susceptible to teratogens. Tetracycline can discolour deciduous teeth even in the second half of pregnancy, whereas other teratogens do not hurt when venerable structures mature.

Drugs	Known side-effects
<b>Drugs teratogens</b>	
Alcohol	Cranio-facial abnormalities, fetal alcoholic syndrome
Tobacco	Brain damage, cleft lip and palate Placental abruption, cognitive delay
Cocaine	Placental abruption, cognitive delay
Thalidomide	Malformation of extremities of new born
Methyl mercury	Brain damage, microcephaly
ACE inhibitors	Cranio-facial abnormalities
Valproic acid	Mental retardation, neural tube effects
Tetracycline	Maternal toxicity and discoloration of tooth
Phenytoin	Hypoplastic nails, typical facies
Warfarin	Facial dysmorphism, chondrodysplasia
Benzodiazepines/ barbiturates	Cleft lip and palate deformities
<b>Maternal teratogens</b>	
Toxoplasmosis	Spinal abnormalities, brain dysfunction
Chlamydia	Conjunctivitis, pneumonia
Hepatitis B	Liver damage
Parvovirus	Anemia
Chicken pox	Eyes damage

**Drugs and maternal teratogens and possible undesired effects (Fig 8)**

**CONCLUSION**

Dental care should not be delayed due to pregnancy. Patients, dentists, and doctors must work together to provide oral health throughout pregnancy. Pregnant patients must learn about oral hygiene, oral cavity changes, and routine dental appointments. Dental professionals must be aware of pregnancy-related disorders and how to treat them without injuring patients or foetuses.

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# Unveiling The Mystery of Screw Loosening: A Review

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## Abstract:

The use of osseointegrated implants has greatly expanded dentists' choices for restoring edentulous spaces. The primary goal for clinicians has always been to treat patients with the best chance of success. Two common issues with implants are screw loosening and fracture at the implant abutment junction. It is believed that the main cause of screw loosening might be the "loss of preload." Many factors can impact the relationship between torque and preload. This review article aimed to examine the various factors that influence abutment screw loosening and how they impact the success of dental implants.

**Keywords:** Abutment screw, Preload, Screw fracture, Screw loosening.

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## INTRODUCTION

Dental implants are a dependable and effective option for restoring the lost teeth, for reviving the oral function, and enhancing quality of life. With the inventions of new technology and techniques, dental implants have become a popular way for patients seeking a long-term tooth replacement solution. Prosthesis which are retained by implants have become an easily available and widespread option for missing teeth. Although implants have become the popular option for replacing lost teeth, the risk of complications such as mechanical, biological, and esthetic cannot be overlooked.<sup>1,2</sup>

Commonly observed complications which are mechanical in nature, related with implant-supported fixed prostheses consists of loosening of screws, fracture of screws, fracture of veneering material or framework, loss of retention, and implant fractures.<sup>3,4</sup>

Implant screws have a critical role in the dental implant treatment success, providing stability, retention, and longevity to the restored teeth or

prostheses. Proper care, maintenance, and follow-up are indispensable to ensure the functionality and durability of implant-supported restorations. The abutment screw is a critical component of almost all implant systems, serving to connect the implant and abutment. When tightened, the screw undergoes elastic deformation and elongation, creating a tensile force known as preload.<sup>5,6</sup>

One of the most commonly encountered mechanical implant complications includes screw loosening and screw fracture.<sup>7</sup>

## MECHANISM OF SCREW LOOSENING:

The abutment screw plays a crucial role in connecting the implant and abutment in major implant systems. Preload can be defined as tension created in a screw due to elastic deformation when the threading are tightened.<sup>8,9</sup> Preload can also be defined as "the axial force generated between the threads of the abutment screw and the inner part of the implant along the direction of the long axis of the implant." The screw can be compared to a stretched spring. The implant and the abutment are held together by the clamping force, which is determined

mainly by the preload and is crucial for maintaining stability in the implant and abutment connection.

