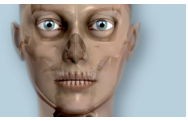
Orthodontics & Craniofacial Research



REVIEW ARTICLE

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# Treatment for agenesis of maxillary lateral incisors: a systematic review

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**Structured Abstract**

***Objectives –*** To compare the efficacy and safety of three orthodontic treatment modalities for agenesis of maxillary lateral incisors: 1) closing the space with the reshaped canine substituting the lateral incisor, 2) opening the space with placement of a conventional fixed bridge, and 3) opening the space with placement of a single-unit implant and an implant-supported crown.

***Setting –*** Brazilian Cochrane Center and Universidade Federal de São Paulo, Brazil.

***Material and Methods –*** The following databases were investigated: Cochrane Register of Controlled Trials (Edition 12, 2011), EMBASE (from 1974 to December 2011), MEDLINE (from 1965 to December 2011), LILACS (from 1966 to November 2011), and Odontology Brazilian Bibliography Database (from 1966 to November 2011). Conference abstracts, main Brazilian dissertations and theses databases, and reference lists were handsearched. This systematic review included randomized or quasi-randomized controlled trials (RCTs) including women aged 15 years or over and men aged 21 years or over who received one of the interventions stated above. Two observers independently evaluated all the studies regarding eligibility criteria and assessed the risk of bias of included studies.

***Results –*** No studies were included in the review as no RCTs were found. Most of the evidence comes from case reports and narrative reviews on case reports and from three studies with a single post-intervention evaluation and non-comparable control groups with high risk of bias.

***Conclusions –*** There is no scientific evidence for any of the three most common types of treatment for agenesis of the maxillary lateral incisors. RCTs into this issue are still necessary.

**Key words:** anodontia; dental implants; incisor; review

## Introduction

There are at least three options for treating congenital absence (agenesis) of the maxillary lateral incisors. These include 1) orthodontic treatment to open a space with placement of a conventional fixed bridge or other prosthetic solutions, 2) orthodontic treatment to close the gap with replacement using a reshaped canine, and 3) orthodontic treatment to open the space with placement of a single-unit implant and implant-supported crown. The decision regarding the appropriate treatment option may depend on the type of malocclusion, the anterior teeth relationship, space availability, and the condition of the adjacent tooth. The ideal treatment should be the most conservative option that satisfies both the individual's esthetics and the functional requirements (1).

In practice, the protocol used for treating agenesis of maxillary lateral incisors depends more on practice organization and the clinical skills available than on considerations regarding treatment effectiveness. In the United Kingdom, a study identified treatment preferences among orthodontists for patients with congenital absence of the maxillary lateral incisors. The results indicated that orthodontists who worked in an environment where only orthodontists were present more frequently indicated orthodontic treatment to close the gap with reshaping of the canine. On the other hand, orthodontists who worked alongside other specialists preferentially indicated prosthetic solutions with minimal preparation techniques (2).

There is much controversy in the literature regarding the best treatment for agenesis of maxillary lateral incisors, and there is no systematic review on this topic. This highlights the need to systematically search for evidence that would provide support for decision-making regarding the best option for treating congenital absence of maxillary lateral incisors. So, the objective of this study is to assess the efficacy and safety of three interventions for agenesis of maxillary lateral incisors.

## Materials and methods

This systematic review was performed at the Clínica Integrada de Odontologia (Ciodonto), with the support of Brazilian Cochrane Centre at the Universidade Federal de São Paulo (UNIFESP), Brazil. The review was carried out in accordance with The Cochrane Collaboration Handbook of Interventions Systematic Reviews (3), and the manuscript was prepared using the PRISMA Statement as reporting guidance (4).

