

Factors Affecting Decision-Making for Patients with Maxillary Lateral Incisors Agenesis: Systematic Review

A. Assali *, R. Elhaddaoui, Y. Oualalou, F. Zaoui

Department of Dentofacial Orthopedics and Orthodontics, Mohammed V University, Rabat, Morocco.

*Corresponding Author: Assali Ahlam; ahlaamassalii@gmail.com

Received: 19 August 2023;

Revised: 08 October 2023;

Accepted: 13 October 2023;

Published: 17 October 2023

Abstract

Introduction: To open or to close the space of a missing maxillary lateral incisors remains a great challenge for the orthodontists. The aim of this systematic review was to investigate the factors affecting decision-making for patients with maxillary lateral incisors agenesis. **Material and methods:** Following the PRISMA guidelines, a systematic search was performed in several databases (Pub Med, Science direct, Cochrane Library) covering publications from 2010 to august 2022. **Results:** Based on the keywords, 56 bibliographical references were initially identified. After eliminating duplicate references, studying the titles and abstracts and then reading the full texts, 8 articles were included in this systematic review. **Conclusion:** Therapeutic decision-making is mainly based on the periodontal parameters and have shown that space closure is preferable when the two therapeutics are possible.

Keywords: Congenitally Missing lateral incisor, Maxillary Lateral Incisor, Orthodontic Space Closure, Orthodontic Space Opening, treatment choice.

Introduction

Tooth agenesis is the absence of one or more teeth, excluding the wisdom teeth [1]. The prevalence of congenitally missing teeth has been reported to range from 2.6-11.3% [2,3]. Besides, Agenesis of both maxillary lateral incisors is more frequent than agenesis of only one [4,5].

Missing maxillary lateral incisors has two treatment options: space opening for prosthetic replacement or space closure. However, certain factors favour one treatment option over the other.

There is too many controversies regarding the two methods, especially, which approach allows for reaching a long term stability by taking into account the aesthetic results, the periodontal health, and the function [6].

The aim of this systematic review was to investigate the factors affecting decision-making for patients with maxillary lateral incisors agenesis.

Material and Methods

The PRISMA selection criteria were used for this systematic review

Table 1: PICO question

Population	Patients with maxillary permanent lateral incisor agenesis (uni/bilateral)
Intervention	Treatment of maxillary lateral incisor agenesis
Comparison:	the outcome (occlusal, periodontal, or aesthetic aspects) of the two treatments
Outcomes	the factors affecting decision-making for patients with maxillary lateral incisors agenesis

Research strategy

A systematic search was done in the following databases (Pub Med, Science direct, Cochrane Library) covering publications from 2010 to august 2022. The search was based on the acronym PICOS, using

Eligibility criteria

1. Articles from 2010 to August 2022
2. Articles with full text availability
3. Articles in English or French
4. Original articles, comparative, prospective, retrospective, longitudinal or cross-sectional studies, cohort study, case-control study, randomized control trials
5. Clinical studies about maxillary lateral incisors missing that involve both methods (space opening and space closure) in permanent dentition.

Exclusion criteria

1. A Case report
2. Literature revues
3. Agenesis of maxillary lateral temporary incisors
4. Studies treating a maxillary lateral incisor missing because of a trauma or caries

Question PICO

The clinical question was created using: Population, Intervention, Comparison, and Outcomes (PICO) format. (Table 1)

this keywords: (lateral incisor OR upper lateral incisor OR maxillary lateral incisor) AND (agenesis OR congenitally missing) AND treatment choice AND orthodontics

Quality assessment

The selected articles were scored based on the proposed criteria "National Institutes of Health, Department of Health and Human Services, USA [7]. Regarding the risk of bias for each study analysed, the documents containing all the points mentioned above [9-13] were

rated as "low risk," those for which the number of points in between [6-8] was rated as "medium risk," a high risk "is assigned to studies that meet or less than five criteria. In studies included in this review: The risk of bias was considered low in two studies and medium in six studies. (Table 2)