Bickford<sup>10</sup> has described the screw loosening process into two phases. In first phase, the screw's initial tensile deformation decreases under external force impact, which leads to a decreased clamping force. In the second phase, as the clamping force decreases, micromotion between the implant and abutment interface increases, leading to connection instability and eventual screw loosening. This progression from preload loss to abutment screw loosening underscores the importance of maintaining clamping force for long-term stability.<sup>5</sup>

### FACTORS AFFECTING SCREW LOOSENING

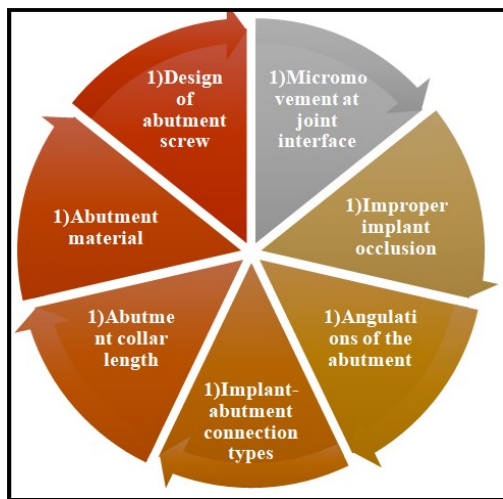


Fig 1. Factors Affecting Screw Loosening

#### 1. Micromovement at the joint interface

Screw loosening routinely result from micromovement at joint interface. This may be correlated with an initial torque which is inadequate, frameworks that are ill-fitting and changes in occlusal overload, screw design, materials used for screw manufacturing, and surface coatings of screw in co-occurrence with a movement in direction of implants with internal connections have decreased the incidence remarkably. Correct torque should be used to place screws and should be re-applied with caution because their mechanical properties might have changed.<sup>6</sup>

#### 2. Improper implant occlusion

Improper implant occlusion might be one of the reasons related with screw loosening. More tendency to occlusal overloading can be found in dental implants compared to natural teeth because periodontal ligament loss. Misch<sup>11</sup> reported that adjustments of occlusion are fundamental to prevent differences in mobility between implants and teeth during heavy occlusal forces. Regular follow-ups and periodic adjustments of occlusion were essential for prevention of overload that might occur with the positional changes of natural teeth.<sup>12,13</sup>

#### 3. Angulations of the abutment

Hotinski et al. found that angulation-correcting implants were more effective at preventing screw loosening compared to straight implants. In another study comparing the removal torque values of internal hex abutments and external hex abutments, a significant difference was observed in the external hex abutments.<sup>14</sup> On the contrary, El-Sheikh et al. found by increasing abutment angulation and collar height, significantly affected removal torque value following dynamic cyclic loading, leading to increase in screw loosening.<sup>15</sup>

#### 4. Types of implant-abutment connection

The connection type present between abutment and implant (e.g., external hex, internal hex) can impact implant system stability and the screw loosening tendency.<sup>16</sup> The advantage of an external connection is the anti-rotation and proper orientation of the abutment. However, the contact parts of the joint have limitations in diameter and height, which means that external forces, especially lateral forces, can cause micro-motion at the implant-abutment interface, leading to joint instability. In a study by Binon et al., it was found that external forces can directly transmit to the abutment screw and the top of the implant near the joint, potentially causing loosening or even fracture of the abutment screw in the external connection.<sup>17</sup> The internal connection is more advantageous than the external connection for maintaining stability of the implant and abutment connection. It resists torque loss and screw loosening to a greater extent than the external connection. A recent systematic review by Vetromilla et al concluded that abutment screw loosening and abutment fracture occur more frequently in external

hexagon connections compared to internal hexagon or morse taper connections.<sup>18</sup>

### 5. Abutment collar length

Abutment collar height should be selected depending on gingival thickness to achieve a more esthetic appearance. Siadat et al<sup>19</sup> studied different collar heights of the abutments and their influence on loss of torque. There was no significant difference in torque loss observed among the various collar heights of abutments before applying cyclic loading. However, the abutment with a greater collar height was found to be more susceptible to torque loss after cyclic loading. This could be due to the increased collar height of the abutment, leading to a longer axial cantilever length.

### 6. Abutment material

The material of abutment could also influence the implant-abutment connection stability. Jo et al<sup>20</sup> conducted a study in which he found that abutments made of titanium alloy (Ti-6Al-4V) had higher compressive strength values and preload in comparison to the commercially pure grade 3 titanium (group T3), and commercially pure grade 4 titanium (group T4). Zirconia and alumina abutments had greater brittleness and higher modulus of elasticity compared with the conventional titanium abutments, thus affecting the torque loss and preload. Dhingra et al<sup>21</sup> concluded that zirconia abutment had higher torque loss than titanium abutment after cyclic loading. Debris lodged between the zirconia abutment and screw, and between the abutment and implant, may also impede further torque loss and maintain joint stability. Therefore, the zirconia abutment may still be a suitable choice for various clinical scenarios.

