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Meta Analysis and Systematic Review of Various Treatment Options for Maxillary Lateral Incisors Agenesis

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ABSTRACT –
Background: Maxillary lateral incisor agenesis (MLIA) affects appearance, functionality, and mental health, thereby making therapeutic decisions will be difficult. Healthcare professionals switch between space opening (SO) and space closure (SC) methods, attempting to find the most appropriate strategy for every patient. The aim of this systematic review is to evaluate the functional, cosmetic and long-term stability results of several treatment modalities for maxillofacial instability (MLIA). Specifically, the research will focus on orthodontic space closure, prosthodontic treatments (such as implants and resin-bonded prostheses) and canine relocation.
Methods: Interdisciplinary research methodologies were used to databases from 2009 to 2024, without regard to language constraints, using PRISMA criteria. The inclusion criteria included research on MLIA treatment, omitting cases of tooth loss due to caries, and evaluating results for long-term stability, aesthetics, and functionality.
Results: Of the 2085 papers that were examined, 10 made a direct comparison between orthodontic space closure and prosthodontic intervention and were considered for the review. Orthodontic gap closure was more common than prosthodontic intervention, and the ratio of MLIA incidence was greater in females. Compared to more conventional prosthodontic techniques, implants were utilized less frequently. Periodontal evaluations demonstrated consistent papilla indices and little soft tissue problems, highlighting better orthodontic closure results. Patient satisfaction varied among treatment modalities, and aesthetic judgments were inconsistent.
Conclusion: In conclusion, treatment planning is aided by early identification of MLIA. In order to minimize long-term biological and technical complications while assuring periodontal health, aesthetic outcomes, and early treatment completion throughout adolescence, orthodontic space closure becomes the recommended choice.

Keywords: Aesthetic results, Periodontal health, Treatment methods, Maxillary lateral incisor agenesis, MLIA, Orthodontic space closure, Prosthodontic intervention, Dental implants, Resin-bonded prosthesis

INTRODUCTION -

The perception of a smile extends far beyond its physical appearance, encompassing intricate cognitive and emotional processes shaped by cultural influences and individual experiences. A harmonious, symmetrical smile holds immense significance in facial aesthetics, not just affecting the visual aspect but deeply impacting expressions, overall facial attractiveness and the individual's psychological well-being. When anterior teeth, particularly the maxillary lateral incisors, are absent due to conditions like Maxillary lateral incisor agenesis (MLIA), it significantly impacts self-esteem and social interactions. This drives individuals to seek treatment to address not just the functional deficit but also the emotional and psychological implications of the missing teeth[1].

Navigating the treatment landscape for MLIA presents clinicians with a myriad of choices, primarily centred around space opening (SO) and space closure (SC) techniques. SO involves replacing the missing lateral incisors with prosthetics, while SC focuses on repositioning the adjacent canine and subsequent reshaping to achieve dental symmetry. Both approaches, despite their complexity, often entail similar treatment durations unless extractions become necessary, amplifying the weight of the decision-making process[2,3].

The choice between SO and SC becomes crucial in the treatment journey, considering their intricacies and potential impact on not only the aesthetic outcome but also the functional and psychological aspects for the patient. This decision-making process requires a thorough understanding of the patient's individual needs, expectations, and the clinician's expertise in balancing esthetic outcomes with functional restoration[3]. Each approach presents its own challenges, necessitating careful consideration of the patient's preferences and the long-term implications of the chosen treatment path.

Addressing maxillary lateral incisor agenesis (MLIA) extends beyond dental restoration; it's a quest to rebuild confidence, ease social interactions, and enhance psychological well-being. Steering this complex terrain demands clinicians consider not just technicalities but also the emotional and psychological impact on patients seeking restoration[4]. SC, while aiming

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for symmetry through repositioning the canine and adjusting neighboring teeth, involves intricate adjustments to ensure natural alignment and color harmony. Despite post-treatment periodontal evaluations showing inconsistencies between SO and SC groups, a positive trend emerges in the long-term periodontal health of MLIA patients treated with space closure and orthodontic procedures, promising better oral health outcomes. However, apprehensions persist regarding potential root resorptions and gingival exposure associated with orthodontic treatments, particularly in cases involving implant-supported crowns. Esthetic considerations wield substantial influence in MLIA management, often outweighing functional aspects, sparking varied opinions among dental professionals regarding treatment approaches[4,5]. These perspectives are significantly shaped by their educational backgrounds and individual viewpoints, further complicating treatment decisions.

The complexity of MLIA treatment lies in balancing esthetic outcomes with functional restoration, understanding that the chosen path significantly impacts the patient's smile and self-confidence. The intricate decision-making between SO and SC necessitates careful consideration of the patient's emotional needs, functional requirements, and long-term implications of the chosen treatment method[6]. Ultimately, the journey to restore MLIA encompasses a holistic approach that merges technical expertise with sensitivity to the patient's emotional well-being, aiming to not just reconstruct a smile but to enhance the patient's overall quality of life. Despite technological advancements, uncertainties persist, particularly in treating young patients with unilateral MLIA. Implant-supported crowns, while offering a solution, may pose long-term issues such as infraocclusion. On the other hand, conservative restorative techniques might necessitate periodic maintenance, adding another layer of complexity to treatment decisions[7,8].