Table 2: Quality criteria of included studies

Quality assessment	Jamilian 2015 [8]	Hvaring 2016 [9]	Josefsson 2019 [10]	Barber 2014 [11]	Shneider 2016 [12]	Demarchi 2014 [13]	Qadri 2016 [14]	Kafantaris 2020 [15]
Research question	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Study population	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Groups recruited from the same population and uniform eligibility criteria	Yes	Yes	Yes	no	Yes	Yes	Yes	Yes
Justification of sample size	No	No	No	No	No	No	No	No
Exposure assessed before measurement of results	Yes	no	Yes	yes	Yes	No	No	Yes
Sufficient time to see an effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Different exposure levels of interest	NA	NA	NA	NA	NA	NA	NA	NA
Exposure measurements and assessment	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Repeated exposure assessment	yes	yes	No	No	No	No	No	Yes
Outcome measures	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Blinding of exposure assessors	no	No	No	No	No	No	No	No
Follow-up rate	NA	NA	NA	NA	NA	NA	NA	NA
Statistical analysis	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Results	9	8	8	7	8	7	7	9

Results

Based on the keywords, 56 bibliographical references were initially identified. After eliminating duplicate references, the number of

articles was reduced to 47. Studying the titles and abstracts let us to select 22 articles. After reading the full text, 8 articles were included in this systematic review. (Figure 1)

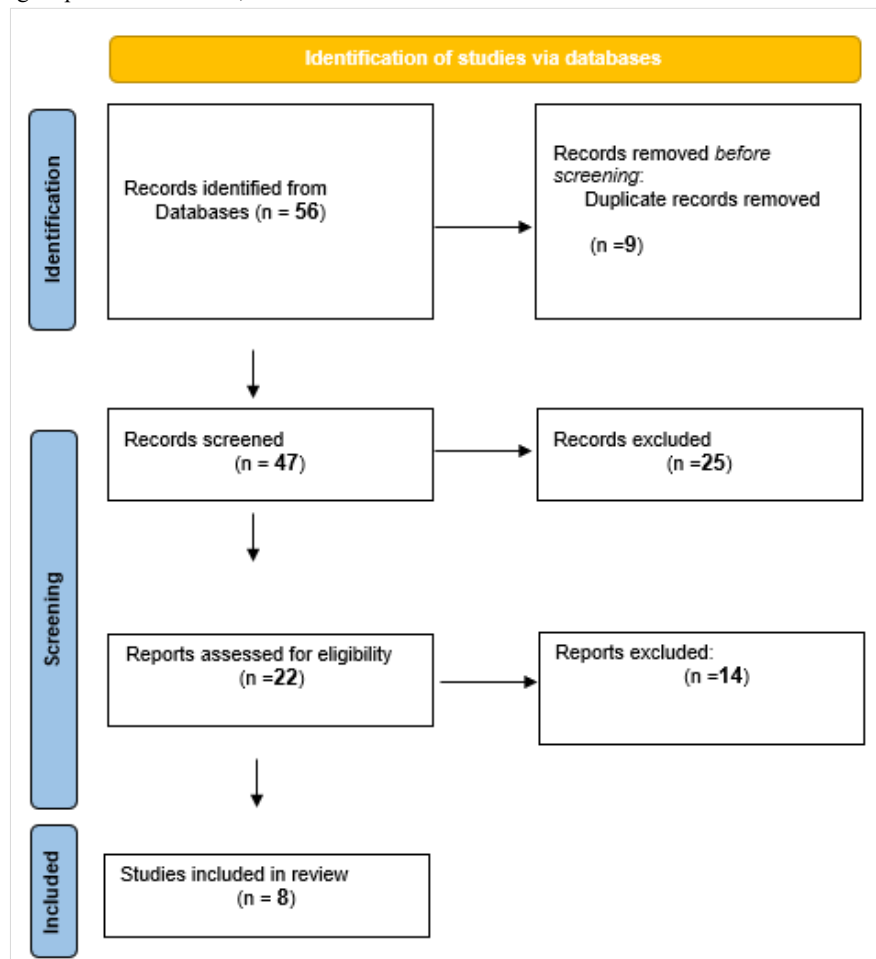


Figure 1: Flow diagram demonstrating literature search, study inclusion and exclusion

The articles were ranked according to the criteria studied by the authors (Table 3)