### 7. Design of abutment screw

Lee et al<sup>22</sup> did a study in which the screw surface was contaminated with nanoparticles of titanium to make surface if screw more rough with a larger coefficient of friction. After repeated insertion and removal, it was discovered that the contaminated screws experienced a greater torque loss compared to the non-contaminated ones. This was due to an increase in the coefficient of friction on the screw surface, making it more susceptible to the settling effect and resulting in a greater loss of preload.

## CONCLUSION

Screw loosening or the loss of torque presents to be the most common mechanical problem seen in day to day practice by clinicians. Various factors influence the decrease or increase in the progression of this complication which involves micromovement, implant-abutment angulation, improper implant occlusion, implant-abutment connection, abutment collar length, abutment screw design, and abutment material. An attempt has been made to include all the major factors that may contribute to abutment screw loosening. Dentists who practice implant placement or restore them prosthetically must be aware of these complications. Screw loosening and fractures can be prevented by increasing frequency of follow-ups, retightening any loose screws or replacing with new ones whenever indicated.

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# Impressing For Excellence –A Technique for Making Final Impression for Resorbed Flabby Residual Ridges

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## Abstract:

Many times, it is difficult to create a final impression of an edentulous arch because of conditions in residual ridges like diminished bone height, undesirable residual ridge morphology, or undesirable muscle attachments. Making an impression becomes challenging when the mucosa is mobile or hyperplastic, often known as flabby tissue, across the remaining alveolar ridges.

To provide the patient with a prosthesis that functions well, treatment processes should be modified to fully capture the characteristics of the denture-bearing surface while retaining the stability of the denture foundation.

This article explains how to use a customized unique custom tray, light body elastomeric impression material, to create a final imprint of highly hyperplastic tissue (sometimes referred to as flabby residual ridges). This method is particularly useful for recording hyperplastic tissue that is present across the slopes of the severely resorbed mandibular ridge.

The goal of the custom tray's design and the material selection for the impression process is to avoid distorting the movable residual ridges during the imprint-making process. The application of this technique helps to preserve the contour and capture every nuance of the tissues' details without shifting hyperplastic tissue. The technique is changed to keep the denture stable.

**Keywords:** Hyperplastic tissues, flabby tissue, Impression, Denture, Custom tray, modified custom tray

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## INTRODUCTION

A final impression of an edentulous arch may often be challenging to create due to problems with residual ridges, such as shortened bone height, undesired residual ridge form, or undesired muscle attachments.<sup>1</sup> When the mucosa is movable or hyper

plastic also referred to as flabby tissue across the remaining alveolar ridges, it becomes difficult to make an impression. Such flabby tissue appears more frequently in the anterior maxilla in two conditions: combination syndrome<sup>2</sup> or significant bone resorption in the mandibular alveolar ridge.<sup>3</sup> Dentures made with this technique will become

unstable and lose retention because the displacement of tissue brought about by taking an imprint under these conditions will force the tissue to return to its original shape when the impression is finished.<sup>4</sup> Studies show that roughly 5% of edentate mandibles and 24% of edentate maxillae have flabby ridges. Flabby ridges are easily moved during occlusal pressures due to insufficient support,<sup>5</sup> which affects denture retention by causing the loss of the peripheral seal.<sup>6</sup> surgical procedures are used to eliminate the flabby ridge before creating a complete denture, including scalpel surgery or injections of sclerosing agents. To address flabby ridges; moreover, surgical ridge enhancement is advised.<sup>5-12</sup> However, because surgical removal of the flabby tissue increases the weight of the denture material and eliminates soft tissues that absorb tension, it causes harm to the underlying tissues.<sup>13</sup>

Furthermore, the treatment of dentures with flabby ridges is increasingly reliant on conventional prosthodontic approaches such as balancing occlusal stresses and particular impression techniques.<sup>5,13, 14</sup> Numerous approaches to treating the flabby tissues in the front maxilla are described in the literature.<sup>5,15</sup> Nevertheless, there are very few reports of techniques for managing soft tissue in the mandible throughout the imprinting process. There are differences in the major and secondary load-bearing areas, supporting areas, and relief areas in the maxilla and mandible, therefore we need to alter certain things when taking an impression of the mandibular ridges with flabby tissues.