The available treatment modalities encompass a spectrum: orthodontic space closure by repositioning the canine, implant placement with or without orthodontic movement, resin-bonded prostheses, and fixed dental prostheses[9,10]. Each approach presents a unique set of advantages and disadvantages concerning treatment duration, cost, invasiveness, efficacy, biological and esthetic outcomes, functional aspects, and patient satisfaction. However, despite the historical use of these modalities, comprehensive evaluations to guide treatment decisions are lacking, leading to difficulty in selecting the most appropriate approach[11]. Often, the choice between these modalities leans towards personal preference rather than solid scientific criteria, adding to the complexity of MLIA management[12].

The objective of this systematic review is to gather and assess studies investigating the many approaches of treating maxillary lateral incisor agenesis, with a particular emphasis on prosthodontic therapies, canine relocation with reshaping, and orthodontic gap closure. The objective is to conduct a thorough comparison and contrast of the results reported in published research pertaining to various methodologies. Through the identification and synthesis of extant literature, the review aims to provide a comprehensive assessment of the efficaciousness, merits, drawbacks, and overall success rates corresponding to every therapeutic approach.

MATERIALS AND METHODOLOGY –

Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) criteria were followed in the execution of this systematic review. A review approach that adhered to the recommendations of the Cochrane Handbook for Systematic Reviews of Interventions was established before the study began.

Focused question:

"In patients with maxillary lateral incisors agenesis, what is the comparative effectiveness of various treatment modalities (such as orthodontic space closure, dental implants, canine substitution, autotransplantation, etc.) in terms of functional, aesthetic, and long-term stability outcomes?"

Search strategy:

In our methodological design, we employed an interdisciplinary research strategy that included case-control studies, cohort studies, and randomized clinical trials to examine the impact of platform switching on clinical outcome evaluation and its relationship to changes at the bone level. The original research publications, review articles, published bibliographies, and applicable citations were carefully examined in order to gather relevant information for this study in order to get Randomized Clinical Trials.

We performed a thorough search throughout MEDLINE/PubMed, the Cochrane Central Register of Controlled Trials, and EMBASE databases to find pertinent papers. The retrieval of articles spanning from 2009 to 2024 was conducted without any limitations on language or publication year. During the search process, MeSH terms such as "Tooth Agenesis, Maxillary," "Lateral Incisor," "Unilateralism," "Bilateralism" OR "Orthodontics," "Tooth Movement Techniques," "Reconstructive Surgical Procedures," "Tooth Replantation," "Orthodontic Space Closure" OR "Orthodontic Space Opening," "Dental Prosthesis," "Prosthetic Replacement," "Dental Prosthesis, Implant-Supported" OR "Esthetics," "Patient Satisfaction," "Treatment Outcome," "Long-Term Care," "Dental Prosthesis Design" were employed as search keywords.

The PRISMA Checklist was used in determining the studies' inclusion and exclusion criteria. The studies' whole texts were carefully examined by the researchers, who also separately evaluated each one in light of the predetermined inclusion criteria. The pre-established search method shown in Table 1, as well as the PRISMA statement standards, were followed.

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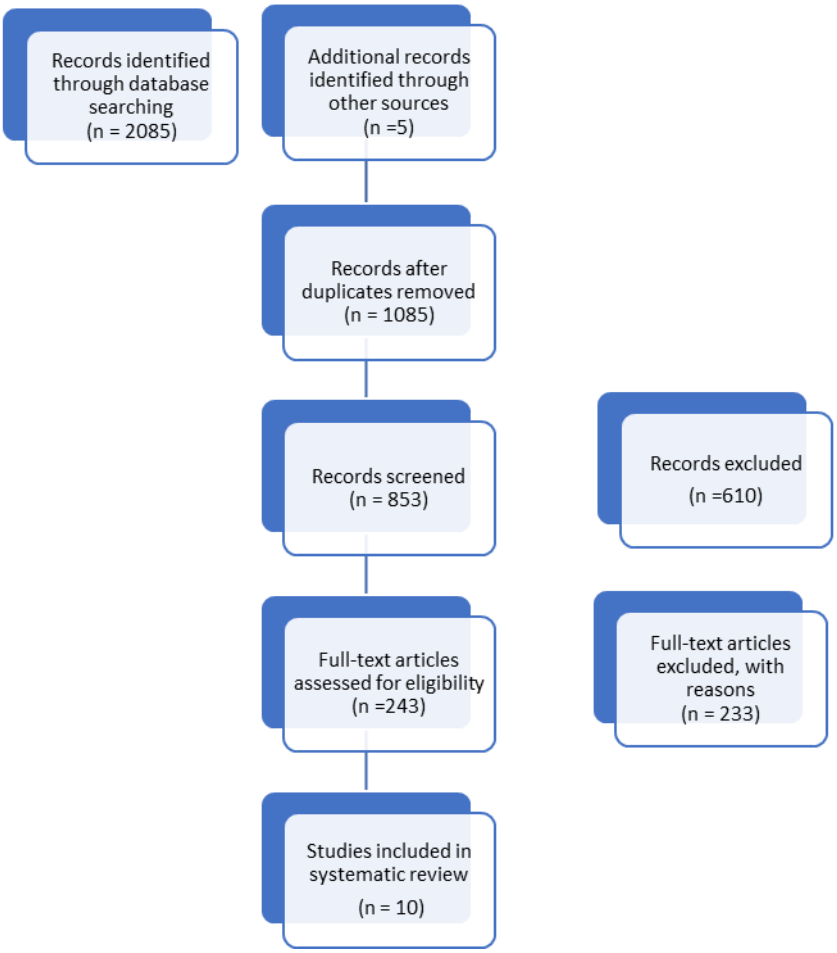
To guarantee thorough literature coverage, a manual search (cross-referencing) was also done in the reference sections of the included studies.