Table 3: Results of studies included in the review

Authors	Study design	Aim of study	Treatment modalities	Participants	Parameters evaluated	Results
Jamilian A. and al (2015) ^[8]	retrospective study	to compare the aesthetic, periodontal, and functional outcomes	-SC -SO + implant	study group: 10 patients SC (19y ± 2.1) and 10 SO+ implant (20y ± 1.4)	- aesthetic, periodontal, and functional outcomes	-well-accepted aesthetic results for the two modalities - infra-occlusion in implant patients - Better periodontal health with SC
Hvaring C. and al (2016) ^[9]	Retrospective study	to compare the soft tissue morphologies and the crown	-SC -SO + implant -SO + fixed prosthesis	-50 patients -mean age, 25.6 years)	-mucosal discoloration -crown morphology -the color and papilla index	-Mucosal discoloration was found only for implant - The papilla index were higher for orthodontic SC
Josefsson and al (2019) ^[10]	Cross-sectional study	to evaluate the best treatment option	-SC -SO +implant	44 patients: 22 SC, 22 SO+ implant Mean age: 24.6-33.7 years	-Aesthetics -Periodontal Status -Occlusal morphology	-No significant aesthetic differences between the groups. -Gingival color was better in the SC group -Gingival recession was more common in implant group
Barber and al (2014) ^[11]	Case control	to establish whether patients have a preference between the aesthetic outcomes	-SC -SO	-102 patients (14-16 years)	aesthetics	the majority of examiners chose SO
Shneider and al (2016) ^[12]	Case control	to determine how dentists, orthodontists, and laypersons judge the aesthetic outcome	-SC -SO + implant	- 9patients: 3 SC, 3SO +implant, 3 Control group	aesthetics	Dentists ranked SO and SC equally aesthetic, laypersons chose SC.
De Marchi and all (2014) ^[13]	Case control	to evaluate the smile attractiveness	-SC -SO + implant	-68 patients: 26 SC, 20 SO, 22 control group	aesthetics	- Patients with SC were significantly more satisfied
Qadri and al (2016) ^[14]	Cross sectional study	To investigate the opinions of laypersons	-SC -SO	-21 patients: 11 SC, 10 SO	aesthetics	Aesthetics after SC is statistically more pleasant than SO
Kafantaris and al (2020) ^[15]	Retrospective study	to investigate the factors affecting decision-making	- SC -SO	-46 patients (31 women > 17 yo et 11 men >18 yo)	-soft tissue response -aesthetic outcome -TMJ response -periodontal and peri-implant status	-Decision-making is directly dependent on: Patient's age, Individual characteristics, participating specialists in the treating team

SO: space opening - SC: space closure - TMJ: temporomandibular joint

Discussion

The management of patients with maxillary lateral incisors agenesis involve either space closure and canine substitution or space opening and prosthodontic replacement.

Certain factors that clinicians should consider in the decision-making are facial profile, the canine dimensions, the colour of those teeth and the gingival height.

We noticed that most of studies were interested by the periodontal parameters while assessing the results and this through the comparison between the two techniques. According to Rosa M and AL's study 2015^[16], orthodontic space closure in patients with missing lateral incisors does not incur risks for periodontal tissue deterioration or temporo-mandibular disorders in the long term. These results are in agreement with the study of Šikšnytytė J and al 2021^[6] and Jamilian A. and al 2015^[8].

According to Josefsson and al 2019^[10], gingival colour was better in the space closure group and the gingival recession was more common in implant group, however, there was no significant aesthetic differences between the groups. the authors concluded that if both treatment alternatives are available, space closure is preferable. This results are in agreement with three systematic reviews done by Kilidiaris S and al 2016^[17], Silveira and al 2016^[18], Al Qahtani and al 2021^[19] who reported that the orthodontic space closure whenever it's possible, is advantageous over the prosthodontic rehabilitation.

There are controversies in the literature regarding the implantation option, indeed, according to some studies, there are changes in the relative position of the implant in the vertical and

sagittal direction, as well as, Jamilian and al 2015^[8], who showed that all implant-supported teeth had increased infraocclusion of more than 1mm, five years after treatment. These findings are the similar to those found by Bernard^[20], and Jemt^[21] who reported that even if the implant is fixed after 19 years, the adjacent teeth and surrounding alveolar bone may continue to develop vertically thus causing the infraocclusion of the implant. According to Oesterle and Croning^[22] facial growth is completed by 17 years in females, whereas it may not be completed until as late as 25 years in males, if implants are placed before the completion of facial growth, the risk of infraocclusion of the implant crown increases.