Mandibular residual ridges can be accurately documented using elastomeric impression materials because of their precision and capacity to disperse pressure uniformly. When the remaining ridges resorb, the tissues become unsupported, movable, or hyper plastic; this will result in a distorted impression if an elastomeric impression medium is used in a tiny tray. Therefore, modifications to the impression procedure are required to avoid deforming the loose and flexible tissues. This article describes how to generate final imprints of the flabby and resorbed mandibular ridge with the help of a specially made adapted tray and elastomeric materials.

## TECHNIQUE -

1. The mandibular primary impression was made with irreversible hydrocolloid impression material (Tropicalgin, Zhermack Spa - Via Bovazecchino,100-45021 Badia pole sine (RO), Italy.)
2. A tray with 2 mm of spacer or relief wax was created over the initial cast using auto polymerizing resin (Rapid Repair, Dentsply India Pvt; Ltd; Noida, India) after the primary cast was poured into Type III dental stone (Kalstone, Kalabhai Karson Pvt; Ltd; Vikhroli West, Mumbai, India).
3. The custom tray was set to be 2 mm short of the labial and lingual sulci's functional depth following an evaluation in the mouth.
4. Border molding was done using a green stick compound. (DPI India Pvt; Ltd; India)(fig.1) The border soft he impression were carefully re-examined for any over-or under-extensions and are corrected accordingly.



**Fig1-Border molding was done in the mandibular arch using a greenstick compound**

5. The hyper plastic tissue over the slopes of the mandibular alveolar ridge was marked using an indelible pencil (Hand Epencils NOZOMIA psarapencils Pvt; Ltd; India) and was transferred to the tray.
6. A window was cut in the tray using a straight bur (HM 33T, Meisinger cutters tungsten carbide, Centennial, CO) outlining the marked area, corresponding to the hyperplastic tissues over the slopes of the mandibular alveolar ridge. (fig.2)



**Fig 2 - Window corresponding to the hyperplastic tissue over the slopes of the mandibular alveolar ridge.**

7. The tray was then inserted into the mouth, and the acrylic resin was replaced with softened admixed impression material (Impression compound and green tracing stick compound, 3:7 parts by weight in a bowl of water at 60 0 c) that was shaped to form a handle. The impression material was obtained from Y-Dents Impression compound, MDM Corporation, Delhi, India, and DPI green sticks, DPI, Pvt; Ltd; India. To stabilize the impression, two studs were produced over the buccal shelf area. (Figure 3)



**Fig3-Handle fabricated with admixed impression material**

8. The tray was stabilized intraorally; the admixed Impression material was allowed to set and the tray was removed from the mouth. (Fig .4)



**Fig4-Intaglio surface of admixed impression material**

9. The window was cut in the handle which was made with admixed impression material using a sharp Bard-Parker knife. (fig. 5), this is done to record hyperplastic tissue in precise form.



**Fig 5. The window was cut in the handle**

10. Light-body elastomeric impression (Affinis, Coltean/whale-dent Pvt. Ltd., Mumbai, India.) material was loaded into the tray, which was loaded into the tray, which was then seated on the ridge. Additional light-body materials are then expressed in the window. Lingual and facial borders were molded, ensuring the tray remained steady until the impression material was set.(fig. 6)



**Fig 6. Light body Expressed into window in Traorally.**

11. Once set, the impression was removed, disinfected with 2.2%glutaraldehyde, and inspected. (Fig. 7)



**Fig 7. Completed mandibular final impression**

12. Beading and boxing were performed, and the impression was poured using Type III dental stone. (Keystone Kalabhai Karson Pvt. Ltd., Vikhroli West, Mumbai, India).