The specifics are shown in Figure 1.

Figure 1. PRISMA Checklist



Selection criteria:
Manual searches of published reviews and additional full-text publications that were found through the computerized search were added to the search. Furthermore, the reviewers manually searched a number of articles published between January 2000 and May 2024. This systematic review was based on prospective, retrospective, cross-sectional and case series studies that were found using manual and electronic searches; randomized controlled trials were not found.
Agenesis of maxillary lateral incisors was treated with one of three treatments in men and women aged 21 or older who participated in randomized controlled trials (RCTs) or quasi RCTs. The treatments included the following: There are three types of orthodontic treatment: 1) utilizing a reshaped canine to fill the gap; 2) using an adhesive fixed bridge or conventional bridge to create space; and 3) using a single implant and an implant-supported crown to create space. All safety and effectiveness outcomes—that is, intervention-related complications were taken into account. Excluded from consideration were studies including patients who lost their lateral incisors due to dental caries, accidents, or other causes, or who did not have any neighbouring teeth. The determination of inclusion and exclusion criteria was guided by the aspects of Study design, Participants, Interventions, Comparisons, and Outcomes (SPICO).

PICO Criteria –

P (Population)	Subjects with unilateral or bilateral agenesis of maxillary lateral incisors.
I (Intervention)	Orthodontic space closure, canine re-anatomization, autotransplantation
C (Comparison)	Orthodontic space opening, prosthetic replacement.

O (Outcome)	Esthetic outcome, post treatment satisfaction, long term stability.
S (Study design)	Cross sectional study, Retrospective analysis, Cross sectional study, Prospective analysis

Screening and selection:
The search and screening procedure was carried out cooperatively by two authors, with a significant degree of agreement ($\kappa = 0.83$). There were four steps to the screening: (1) Initially eliminating superfluous citations; (2) Examining titles and abstracts in accordance with predetermined standards, and when in doubt, obtaining a second opinion; (3) Carefully evaluating a subset of selected articles for eligibility based on study design and outcome measurement, excluding those lacking proper referencing; and (4) Extensive inspection and data extraction from included articles, scrutinizing clinical methodologies, interventions, and outcomes examined.

Data extraction:
The first author carried out the first round of data extraction, after which the second author reviewed and improved it. For every full-text article that satisfied the predetermined inclusion criteria, data extraction was done automatically. As shown in Table 1, this procedure used digital tools (Office Excel 2013 software, Microsoft Corporation) in a consistent fashion. The aggregated data were methodically divided into discrete parts, including information on authorship and year of publication, research design, participant demographics, age range, intervention details, comparator components, and final results.

Assessment of risk of bias:
The ROBANS (Risk of Bias Assessment Tool for Non-randomized research) criteria were used to account for potential bias, taking into account the experimental design of the research, which were Randomized Clinical Trials, as detailed in Appendix 2. The evaluation covered the following domains: (1) Random Sequence Generation; (2) Allocation Hiding; (3) Selective Reporting; (4) Other Types of Bias; (5) Personnel and Participant Blinding; (6) Outcome Assessment Blinding; and (7) Incomplete Outcome Data.
Research that presented thorough data in each of these areas was categorized as exhibiting an excellent degree of methodological rigor, as Table 2 illustrates. Individuals who were able to exhibit two or three of these criteria were acknowledged as having a respectable standard of quality. On the other hand, studies with insufficient data on most of the criteria were labeled as having a lower quality level.