Mini-screw implant supported pontics have been proposed by Ciarlantini and Melsen 2017^[23] and found that it allows the development of the alveolar process, as well as, Michelogiannakis and al 2020^[24] who reported that the mini screw could stimulate the bone crest in the toothless site and reported a development in the vertical direction of the alveolar bone. So, mini-screw implant supported pontics might be useful as an alternative procedure for the temporary replacement of missing permanent maxillary lateral incisors in growing patients when the space opening is indicated.

Lacarbonara and al 2021^[25] evaluated the behavior of the mini-implants in a period of 10 years and reported no signs of infra-occlusion with good conditions of the peri-implant tissue and satisfactory values of marginal bone resorption. The authors concluded that in presence of severe bone atrophy, dental mini-implants may provide a good solution.

Implant substitution could have other disadvantages, indeed, Hvaring and al 2016^[9] reported a mucosal blue discoloration only for implant patients, likewise, Dueled and al 2009^[26] who noticed a

blue colouring of the labial gingiva in above more than 50% of single-implant crowns at 4-year follow-ups.

The current evolution promotes the resin bonded fixed partial denture as the gold standard (aesthetic and less invasive), by the way, Kafantaris and al 2020 [15] reported that, either bilaterally attached or cantilevered, it offers better results compared to implants in cases of agenesis of the maxillary lateral incisors in terms of aesthetics, function and soft tissue response. According to, Antonarakis and al 2014 [27], who have done a comparative economic evaluation of different treatment modalities for missing maxillary lateral incisors and have shown that the full-coverage fixed partial denture is the least cost-effective treatment.

Conclusion

According to studies, therapeutic decision-making is mainly based on the periodontal parameters and have shown that space closure is preferable when the two therapeutics are possible.

In case of space opening, studies promote the resin bonded fixed partial denture as more aesthetic, and less invasive, with satisfactory functional and periodontal results, more than implantation option.

The treatment must be a multidisciplinary approach to achieve an optimal occlusion and also a natural smile with a long-term stability.

Declarations

Ethical Approval

Not Applicable

Competing Interest

The authors declare that they have no competing interests

Funding Statement

None

Acknowledgments

None

Authors Contributions

All the authors have actively participated in this work.