## DISCUSSION

The mandible that is edentulous in Class IV is the most severely disabled.<sup>1</sup> Modifying the custom tray and using specialized impression procedures are suggested when surgical intervention is not an option to obtain an appropriate treatment outcome.<sup>1,16</sup>

The approach explained uses light body elastomeric imprint materials, with the former being more palatable to patients and more practical for the operator. One benefit of using elastomers

as an impression material that is easier to handle, uses less time, requires fewer insertions, and causes less discomfort in the patient.<sup>17,18</sup>

The window was made in a tray with a limited labiolingual extent after border molding, which could make handling afterward more difficult. The lack of a handle and finger rests might make handling and stabilization more difficult.

In the method described, a handle formed from the mixed impression material was also used to make the window. By removing the mixed impression material corresponding to the hyperplastic tissue across the slopes of the mandibular alveolar ridge, the window was created.

According to Boucher's selective pressure technique, this method applies pressure to the ridge slopes.<sup>19</sup> Rebound will be more effective and pressure will be lowered in the tray when controlling displaced tissue<sup>20</sup>, regardless of the material employed. This can be achieved by adding a window to cover the ridge's slopes. With the least amount of pressure possible, an impression is formed using light-body impression material over the ridge's slopes. You may also use impression plaster, but it is difficult to pour and manage.<sup>16</sup>

Making impressions is essential to creating complete dentures. If a flabby ridge appears within a 'normal' denture-bearing area but is otherwise absent, there is an issue. It is necessary to use an impression technique that won't shift the flabby tissues while compressing the non-flabby tissues to provide the best support.

## CONCLUSION

The method described here uses a modified special tray and elastomeric impression materials to create an imprint of resorbed and moveable, or hyperplastic, also known as flabby mandibular ridges. By utilizing theoretical impression-making principles, this technique gets over the practical challenges frequently seen during such processes. They reduce the amount of pressure applied to the moveable tissue of the remaining ridges throughout the impression-making process. The custom tray's design and the option of impression materials have both been taken into account.

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# Success Pyramid for Postgraduate Students [Master of Dental Surgery]

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## Abstract:

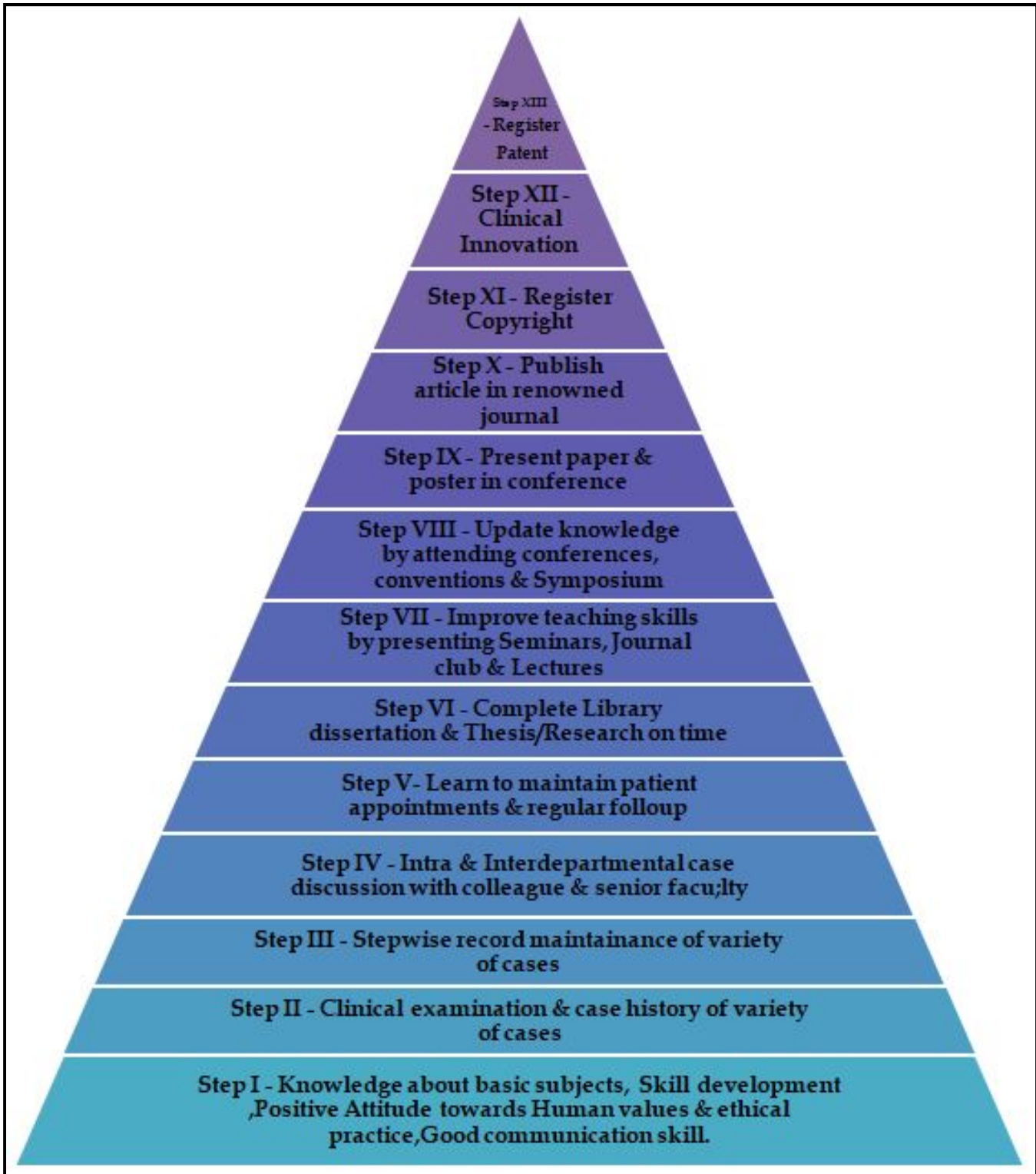
The "Success Pyramid for Postgraduate Students" serves as a roadmap for Master of Dental Surgery (MDS) students to navigate their postgraduate journey effectively. This structured guide comprises thirteen steps, each designed to build upon the previous, ensuring a holistic approach to professional development. Beginning with the acquisition of foundational knowledge and clinical skills, the pyramid progresses through stages of patient management, case documentation, and interdisciplinary collaboration. It emphasizes the importance of research, teaching, and continuous learning through seminars and conferences. Advanced stages focus on clinical innovation, publication, and intellectual property protection through copyrights and patents. This pyramid not only guides students in achieving academic excellence but also prepares them for future career opportunities in dentistry.