RESULTS –
The systematic review on the treatment for agenesis of maxillary lateral incisors adhered to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) checklist to ensure a thorough and transparent data extraction process. Initially, 2,085 records were identified through database searching, with an additional 5 records obtained from other sources. After removing duplicates, 1,085 records remained, of which 853 were screened. This screening process narrowed the field further, resulting in 243 full-text articles assessed for eligibility. Ultimately, 10 studies were included in the systematic review. During the review process, 610 records were excluded due to not meeting inclusion criteria, and 233 full-text articles were excluded with specific reasons documented. This meticulous adherence to the PRISMA guidelines ensures the reliability and comprehensiveness of the systematic review, facilitating a well-rounded understanding of treatment options for agenesis of maxillary lateral incisors.
In the direct comparison group of studies, there were 137 patients, ages ranging from 14 to 54, with an average age of 23. Regarding one study, the authors fail to provide the patients' ages who had maxillary lateral agenesis. There have been four studies that have addressed the gender of the patients.
In particular, there were 76 girls (73%), and 28 men (27%) in all. Moreover, 94 instances (68.61%) and 43 cases (31.38%) show that the agenesis is unilateral. The gingival biotype was found to be thin in 25 cases (54.35%) and thick in 21 cases (45.65%), with the rest of patients receiving no information at all. For 142 sites (61.47%), the treatment strategy included orthodontic space closure and canine recontouring, and for 89 sites (38.57%), prosthodontic rehabilitation. 55 sites (23.86%) had a traditional prosthodontic treatment (fixed or removable partial denture or resin-bonded prostheses), whereas the remaining 34 sites (14.71%) underwent implant insertion. The assessment period spanned 0.42 to 25.50 years.
The systematic review mentioned above provide implant and resin-bonded prostheses as treatment alternatives. Regretfully, there were no published randomised controlled trials that directly compared various prosthodontic techniques. A university hosted five of the above studies, a private dental practice hosted one, and one study provided no information. One of the prosthodontic treatments mentioned above was used to treat 149 individuals. These patients were between the ages of 13 and 45. However, it should be noted that in two studies, information regarding the sample age is either not disclosed or cannot be gleaned from the available data[6&9].
This systematic review identified ten studies investigating treatment options for maxillary lateral incisor agenesis. The studies employed various methodologies, including cross-sectional, retrospective, and prospective analyses. The studies evaluated three main treatment modalities: For replacing a missing maxillary lateral incisor, three main treatment options

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exist: orthodontically moving the canine tooth to fill the gap and reshape it (canine repositioning), creating space with orthodontics for a prosthetic replacement (bridge) or implant (space opening), and transplanting a tooth from another location in the mouth (autotransplantation).

Periodontal/peri-implant assessment:
When comparing prosthodontic intervention versus orthodontic space closure, soft tissue assessments included probing depth (PD), gingival index (GI), plaque index (PI), bleeding index (BI), and papilla index (Ppl). Plaque buildup, bleeding on probing, and probing depth among certain patients undergoing prosthodontic intervention were shown to differ statistically significant. On the other hand, the majority showed no discernible variations in the indices. In comparison to implants, orthodontic closure revealed superior mesial papilla filling in terms of papilla index. Limited evaluations of soft tissue were found in implant investigations. Variations were seen in plaque, gingival indices, and probing depth. One research did, however, demonstrate steady PD levels throughout time. For a considerable percentage of implants, the Papilla index recommended the ideal interdental papilla fill. Articles on resin-bonded prostheses lacked enough information to assess soft tissues.
Several studies compared the periodontal health outcomes of different treatment modalities. DeMarchi et al[13] found comparable levels of bone loss and space closure between orthodontic space closure and implants. However, they observed slightly larger mesial changes in orthodontic closure compared to implants. Nordquist et al[14] reported that implant-supported prostheses exhibited better gingival and bone health compared to fixed partial dentures (FPDs) placed without surgical intervention. In contrast, Robertsson et al[15] found no significant differences between orthodontic space closure and FPDs in terms of peri-implant health. Overall, the studies provided mixed results regarding the impact of treatment modality on periodontal health. More high-quality research with standardized outcome measures is necessary to draw definitive conclusions.

Orthodontic Considerations:
Several studies addressed the orthodontic considerations of different treatment modalities. Sailer et al[21] reported successful space closure using a single retainer cantilever for unilateral agenesis. In contrast, most studies involving space opening with prosthetics or implants employed orthodontic techniques to create space for the restoration[17-19].

Aesthetic assessment:
In trials comparing prosthodontic and orthodontic treatments, 50 patients preferred orthodontic therapy due to greater satisfaction, whereas no discernible difference was found in 46 individuals. Two studies' little data made it impossible to obtain satisfaction ratings. Studies focusing on implants found that 62% of patients were satisfied and 38% were not. 85 patients had examiner evaluations that ranged from satisfactory to high; five patients had insufficient information. Research on aesthetic evaluations of resin-bonded prostheses often lacked or did not report aesthetic assessment data. Overall, different conclusions were drawn about how satisfied patients were with different treatment techniques, and implant trials showed varying degrees of examiner-rated aesthetics and satisfaction.
DeMarchi et al[13] reported higher patient satisfaction with orthodontic space closure compared to implant placement. However, Robertsson et al[15] found no significant difference in patient satisfaction between implant and orthodontic closure techniques. Jamilian et al [16] reported that a higher percentage of patients desired a crown replacement following orthodontic closure, suggesting potential esthetic concerns. Conversely, several studies using independent calibrated examiner evaluations documented high esthetic outcomes with both orthodontic space closure and implant-supported prostheses[18-20].

Risk of Bias Assessment (ROBANS):
The ROBANS tool was used to assess the risk of bias in the included studies (Table 2). Most studies had limitations, particularly regarding blinding of participants and personnel, allocation concealment, and incomplete outcome data. These limitations should be considered when interpreting the findings.