References

- [1] Hashim HA, Al-Said S. The prevalence and distribution of hypodontia in a sample of Qatari patients. *J Orthod Sci*. 2016;5(1):1-6.
- [2] Polder, B. J., Van't Hof, M. A., Van der Linden, F. P., & Kuijpers-Jagtman, A. M. A meta-analysis of the prevalence of dental agenesis of permanent teeth. *Community dentistry and oral epidemiology*, 2004 32(3), 217–226.
- [3] Larmour, C. J., Mossey, P. A., Thind, B. S., Forgie, A. H., & Stirrups, D. R. Hypodontia-a retrospective review of prevalence and etiology. Part I. *Quintessence international*, 2005 36(4), 263–270.
- [4] Khalaf K, Miskelly J, Voge E, Macfarlane TV. Prevalence of Hypodontia and Associated Factors: A Systematic Review and Meta-analysis. *Journal of Orthodontics*. 2014;41(4):299-316.
- [5] Robertsson, S., & Mohlin, B. The congenitally missing upper lateral incisor. A retrospective study of orthodontic space closure versus restorative treatment. *European journal of orthodontics* 2000, 22(6), 697–710.
- [6] Šikšnelytė, J., Guntulytė, R., & Lopatienė, K. Orthodontic canine substitution vs. implant-supported prosthetic replacement for maxillary permanent lateral incisor agenesis: A systematic review. *Stomatologija*, 2021, 23(4), 106–113.
- [7] National Institutes of Health. Quality Assessment of CaseControl Studies. Department of Health & Human Services. <https://www.nhlbi.nih.gov/health-topics/study-quality-assessment-tools> [accessed 02/01/23]
- [8] Jamilian, A., Perillo, L., & Rosa, M. Missing upper incisors: a retrospective study of orthodontic space closure versus implant. *Progress in orthodontics* 2015, 16, 2.
- [9] Hvaring CL, Øgaard B, Birkeland K. Tooth replacements in young adults with severe hypodontia: Orthodontic space closure, dental implants, and tooth-supported fixed dental prostheses. A follow-up study. *Am J Orthod Dentofacial Orthop*. 2016;150(4):620-626
- [10] Josefsson E, Lindsten R. Treatment of missing maxillary lateral incisors: a clinical and aesthetic evaluation. *Eur J Orthod*. 2019;41(3):273-278.
- [11] Barber SK, Houghton N, Spencer RJ. Limitations of a method used for adolescent assessment of smile aesthetics. *Eur J Orthod*. 2015;37(2):135-141
- [12] Schneider U, Moser L, Fornasetti M, Piattella M, Siciliani G. Esthetic evaluation of implants vs canine substitution in patients with congenitally missing maxillary lateral incisors: Are there any new insights?. *Am J Orthod Dentofacial Orthop*. 2016;150(3):416-424.
- [13] De-Marchi LM, Pini NI, Ramos AL, Pascotto RC. Smile attractiveness of patients treated for congenitally missing maxillary lateral incisors as rated by dentists, laypersons, and the patients themselves. *J Prosthet Dent*. 2014;112(3):540-546.
- [14] Qadri S, Parkin NA, Benson PE. Space closing versus space opening for bilateral missing upper laterals - aesthetic judgments of laypeople: a web-based survey. *J Orthod*. 2016;43(2):137-146.
- [15] Kafantaris SN, Tortopidis D, Pissiotis AL, Kafantaris NM. Factors Affecting Decision-Making For Congenitally Missing Permanent Maxillary Lateral Incisors: A Retrospective Study. *Eur J Prosthodont Restor Dent*. 2020;28(1):43-52
- [16] Rosa M, Lucchi P, Ferrari S, Zachrisson BU, Caprioglio A. Congenitally missing maxillary lateral incisors: Long-term periodontal and functional evaluation after orthodontic space closure with first premolar intrusion and canine extrusion. *Am J Orthod Dentofacial Orthop*. 2016;149(3):339-348.
- [17] Kiliaridis S, Sidira M, Kirmanidou Y, Michalakis K. Treatment options for congenitally missing lateral incisors. *Eur J Oral Implantol*. 2016;9 Suppl 1: S5-S24.
- [18] Silveira GS, de Almeida NV, Pereira DM, Mattos CT, Mucha JN. Prosthetic replacement vs space closure for maxillary lateral incisor agenesis: A systematic review. *Am J Orthod Dentofacial Orthop*. 2016;150(2):228-237.
- [19] Nasser D. Alqahtani, Successful treatment modalities for missing lateral incisors– A systematic review, The Saudi Dental Journal, Volume 33, Issue 6, 2021, Pages 308-315.
- [20] Bernard JP, Schatz JP, Christou P, Belser U, Kiliaridis S. Long-term vertical changes of the anterior maxillary teeth adjacent to single implants in young and mature adults. A retrospective study. *J Clin Periodontol*. 2004;31(11):1024-1028.

- [21] Jemt T, Ahlberg G, Henriksson K, Bondevik O. Changes of anterior clinical crown height in patients provided with single-implant restorations after more than 15 years of follow-up. *Int J Prosthodont.* 2006;19(5):455-461.
- [22] Oesterle LJ, Cronin RJ Jr. Adult growth, aging, and the single-tooth implant. *Int J Oral Maxillofac Implants.* 2000;15(2):252-260.
- [23] Ciarlantini R, Melsen B. Semipermanent replacement of missing maxillary lateral incisors by mini-implant retained pontics: A follow-up study. *Am J Orthod Dentofacial Orthop.* 2017;151(5):989-994.
- [24] Michelogiannakis D, Javed F, Vastardis H. Mini-screw implant-supported pontics for the transitional management of missing permanent maxillary lateral incisors in children and adolescents: a review of currently available evidence. *Eur Arch Paediatr Dent.* 2020 Jun;21(3) 285-293.
- [25] Lacarbonara M, Cazzolla AP, Lacarbonara V, et al. Prosthetic rehabilitation of maxillary lateral incisors agenesis using dental mini-implants: a multicenter 10-year follow-up. *Clin Oral Investig.* 2022;26(2):1963-1974.
- [26] Dueled E, Gotfredsen K, Trab Damsgaard M, Hede B. Professional and patient-based evaluation of oral rehabilitation in patients with tooth agenesis. *Clin Oral Implants Res.* 2009;20(7):729-736.
- [27] Antonarakis GS, Prevezanos P, Gavric J, Christou P. Agenesis of maxillary lateral incisor and tooth replacement: cost-effectiveness of different treatment alternatives. *Int J Prosthodont.* 2014;27(3):257-263.



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