**Keywords:** Success Pyramid, Post Graduate Students, Master of Dental Surgery

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## INTRODUCTION

Postgraduate education in dentistry, particularly in the field of Master of Dental Surgery (MDS), demands a multifaceted approach to ensure professional growth and success. The "Success Pyramid for Postgraduate Students" outlines a structured path to achieve this goal, emphasizing the importance of foundational knowledge, clinical skills, research, innovation, and professional development. This comprehensive guide aims to equip postgraduate dental students with the necessary tools and strategies to excel in their academic and professional careers. By following the steps detailed in this pyramid, students can enhance their clinical expertise, contribute to the advancement of dental science, and establish themselves as leaders in the field.



**Step 1:**

To be successful in the post-graduate in dentistry, you must have a firm foundation of knowledge in your specialty. A positive attitude towards human values and ethical practise is also important in the dentistry profession since it aids in the development of trust and relationship with patients. Furthermore, efficient patient care and successful collaboration with colleagues require excellent communication skills. Post-graduate dental professionals can improve their knowledge and skills by focusing on these areas, while also establishing a culture of great ethical outcome.<sup>1-3</sup>

**Step 2:**

Clinical examination and case history taking are the important components of dentistry practise, especially in post-graduate training. A detailed grasp of a patient's medical and dental history can help you in the identification of potential risk factors and the delivery of safe and effective care. Clinical examination is also necessary for analysing the patient's oral health and identifying any underlying disorder that may necessitate treatment. Furthermore, the examination procedure can aid you in the establishment of rapport with the patient and the development of a trusting relationship. By this knowledge you can guarantee that you can deliver the highest quality care to your patients while also staying up to speed with the latest techniques and best practises in the field by taking a comprehensive approach to clinical examination and case history taking.<sup>1,4</sup>

**Step 3:**

Maintaining step-by-step case records is a crucial component of dentistry practise, especially in post-graduate life. It enables you to monitor a patient's treatment progress and adjust as needed. Furthermore, it serves as a useful reference point for future treatment planning and can aid in the avoidance of prospective difficulties or issues.<sup>5</sup> A planned technique of documenting each stage of the patient's therapy, including the initial evaluation, diagnosis, treatment plan, and follow-up care, is referred to as stepwise record maintenance. It also enables you to evaluate your own work and find areas for improvement, as well as facilitate communication with other dental experts involved in

the patient's care. Overall, stepwise record keeping is an important component of efficient dental practise, and assist you in providing optimal treatment to their patients.