DISCUSSION –
In order to treat maxillary lateral incisor agenesis, the goal of this study was to compare the biological, functional, and cosmetic results of two distinct therapy techniques. Patients with congenitally absent maxillary lateral incisors are treated with prosthodontic intervention (i.e., implant-supported restorations, resin-bonded prostheses, fixed partial dentures) and orthodontic space closure by canine mesial repositioning, reshaping, or space opening. High-level evidence was found by conducting a systematic search of the literature for studies that looked at the treatment of maxillary lateral incisor agenesis using either an orthodontic or prosthodontic approach. There were no randomized controlled trials to be discovered, and only 5 papers comparing the two distinct therapy alternatives were collected from the literature.
According to our findings, there was a 2:1 ratio between the prevalence of congenitally missing lateral incisors in females and boys. This conclusion is consistent with the findings of other investigators, who discovered that females had a 1.5–2.0 times greater prevalence of dental agenesis than did males. There is no difference in the frequency of agenesis of one

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maxillary lateral incisor in the same patient when it comes to the type of lateral agenesis (i.e. bilateral or unilateral). However, other studies discovered variations in the distribution of the agenesis type in the surveyed population[14].

In terms of the therapeutic choice, a greater proportion of the sites in the direct comparison group that had canine recontouring and orthodontic space closure got treatment than the sites that underwent prosthodontic intervention. This conclusion is consistent with that of Fekonja et al., who discovered that orthodontic space closure had been used to treat 87.5% of the patients with tooth agenesis[15,16]. Prior to receiving prosthodontic rehabilitation, the majority of the patients who underwent therapy using the prosthodontic technique had undergone orthodontic treatment to preserve or open the space. This is a logical conclusion given that the permanent canine often travels mesially and slopes since the laterals are absent.

None of the studies in the direct comparison group included indications of temporomandibular joint abnormalities connected to orthodontic or prosthodontic treatments. This conclusion is supported by past research, which also shown that there was no correlation between the occlusal condition and mandibular dysfunction symptoms. Only two investigations indicated that there were no appreciable variations in the number of excursive contacts and centric interferences between the prosthodontic intervention and the orthodontic space closure in the occlusal scheme created following the treatment of lateral agenesis.

Orthodontic space closure

Maintaining gingival and alveolar architecture, avoiding complex prosthodontic operations, and long-term therapeutic outcomes finished in early adolescence are the benefits of orthodontic space closure over prosthodontic intervention. Orthodontic closure is an affordable option that gives patients the impression that there are no missing teeth. Severe crowding and a Class I molar connection, or an end-to-end and Class II molar relationship without mandibular crowding or protrusion, are indications for this treatment[15]. Decision variables include gingival height, canine proportions, facial profile, and colour match; face aesthetics, canine size, and colour difference are taken into account. Recontouring the canine to resemble a lateral incisor, taking gingival alignment, tooth size and colour variations, and attaining a balanced occlusion are all part of the process[19]. In order to achieve a beautiful gingival contour and replicate the location of the lateral incisor, careful consideration of soft tissue architecture is essential. Mesial tilting of the canine crown and group function establishment are part of the closure operation[20,21]. Space closure stability is ensured by using lingual retainers for an extended period. In comparison to prosthetic intervention, orthodontic space closure has several advantages that address cosmetic issues and provide long-term stability and functional occlusion.

DeMarchi et al[13] reported that both orthodontic space closure (OSC) and implants exhibited comparable percentages of bone loss and space closure, with negligible variations in periodontal probing depth. They observed somewhat larger mesial changes in orthodontic closure relative to implants but no appreciable distal variations. Nordquist and McNeil and Robertsson and Mohlin found that fixed partial dentures (FPD) with surgical approaches (Ss) had better gingival and bone indices than non-surgical (Nss) methods. However, there were no discernible differences between Nss and OSC in terms of peri-implant conditions. Furthermore, peri-implant probing depth in FPD surgical methods was substantially less than in OSC[14,15].

Jamilian et al[16], Branzen et al[17] and Garnett et al[18] highlighted that surgical techniques generally exhibited decreased probing depth and bone indices compared to OSC, while non-surgical approaches showed negligible variations in periodontal depth. Mangano et al[19] and Penarrocha et al[20] reported no significant differences in periodontal indices between implant treatments and orthodontic closure, although surgical implants sometimes had greater probing depths (>3mm) than OSC. Sailer et al[21] and Zarone et al[22] concluded that both orthodontic and implant-based solutions had comparable periodontal outcomes. Both methods showed high aesthetic results and no significant differences in biological outcomes compared to control teeth.

Prosthodontic intervention

An option for correcting lateral incisors that are congenitally absent is prosthodontic intervention. The necessity of orthodontic space opening prior to prosthodontic rehabilitation is determined by factors including occlusion, space distribution, and aesthetics. The golden ratio, contralateral incisor comparison, and Bolton analysis are techniques used to calculate lateral incisor space. An examination of space distribution is aided by a diagnostic wax-up. 5 to 7 mm is the typical amount of residual room for repair[13,14]. Class I molar relationships without malocclusion, Class III malocclusion, or situations in which canine recontouring is not advised are among the conditions that qualify for prosthodontic intervention[17].