### Eligibility criteria

Randomized controlled trials (RCTs) or quasi-RCTs which recruited women aged 15 years or over and men aged 21 years or over who received one of the three types of treatment for agenesis of maxillary lateral incisors included the following: 1) orthodontic treatment to close the gap with replacement using the reshaped canine, 2) orthodontic treatment to open the space with placement of a conventional or adhesive fixed bridge, 3) orthodontic treatment to open the space with placement of a single-unit implant and an implant-supported crown. All efficacy and safety outcomes (i.e., complications related to intervention) were considered. Studies that included patients whose lateral incisors were missing for other reasons, such as accidents, dental caries, or other causes, or with absence of more than one tooth adjacent to the lateral incisor, were excluded.

### Information sources

The following databases were investigated: Cochrane Register of Controlled Trials (CENTRAL, Edition 12, 2011), EMBASE (via Elsevier, from beginning to December 2011), MEDLINE (via PubMed, from 1965 to December 2011), Latin American and Caribbean Health Science Literature Database (LILACS, from 1966 to November 2011), and Odontology Brazilian Bibliography Database (*Bibliografia Brasileira de Odontologia*; BBO, from 1966 to November 2011). Conference abstracts, main Brazilian

dissertations and theses databases, and reference lists of articles were handsearched. Some examples of searching strategies used are presented in Table 1.

#### Study selection

Two observers (DA and CAL) independently evaluated all the studies to decide whether they were eligible for this review. When necessary, a third reviewer (AA) solved disagreements.

#### Risk of bias across studies

Two observers (DA and CAL) assessed all included studies for risk of bias. Disagreements were solved after discussion by consensus. The risk of bias of the included studies was assessed in accordance with the Cochrane Handbook for Systematic Reviews of Interventions (3). The studies were considered to have high, unclear, or low risk of bias according to an assessment of the following items: generation of allocation sequences, allocation concealment, blinding of participants, blinding of outcome assessment, incomplete data addressed, presence of biases in the reporting of the study, and other sources of bias that might influence the study's validity.

## Results

#### Study selection

The search conducted in the EMBASE database found 347 studies, among which 69 (19.88%) were exclusively in EMBASE and 278 (80.12%) were shared with MEDLINE. From reading the titles and abstracts and reading the hard copy of the doubtful studies, it was seen that none of them were eligible. In the LILACS database, 249 studies were found and none of them were eligible. There were 204 studies in BBO, and none of them were eligible. A search in MEDLINE retrieved 23 studies related to implant treatment, 195 studies related to prostheses, and 1054 studies related to orthodontics, thus totaling 1272 studies. The search in the CENTRAL database found 13 studies, but none of them was related to agenesis of maxillary lateral incisors. No relevant studies were found in the hand search. The flowchart of studies and the reasons for exclusion are presented in Fig. 1.

#### Study characteristics

Three studies used a comparative study design with a control group, and they are presented in Table 2 (5–7).

#### Risk of bias

None of the four studies reported random allocation sequence or allocation concealment, and also none of them used any form of blinding, not even simple blinding of the professional or lay observer in relation to subjective measurements that are particularly sensitive to the absence of blinding. Given these points, all of them were classified as presenting high risk of bias (Fig. 2).

## Discussion

The results from this systematic review indicate that there is no scientific evidence for any of the three commonest types of treatment for congenital absence of maxillary lateral incisors (orthodontic treatment to close the gap with replacement using the reshaped canine; orthodontic treatment to open the space with placement of a conventional or adhesive fixed bridge; or orthodontic treatment to open the space with placement of a single-unit implant and an implant-supported crown). No study satisfied the inclusion criteria, especially with regard to the type of design used by the studies. With the type of design used, it is impossible to obtain valid conclusions regarding treatment effects, based on a single post-intervention measurement on non-equivalent groups, given that the effects measured could have been produced either by the treatment or by the non-equivalence of the groups. All the outcomes reported, with the exception of the study of Holm (7), were favorable for the treatment proposed