**Step 4:**

Case discussions intra-departmental and inter-departmental are an essential component of the dental post-graduate education. These discussions enable you to share your knowledge and experience with your colleagues and senior faculty members, so improving patient care and outcomes. By discussing complex cases and treatment plans, you can gain insights into different approaches and techniques, as well as receive feedback on your own work.<sup>6</sup> Interdepartmental case discussions also provide an opportunity to collaborate with specialists from other fields in dentistry. You can gain a better understanding of the newest research and best practises in the dentistry through these talks, while also improving your own skills and knowledge.<sup>1</sup> Overall, intra and inter-departmental case discussions are an important aspect of dental post-graduate education and can help you to provide the highest quality care to your patients.

**Step 5:**

It is important to ensure that patients receive prompt and appropriate care, which can aid in the prevention of problems and the achievement of excellent treatment outcomes. Regular follow-up appointments also allow you to track the patient's progress and make any required changes to the treatment plan.<sup>1</sup> Furthermore, regular follow-up sessions can aid in the development of rapport with patients and the establishment of a long-term relationship based on trust and mutual respect.<sup>7</sup> Overall, learning to maintain patient appointments and regular follow-up is an essential component of dental post-graduate education and can help you to provide best care to your patients.

**Step 6:**

On-time completion of a library dissertation and thesis research is an important part of dental post-graduate life. These projects take a significant amount of time, effort, and resources, but they are essential to proving subject knowledge and preparation for a career in dentistry research or academics.<sup>8,9</sup> You can ensure that you complete



programme requirements and proceed towards graduation by completing these projects on schedule. Completing a library dissertation or thesis research on time can also aid in the development of abilities in time management, research methods, and academic writing. These skills are essential for success in the dental profession and can help to position you for future career opportunities.<sup>10</sup> By focusing on completing these projects on time and to a high standard of quality, you can demonstrate your commitment to excellence and your readiness to contribute to the field of dentistry.

**Step 7:**

These activities allow you to stay current on the newest research and best practises in the industry while also enhancing your own communication, critical thinking, and problem-solving abilities. You can learn about alternative teaching methods and strategies, as well as receive feedback on your own teaching style, by attending seminars, journal clubs, and lectures. Furthermore, these activities can aid in the development of a community of scholars and practitioners dedicated to the advancement of dentistry. By participating in these activities, you can position yourself as thought leader and subject matter expert, while also improving your own teaching skills and preparing for future academic or research roles.<sup>1</sup>

**Step 8:**

Attending conferences, conventions, and symposiums is a crucial component of dentistry postgraduate life since it allows you to keep your knowledge and abilities up to date. These events allow you to learn about the most recent research and breakthroughs in the industry while also networking with other experts and practitioners. You can obtain exposure to new techniques, tools, and technology by attending these events, as well as ideas into how to utilise these improvements in your own practise.<sup>11,12</sup> Attending conferences, conventions, and symposiums can also help you to stay up to date on changes in rules and policies, as well as understand how these changes may affect your practise.

**Step 9:**

Presenting papers and posters at conferences and conventions is an important part of the dental post-graduate experience. These chances allow you to

present your research and discoveries to a larger audience. Presenting a paper or poster can help you gain knowledge, reputation, and professional contacts. It also aids in the development of critical thinking, analytical, and communication skills. Furthermore, giving presentations at conferences and conventions can provide feedback and constructive criticism, which can assist you to better your work and research methods.<sup>13</sup> This technique can also expose you to different points of view and ideas, as well as assist you to find gaps in your knowledge or research.<sup>1</sup>

**Step 10:**

Publishing articles in renowned dental provides you with a platform to disseminate your research findings, showcase your expertise, and contribute to the field of dentistry. Publishing in renowned journals helps to increase visibility and recognition, and can establish the author's credibility and reputation as a subject matter expert. It also helps you to stay up-to-date with the latest research and developments in the field, as well as promote your practice or institution.<sup>14</sup> Further more, publishing articles in renowned journals can also lead to career opportunities such as teaching, research and even becoming an editorial board member. It is a lengthy process, and it requires perseverance, dedication, and a significant investment of time and effort. However, the benefits of publishing in renowned journals are manifold, and can help you to advance your career and contribute to the field of dentistry.