Prosthodontic solutions include full-coverage fixed partial dentures, resin-bonded fixed partial dentures, and single-tooth implants. Implant insertion is timed to coincide with the completion of face development, usually a year following the termination of body height. Orthodontic space opening affects ridge dimensions and bone quality by taking bone volume into account for implant implantation[18]. Important factors include root approximation, interradicular distance, and retention post-orthodontics. Obstacles like as infraocclusion and bone resorption might hinder the success of single implants. Because they are conservative, resin-bonded prostheses have varying lifetime rates and need careful patient selection[20]. Because they need more tooth preparation, full-coverage fixed partial dentures are less common and least conservative.

Implant therapy is costly and includes bone volume and space opening, which affects the conclusion of face development. Ridge preservation and interradicular spacing are essential for success. Risks associated with prosthetic procedures include debonding, fractures, and biological complications. Resin-bonded prostheses are preferred over single implants or fixed partial dentures in cost-effectiveness assessments.

DeMarchi et al [13] and Robertsson and Mohlin[15] reported high levels of patient satisfaction with OSC, particularly with recontouring canines, resulting in improved smile attractiveness and overall esthetics. Nordquist and McNeil and Garnett et al[14] emphasized high satisfaction levels with OSC, noting that patients preferred OSC over non-surgical methods ($P > 0.002$) due to higher levels of satisfaction related to smile attractiveness and the overall look. Branzen et al[17] and Mangano et al[18] found that surgical methods, including implants, were preferred for tooth colour and form, although the differences were not statistically significant in other dimensions.

Penarrocha et al[16] and Jamilian et al[20] reported that orthodontic and surgical interventions both achieved high retention rates, indicating stability and effectiveness. Sailer et al[21] and Zarone et al[22] highlighted that both orthodontic closure and implant techniques led to high aesthetic outcomes and patient satisfaction, although patient preferences sometimes leaned towards prosthetic solutions for optimal esthetics.

Although there are benefits to both therapy approaches, orthodontic closure seems to be better for both periodontal health and appearance. It guarantees treatment completion and duration during adolescence without causing long-term problems. To evaluate results and draw firm conclusions about these medicines, extensive randomized controlled trials and multicentre investigations are required.

CONCLUSION –

In summary, early detection of congenitally absent lateral incisors is critical because it permits guided canine eruption next to the permanent central incisor and planned extraction of the deciduous lateral incisor, which can either facilitate prosthodontic rehabilitation or later space closure. Alveolar ridge thickness is preserved and bone loss is prevented as a result. Finally, due to its superiority in terms of periodontal health and cosmetic result, orthodontic space closure is the most therapeutic alternative when both prosthodontic and orthodontic intervention are feasible. Furthermore, in situations where both therapeutic approaches are suggested, orthodontic space closure is the preferred course of action due to the early completion of the final treatment and the lack of long-term biological and technological difficulties.

REFERENCES –

1. Vastardis H. The genetics of human tooth agenesis: New discoveries for understanding dental anomalies. American Journal of Orthodontics and Dentofacial Orthopedics 2000;117:650–6. https://doi.org/10.1016/s0889-5406(00)70173-9.
2. Krassnig M, Fickl S. Congenitally Missing Lateral Incisors—A Comparison Between Restorative, Implant, and Orthodontic Approaches. Dental Clinics of North America 2011;55:283–99. https:// doi.org/10.1016 /j.cden.2011.01.004.
3. Arte S, Nieminen P, Apajalahti S, Haavikko K, Thesleff I, Pirinen S. Characteristics of Incisor-Premolar Hypodontia in Families. Journal of Dental Research 2001;80:1445–50. https://doi.org/10.1177/00220345010800051201.
4. Prevalence of Congenitally Missing Permanent Teeth in Aseer, KSA. Journal of Oral & Dental Health 2017;1. https://doi.org/10.33140/jodh/01/02/00006.
5. V V-R, M M, Z M. Prevalence of Dental Anomalies in Deciduous Teeth and their Correlation with the Permanent Dentition: Double Teeth, Hypodontia and Hyperdontia. International Journal of Dentistry and Oral Health 2019;5. https://doi.org/10.16966/2378-7090.292.
6. Goya HA, Tanaka S, Maeda T, Akimoto Y. An orthopantomographic study of hypodontia in permanent teeth of Japanese pediatric patients. Journal of Oral Science 2008;50:143–50. https://doi.org/10.2334/josnusd.50.143.
7. Shimizu T, Maeda T. Prevalence and genetic basis of tooth agenesis. Japanese Dental Science Review 2009;45:52–8. https://doi.org/10.1016/j.jdsr.2008.12.001.
8. Alves-Ferreira M, Pinho T, Sousa A, Sequeiros J, Lemos C, Alonso I. Identification of Genetic Risk Factors for Maxillary Lateral Incisor Agenesis. Journal of Dental Research 2014;93:452–8. https://doi.org /10.1177 /0022034514523986.
9. S S. Orthodontically Replacement of Canine with Congenitally Missing Maxillary Lateral Incisor – A Case Report. Medical Journal of Clinical Trials & Case Studies 2018;2. https://doi.org/10.23880/mjccs-16000149.
10. Millet C, Viennot S, Duprez JP. Case report: Rehabilitation of a child with dentinogenesis imperfecta and congenitally missing lateral incisors. European Archives of Paediatric Dentistry 2010;11:256–60. https://doi.org/10.1007/bf03262758.
11. Branzén M, Eliasson A, Arnrup K, Bazargani F. Implant-Supported Single Crowns Replacing Congenitally Missing Maxillary Lateral Incisors: A 5-Year Follow-Up. Clinical Implant Dentistry and Related Research 2014;17:1134–40. https://doi.org/10.1111/cid.12233.
12. Simeone P, De Paoli C, De Paoli S, Leofreddi G, Sgrò S. Interdisciplinary Treatment Planning for Single-Tooth Restorations in the Esthetic Zone. Journal of Esthetic and Restorative Dentistry 2007;19:79–88. https://doi.org/10.1111/j.1708-8240.2007.00071.x.