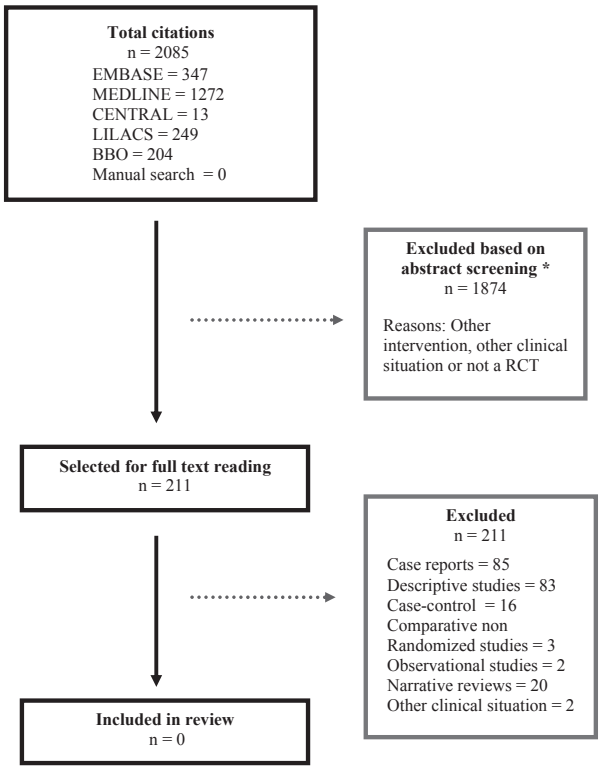
***Table 1.*** **Electronic search strategies**

| Database | Strategy |
|---|---|
| COCHRANE LIBRARY (CENTRAL) – via BIREME | (Tooth Abnormalities) OR (Orthodontic* Malocclusion) OR ((Orthopedic* OR Orthopaedic) AND (Tooth Abnormality) OR (Tooth Abnormalities)) OR (Teeth Abnormalities) OR (Mouth Abnormalities) OR (Abnormality Tooth) OR (Teeth Abnormality) OR Anodontia OR Hypodontia OR Agenesis<br>AND<br>(Dental prosthesis) OR (Implant supported) OR (Dental Prosthesis implant supported) OR (Dental prostheses implant supported) OR (Dentals prosthesis implant supported) OR (Dentals Prostheses implant supported) |
| MEDLINE (via PubMed) | (Tooth abnormalities) OR (Orthodontic* Malocclusion) OR ((Orthopedic* OR Orthopaedic) AND (Tooth Abnormality)) OR (Abnormalities, tooth) OR (Teeth Abnormalities) OR (Mouth abnormalities) OR (Abnormality, tooth) OR (Teeth Abnormality) OR Anodontia OR Hypodontia OR Agenesis<br>AND<br>(Dental prosthesis) OR (Implant supported) OR (Prosthesis, implant supported Dental) OR (Dental prostheses, implant supported) OR (Implant supported Dental prosthesis) OR (Dental, implant supported prosthesis) OR (Dentals, implant supported prosthesis) OR (Prostheses, implant supported dental) OR (Prosthesis dental, implant supported) OR (Prosthesis dentals, implant supported) OR (Implant supported prosthesis dental)<br>AND<br>Filter below:<br>#1 randomized controlled trial (RCT) [pt]<br>#2 controlled clinical trial [pt]<br>#3 randomized [tiab]<br>#4 placebo [tiab]<br>#5 drug therapy [sh]<br>#6 randomly [tiab]<br>#7 trial [tiab]<br>#8 groups [tiab]<br>#9 #1 or #2 or #3 or #4 or #5 or #6 or #7 or #8 #<br>10 humans [mh]<br>#11 #9 and #10 |