**Step 11:**

Registering a copyright in dental post-graduate life is an important step in protecting original works. This includes research papers, textbooks, educational materials, and other intellectual property. By registering a copyright, you can prevent others from using or copying your work without permission, and can seek legal recourse if necessary. This protects the author's investment of time and effort, and can also be a valuable asset for career advancement.<sup>2,5,15</sup> Additionally, registering a copyright can help to establish ownership and authorship, which can be important in cases of plagiarism or intellectual property disputes. Overall, registering a copyright is an important aspect of dental post-graduate life, and

can help you to protect your original works and advance your career in the field of dentistry.

**Step 12:**

Doing more and more clinical innovations in dental post-graduate life is an important aspect of professional growth and development. By continually seeking out new techniques, technologies, and approaches, you can expand your skill set and provide the highest level of care to your patients. This requires a commitment to lifelong learning, as well as an open minded approach to exploring new ideas and methods. Clinical innovations can include anything from new materials or devices, to new treatment protocols or diagnostic techniques.<sup>16</sup> by being at the forefront of these innovations; you can differentiate yourself from your peers and stay competitive in the field. Additionally, clinical innovations can help to improve patient outcomes, increase patient satisfaction, and even lead to new opportunities for research and publication.

**Step 13:**

In dental post-graduate life, registering a patent can be a crucial component of professional growth and development. A patent is a legal safeguard for a new product or idea, and registering a patent can assist you in establishing ownership and protecting your intellectual property. This is especially critical for new commercially valuable devices, materials, or procedures.<sup>1,3</sup> Registering a patent can assist prohibit others from exploiting or benefitting from an idea without permission, and it can grant the creator exclusive rights to manufacture and sell the invention for a set length of time. Additionally, registering a patent can help you to establish credibility and demonstrate expertise in the field of dentistry, which can be valuable for career advancement and attracting new patients. However, registering a patent can be a complex and time-consuming process, and may require the assistance of legal professionals or patent agents.<sup>17</sup> Overall, registering a patent in dental post-graduate life can be an important step in protecting intellectual property and advancing one 's career in the field of dentistry.

**CONCLUSION**

Enhancing your post-graduate life requires dedication and initiative. By pursuing advanced courses, exploring innovative clinical solutions, and improving your communication skills and networking with other professionals in your field, you can set yourself up for success and make a meaningful difference in patient care

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## ॥ पसायदान ॥

आतां विश्वात्मकं देवं । येणं वाग्यज्ञं तोषावं ।  
तोषोनि मज द्यावं । पसायदानं हे ॥१॥  
जे खळांची व्यंकटी सांडो । तयां सुत्कर्मां रती वाढो ।  
भूतां परस्परें पडो । मैत्र जीवाचें ॥२॥  
दुरिताचें तिमिर जावो । विश्व स्वधर्मसूर्य पाहो ।  
जो जें बांछीरु तो तें लाहो । प्राणिजात ॥३॥  
वर्षत सकळमंगळी । ईश्वरनिष्ठांची मांदियाळी ।  
अनवरत भूमंडळी । भेटतु भूतां ॥४॥  
चलां कल्पतरुंचे आरव । चेतना चिंतामणीचें गांव ।  
बोरुते जे अर्णव । पीयूषाचे ॥५॥  
चंद्रमे जे अलाछन । मार्तंड जे तापहीन ।  
ते सर्वाही सदा सज्जन । सोयरे होतु ॥६॥  
किंबहुना सर्वसुखां । पूर्ण होऊनि तिहीं लोकां ।  
भजिजो आदिपुरुखां । अखंडित ॥७॥  
आणि ग्रंथोपजीवियें । विशेषीं लोकीं इयें ।  
दृष्टादृष्ट विजयें । हो आवें जी ॥८॥  
तेथ म्हणे श्रीविश्वेश्वरावो । हा होईल दानपसावो ।  
येणं वरें ज्ञानदेवो । सुखिया झाला ॥९॥

॥ श्री संत ज्ञानेश्वर मारुली ॥