13. De-Marchi LM, Pini NIP, Ramos AL, Pascotto RC. Smile attractiveness of patients treated for congenitally missing maxillary lateral incisors as rated by dentists, laypersons, and the patients themselves. The Journal of Prosthetic Dentistry 2014;112:540–6. https://doi.org/10.1016/j.prosdent.2014.01.019.
14. Nordquist GG, McNeill RW. Orthodontic vs. Restorative Treatment of the Congenitally Absent Lateral Incisor—Long Term Periodontal and Occlusal Evaluation. Journal of Periodontology 1975;46:139–43. https://doi.org/10.1902/jop.1975.46.3.139.
15. Robertsson S. The congenitally missing upper lateral incisor. A retrospective study of orthodontic space closure versus restorative treatment. The European Journal of Orthodontics 2000;22:697–710. https: //doi.org /10.1093/ejo/22.6.697.
16. Jamilian A, Perillo L, Rosa M. Missing upper incisors: a retrospective study of orthodontic space closure versus implant. Progress in Orthodontics 2015;16. https://doi.org/10.1186/s40510-015-0072-2.
17. Branzén M, Eliasson A, Arnrup K, Bazargani F. Implant-Supported Single Crowns Replacing Congenitally Missing Maxillary Lateral Incisors: A 5-Year Follow-Up. Clinical Implant Dentistry and Related Research 2014;17:1134–40. https://doi.org/10.1111/cid.12233.
18. Garnett MJ, Wassell RW, Jepson NJ, Nohl FS. Survival of resin-bonded bridgework provided for post-orthodontic hypodontia patients with missing maxillary lateral incisors. British Dental Journal 2006;201:527–34. https://doi.org/10.1038/sj.bdj.4814160.
19. Mangano C, Levrini L, Mangano A, Mangano F, Macchi A, Caprioglio A. Esthetic Evaluation of Implants Placed after Orthodontic Treatment in Patients with Congenitally Missing Lateral Incisors. Journal of Esthetic and Restorative Dentistry 2013;26:61–71. https://doi.org/10.1111/jerd.12081.
20. Peñarrocha M, Lamas J, Peñarrocha M, Garcia B. Immediate Maxillary Lateral Incisor Implants with Nonocclusal Loading Provisional Crowns. Journal of Prosthodontics 2007;17:55–9. https://doi.org/10.1111/j.1532-849x.2007.00242.x.
21. Sailer I, Bonani T, Brodbeck U, Hammerle C. Retrospective Clinical Study of Single-Retainer Cantilever Anterior and Posterior Glass-Ceramic Resin-Bonded Fixed Dental Prostheses at a Mean Follow-up of 6 Years. International Journal of Prosthodontics 2013;26:443–50. https://doi.org/10.11607/ijp.3368.
22. Zarone F, Sorrentino R, Vaccaro F, Russo S. Prosthetic treatment of maxillary lateral incisor agenesis with osseointegrated implants: a 24–39-month prospective clinical study. Clinical Oral Implants Research 2006;17:94–101. https://doi.org/10.1111/j.1600-0501.2005.01188.x.

Table 1 – Data extraction sheet

Sl No.	Study	Type of study	Age range of patients	Gender	Tooth agenesis (whether unilateral/ bilateral)	Treatment options	Orthodontic space closure and recontouring canine/ Orthodontic space opening with implants or resin bonded prostheses/ Autotransplatation
	DeMarchi et al (2012) [13]	Cross sectional study	14-45 years, Mean: 25	9Male, 37 Female	19 Unilateral and 27 Bilateral	Orthodontic Space Closure (n = 43) and Implants (n = 30)	YES, recontouring was done.
	Nordquist and McNeil (1975) [14]	Cross sectional study	Not mentioned	Not mentioned	8 Unilateral and 25 Bilateral	Orthodontic Space Closure (n = 39) and Prosthesis (n = 19)	YES, recontouring was done for the prosthesis
	Robertsson and Mohlin (2000) [15]	Retrospective analysis	19.4-54.9 years Mean 25.8	14 Male, 36 Female	13 Unilateral and 39 Bilateral	Orthodontic Space Closure (n = 53) and Prosthesis (n = 36)	YES, recontouring was done for the prosthesis
	Jamilian et al (2015) [16]	Retrospective analysis	19.4-22.8 years Mean 21.02	5 Male, 3 Female	5 Unilateral and 3 Bilateral	Orthodontic Space Closure (n = 7) and Prosthesis (n = 4)	Not mentioned
	Branzen et al (2014) [17]	Retrospective analysis	Range: 14 – 26 years	17 Male, 19 Female	18 Unilateral and 18 Bilateral	Implants (n = 54)	Yes, Orthodontic space opening with implants is being done
	Garnett et al (2006) [18]	Retrospective analysis	13-44 years, Mean: 17	14 Male 31 Female	17 Unilateral and 28 Bilateral	RBP (n =73): Canine Cantilevered (n = 38); Central Incisor Cantilevered (n = 24); Conventional (n = 9); Canine+Premolar Cantilevered (n = 2)	Yes, Orthodontic space opening with implants is being done