***Table 1.*** **(continued)**

| Database | Strategy |
|---|---|
| LILACS/BBO (via BIREME) | (Anormalidades Dentárias) OR (Odontome) OR (Tooth Abnormalities) OR (Ex. C07.650.800) or (Ex. C07.793.700) or (Ex. C16.131.850.800) or (Maloclusão) or (malocclusion) or (Tooth Crowding) or (Crossbite) or (Angle's Classification)or (Ex. C07.793.494) or (Maloclusión) or (Orthodontics) or (Ortodontia) or (Ortodoncia) or (Ex. E06.658) or (Ex. G02.163.876.439)<br>AND<br>(Orthodontic Space Closure) or (Cierre del Espacio Ortodóntico) or(Fechamento de Espaço Ortodôntico) or (Space Closure, Orthodontic) or (Ex. E06.658.578.229) or (Prosthesis, Dental) or (Prótese Dentária) or (Prótesis Dental) or (Dental Prosthesis) or (Ex. E06.780.345) or (Ex.E07.695.190) or (Dental Prosthesis, Implant-Supported) or (Prótesis Dental de Soporte Implantado) or (Prótese Dentária Fixada por Implante) or (Denture, Implant-Supported Implant-Supported Dental Prosthesis) or (Ex. E06.780.345.630) or (Ex. E07.695.190.185) or (Dental Prosthesis, Implant-Supported) or (Prótesis Dental de Soporte Implantado) or (Prótese Dentária Fixada por Implante) or (Denture, Implant-Supported Implant-Supported Dental Prosthesis) or (Ex. E06.780.345.630) or (Ex. E07.695.190.185) or (Cuspid) or (Diente Canino) or (Dente Canino) or (Canine Tooth) or (Ex. A14.549.167.860.200) or (Bicuspid) or (Diente Premolar) or (Dente Premolar) or (Premolar) or (Ex. A14.549.167.860.150)<br>AND<br>((Pt RCT OR Pt controlled clinical trial OR Mh RCTs OR Mh random allocation OR Mh double-blind method OR Mh single-blind method) AND NOT (Ct animal AND NOT (Ct human and Ct animal)) OR (Pt clinical trial OR Ex E05.318.760.535$ OR (Tw clin$ AND (Tw trial$ OR Tw ensa$ OR Tw estud$ OR Tw experim$ OR Tw investiga$)) OR ((Tw singl$ OR Tw simple$ OR Tw doubl$ OR Tw doble$ OR Tw duplo$ OR Tw trebl$ OR Tw trip$) AND (Tw blind$ OR Tw cego$ OR Tw ciego$ OR Tw mask$ OR Tw mascar$)) OR Mh placebos OR Tw placebo$ OR (Tw random$ OR Tw randon$ OR Tw casual$ OR Tw acaso$ OR Tw azar OR Tw aleator$) OR Mh research design) AND NOT (Ct animal AND NOT (Ct human and Ct animal)) OR (Ct comparative study OR Ex E05.337$ OR Mh follow-up studies OR Mh prospective studies OR Tw control$ OR Tw prospectiv$ OR Tw volunt$ OR Tw volunteer$) AND NOT (Ct animal AND NOT (Ct human and Ct animal))) |

LILACS, Latin American and Caribbean Health Science Literature Database; BBO, Odontology Brazilian Bibliography Database (Bibliografia Brasileira de Odontologia); BIREME, Biblioteca Regional [Regional Library].




*RCT: Randomized controlled trial.*

** One single study may present more than one reason to be excluded*

*Fig. 1.* Flowchart of the process of study selection.

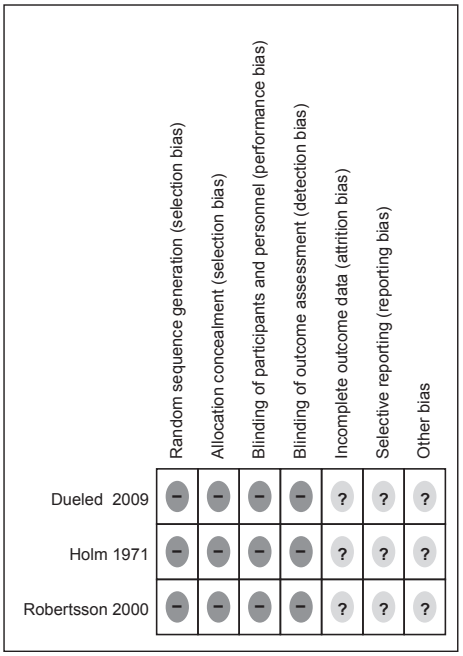



*Fig. 2.* Risk of bias summary: review authors' judgements about each risk of bias item for each included study in accordance with the Cochrane Handbook for Systematic Reviews of Interventions.

within the specialty practiced by the authors of the study in question. This suggests that there was a high chance of bias in studies in which there was no control for selection bias or in studies with no blinding of outcome assessment. This means that there is no certainty regarding the possible benefits or undesirable effects of each alternative intervention or with regard to one intervention over the others.

Comparing the results from published narrative reviews with the results obtained from the present systematic review, no agreement between the conclusions was found (8–14).

The clinical consequence of this systematic review is that there is no evidence that could support any of the three studied treatment alternatives for congenital absence of maxillary lateral incisors. Under these conditions, clinicians should select patients with a large dose of caution in relation to their own clinical skills and experience, the clinical conditions encountered in each patient and the patients' own wishes. It is, however, reasonable to highlight that an acceptable answer regarding which would be the best treatment maybe can never be given if only evidence from RCTs is considered. It should also be recognized that optimal treatment modalities could differ in relation to the age of the patient. Indeed, some clinical problems are so complex that the second best evidence should/could be sufficient. Prospective controlled studies and/or even retrospective controlled studies of a better design than the existing studies may be an alternative that could give us some better guidelines in the future.

As implications for research, there is a need of RCTs planned and conducted in accordance with the CONSORT (Consolidated Standards of Reporting Trials) statement (15) with the aim of evaluating the risks and advantages of treatment alternatives for agenesis of maxillary lateral incisors. It would be important to put forward a classification of clinical situations resulting from congenital absence of maxillary lateral incisors and to evaluate the possibility of choosing more than one treatment alternative, for different clinical situations, especially with regard to space availability in the maxilla. It would be relevant

***Table 2.*** **Comparative studies found in the literature**

| | Comparative Groups | Outcomes/Results | Reasons for exclusion |
|---|---|---|---|
| Dueled 2009[5] | Orthodontic treatment to open a space, with replacement of a single-unit implant and a prosthesis on the implant or<br>Orthodontic treatment to open a space, with replacement of a conventional fixed bridge or other prosthetic solutions | Subjective indicator (OHIP) in relation to esthetics showed that the patients declared more problems when rehabilitated using a fixed prosthesis than when a single-unit implant was used (47% vs. 41%)<br>Mean score for the five esthetic variables was considered acceptable in 92% of the cases of treatment with a single-unit implant and in 83% of the cases of treatment with a fixed prosthesis | Non-controlled study |
| Robertsson and Mohlin 2000[6] | Orthodontic treatment to close the gap and reshaping of the canine<br>Orthodontic treatment to open a space, with placement of an adhesive fixed bridge | Patients' judgment regarding appearance: remodeling of the canine produced greater satisfaction than did filling the space with an adhesive fixed prosthesis<br>Periodontal parameters such as plaque accumulation and gingivitis: favoring remodeling of the canine<br>Objective symptoms: no significant difference between groups<br>Temporomandibular dysfunction: no significant difference between groups | The use of a non-randomized design with a single post-intervention assessment |
| Holms 1971[7] | Orthodontic treatment to close the gap and reshaping of the canine and premolar<br>Orthodontic treatment to open a space and replace a fixed bridge | Complete closure of the spaces: 60%<br>Requirement of subsequent prosthetic treatment: 22% | Single post-intervention assessment<br>The two forms of intervention were pooled and were compared with a control group without agenesis |

as well to perform cost-effectiveness studies for different treatment alternatives.

## Conclusions

The results from this review indicate that there is no scientific evidence for recommending or not recommending any of the three most common treatments for congenital absence of the maxillary lateral incisors.

## Clinical relevance

Although the congenital absence of maxillary lateral incisors represents a major stereotype, the findings of this systematic review highlights that there is still a lack of good quality evidence regarding the best approach for this clinical situation, and thus, further randomized clinical trials are still necessary.

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