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	Mangano et al (2014) [19]	Retrospective analysis	19.75-24.25 years	9 Male 11 Female	20 Unilateral	Implants (n = 20)	Yes, Orthodontic space opening with implants is being done
	Penarrocha et al (2008) [20]	Cross sectional study	17-32 years, Mean:22	2 Male 4 Female	17 Unilateral and 28 Bilateral	Implants (n=8)	Yes, Orthodontic space opening with implants is done only in two cases
	Sailer et al (2013) [21]	Retrospective analysis	13.1-75.1 years	6 Male 9 Female	7 Unilateral	Single retainer cantilever (n = 7)	Not available
	Zarone et al (2006) [22]	Prospective analysis	21-45 years	11 Male 19 Female	26 Unilateral and 4 Bilateral	Implants (n = 34)	Not available

Periodontal assessment	Esthetic assessment	Retention
Study finds comparable percentages of bone loss and space closure, negligible variations in periodontal probing depth, and somewhat larger mesial changes in orthodontic closure relative to implants, but no appreciable distal variations. 19 thin and 7 thick biotypes.	OSC reported higher levels of satisfaction compared to NSs. P is greater than 0.002. Smile attractiveness (VAS): P = 0.64 for the differences in Nss between laypeople and dentists.	Not mentioned
When fixed partial dentures (FPD) with surgical (Ss) and non-surgical (Nss) approaches are compared, gingival and bone indices for the former are considerably better than those for the latter. However, there are no discernible differences between Nss and OSC in terms of peri-implant conditions. Furthermore, peri-implant probing depth in FPD surgical methods is substantially less than in OSC.	Not required	Not required
In contrast to orthodontic closure, surgical techniques exhibit decreased PR and BI, while Nss shows negligible variations in periodontal depth.	Patients expressed greater satisfaction with the overall look following surgical closure, however prosthetic approaches were substantially favoured by tooth colour and form. There were non-significant variations in other dimensions.	Retention was achieved
While there was no discernible difference in the periodontal index (PI), surgical (SS) implants had a greater probing depth (>3mm) than orthodontic closure.	There was no discernible difference in patient satisfaction between implant and orthodontic closure (OSC) techniques, as measured by VAS. The examiner's assessment was not documented.	Retention was achieved
PpI: 0 (n = 2, 4%), 1 (n = 7, 13%) 2 (n = 15, 28%), 3 (n = 30, 56%)	Patients' satisfaction: 32.43% desired a crown replacement 56.75% completely. Satisfied CDA Evaluation: 70% excellent 30% acceptable	Retention was achieved
Not Reported	Not Reported	Retention was achieved
Not Reported	Patient's satisfaction: NR Independent calibrated examiner evaluation (PES/WES) High aesthetic outcome PES Index: Mean: 8.15 ± 1.69 WES Index: Mean 8.70 ± 0.92	Retention was achieved
Not Reported	Patient's satisfaction (VAS), High degree of satisfaction, Examiner/panel evaluation: NR	Retention was achieved
no differences in biological outcomes compared to the control teeth	High aesthetic outcome	Retention was achieved
no differences in biological outcomes compared to the control teeth	High aesthetic outcome	Retention was achieved
PI: 0 (n = 27) 1 (n = 6), GI: 0 (n = 31) 1 (n = 2), BI: 0 (N = 33) PpI: 0 (n = 0); 1 (n = 2); 2 (n = 4); 3 (n = 27); PD: Nss after 0.5, 1 and 2 years of function P > 0.05	Patient's satisfaction: NR Author's evaluation: Optimal aesthetic outcome	Retention was achieved

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Table 2 – ROBANS bias

Domain	DeMarchi et al (2012) [13]	Nordquist and McNeil (1975) [14]	Robertsson and Mohlin (2000) [15]	Jamilian et al (2015) [16]	Branzen et al (2014) [17]	Garnet et al (2006) [18]	Mangano et al (2014) [19]	Penarrocha et al (2008) [20]	Sailer et al (2013) [21]	Zarone et al (2006) [22]
Random sequence generation	1	1	1	1	1	1	1	1	1	1
Allocation concealment	1	1	1	2	2	1	1	1	2	2
Selective reporting	1	1	1	1	2	1	2	1	1	1
Other bias	2	1	1	2	1	1	2	2	1	2
Blinding of Participants and Personnel	1	2	1	3	1	1	2	1	3	1
Blinding of outcome assessment	2	2	1	1	1	2	1	1	1	1
Incomplete outcome data	1	2	1	1	2	1	2	1	2	2
Total	**9**	**10**	**7**	**11**	**10**	**8**	**11**	**8**	**11**	**10**