

# INPLASY

## Effectiveness and side effects of orthodontic traction of impacted maxillary incisors in a labially inverted position. A systematic review

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### Corresponding author:

Luis Ernesto Arriola-Guillén

luchoarriola@gmail.com

### Author Affiliation:

Universidad Científica del Sur.

Arriola-Guillén, LE; Aliaga-Del Castillo, A; Rodríguez-Cárdenas, YA; Ruíz-Mora, GA; Dias-Da Silveira, HL; Dutra, V.

### ADMINISTRATIVE INFORMATION

**Support** - Self-financed.

**Review Stage at time of this submission** - Preliminary searches.

**Conflicts of interest** - None declared.

**INPLASY registration number:** INPLASY202460112

**Amendments** - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 27 June 2024 and was last updated on 27 June 2024.

### INTRODUCTION

**Review question / Objective** This systematic review will aim to determine the effectiveness and side effects of orthodontic traction of impacted maxillary incisors in a labially inverted position.

The following selection criteria will be applied following the PICOS strategy (Population-Intervention-Comparator-Outcome-Study Design):

1. Population: Patients in mixed dentition including impacted maxillary incisors located in an inverted position.

2. Intervention: Orthodontic treatment with traction of impacted maxillary incisors.

3. Control: homologous maxillary incisor with orthodontic treatment.

4. Outcome: Primary: Efficiency of traction (successful traction of the impacted incisor), and traction time of traction. Secondary: Undesirable effects (loss of buccal bone continuity, gingival retractions in that tooth, and diminished root length).

5. Study design: randomized clinical trials (RCT) and non-randomized, prospective, and retrospective studies.

**Rationale** Orthodontic traction of impacted upper incisors is considered a complex treatment for orthodontists. There have been comparative studies and some meta-analyses in the scientific literature, all with encouraging results for orthodontic traction of these impacted teeth. However, it is essential to note that the generalization of these results and conclusions is limited because an impacted incisor can be located in different positions, even in very complex positions such as a labially inverted direction. Current reviews have yet to consider this difference. Therefore, it is necessary to clarify this question by evaluating only the studies that have included these cases to analyze the viability of their traction and make a more efficient treatment plan.

An impacted maxillary incisor in a complex position is undoubtedly one of the most significant challenges for the orthodontist, with treatment

alternatives being the possibility of extracting this tooth and replacing it orthodontically with neighboring teeth or maintaining its space for a future dental implant. However, the best condition would be the traction of the incisor due to its function and consequent aesthetics. In this sense, determining factors lead the orthodontist to make the best decision in these cases. Still, in general, it depends on efficient biomechanics and prudent management of treatment time to avoid any unexpected situation.

The traction of impacted incisors can have some adverse effects, such as loss of buccal bone continuity, gingival retractions, and decreased root length. However, no severe complications affecting the patient's oral health have been reported. It's important to note that these situations have not been well described, and the complexity of each case could lead to different outcomes. Therefore, a systematic review is needed to assess orthodontic traction's effectiveness and side effects for impacted upper incisors in a labially inverted position. The findings of this study benefit the orthodontic community by providing clinicians with the knowledge and confidence to treat such cases effectively. Currently, no analyses considering these factors have been conducted.

**Condition being studied** One of the significant challenges for orthodontists is treating impacted teeth. This treatment is problematic because it involves complex biomechanics and requires better control of unwanted effects. In some cases, the prognosis for treatment may be unfavorable. Treatment options include tooth extraction and replacement with neighboring teeth, dental prostheses, or implants. However, when treating patients with impacted maxillary central incisors are usually children and adolescents, and the issue is identified when the impacted tooth does not erupt and the homologous tooth is present.

## METHODS

**Search strategy** The main electronic databases including Medline via Pubmed, Embase, Scopus, Web of Science, Cochrane Library, Lilacs will be searched up to June 2024. The search will be conducted by two reviewers (L.E.A.G and A.A.D.C) independently in two phases. First, both reviewers will assess the titles and abstracts of the selected studies, and after the duplicates were removed. The reference management software Endnote, version X8 (Clarivate Analytics, Philadelphia, Pennsylvania, USA) will be used for this purpose. Any study that did not fulfill the eligibility criteria was excluded. In the second phase, the same reviewers retrieved and assessed the full articles of

the remaining studies to confirm their inclusion. Finally, the reference list of the included studies will be checked for any potential study loss, as a separate search strategy.

**Search strategy**

(((((treatment of impacted incisors) OR (treatment of impacted upper incisors)) OR (impacted incisors treatment)) OR (orthodontic treatment of impacted incisors)) OR (orthodontic treatment of impacted upper incisors)) OR (orthodontic traction of impacted incisor)) OR (orthodontic traction of impacted upper incisor)) OR (orthodontic traction of impacted upper central incisor)) AND (((individuals) OR (subjects)) OR (patients))) NOT (((case report) OR (case reports)) OR (case series)).

**Participant or population** Patients in mixed dentition, including impacted maxillary incisors, are located in an inverted position.

**Intervention** Orthodontic treatment with traction of impacted maxillary incisors.

**Comparator** Homologous maxillary incisor with orthodontic treatment.

**Study designs to be included** Randomized clinical trials (RCT) and non-randomized, prospective, and retrospective studies.

**Eligibility criteria** The exclusion criteria included studies in patients with previous orthodontic treatment, systemically compromised teeth with a history of trauma or endodontically treated, and finally, in vitro, in vivo, or finite element analysis.

**Information sources** The main electronic databases, including Medline via Pubmed, Embase, Scopus, Web of Science, Cochrane Library, and Lilacs, including Medline via PubMed, Embase Scopus, Web of Science Cochrane Library, Lilacs will be searched up to June 2024.

**Main outcome(s)** Outcome: Primary: Efficiency of traction (successful traction of the impacted incisor), and traction time of traction.

**Additional outcome(s)** Secondary outcomes: Undesirable effects (loss of buccal bone continuity, gingival retractions in that tooth, and diminished root length).

**Data management** In the chosen articles, the type of study, sample size, distribution by sex, the initial position of the impacted maxillary incisor, efficiency of traction, traction time, and the undesired effects that occurred will be evaluated,

the latter in a comparative way with the side of the not impacted incisor.

RoB across studies and additional analysis

If there are at least 10 papers that measure outcome variables in a similar way, then standard funnel plots, Egger's test, and meta-analysis will be analyzed. The certainty of the evidence produced will be assessed using the Grade of Recommendation, Evaluation, Development, and Evaluation (GRADE) approach. Agreement between reviewers will be assessed using Cohen's weighted kappa test.

All analyses will be performed using Review Manager (RevMan, version 5.3, Copenhagen, The Cochrane Collaboration) ( $P < 0.05$ ).

**Quality assessment / Risk of bias analysis** The risk of bias for observational studies and before and after study will be assessed using the Newcastle-Ottawa Scale. The assessment will include three main items: Selection, comparability, and outcome. Each item and the overall risk of bias for the studies will be categorized as high or low risk. [https://www.ohri.ca/programs/clinical\\_epidemiology/oxford.asp](https://www.ohri.ca/programs/clinical_epidemiology/oxford.asp). Two reviewers independently conducted the complete evaluation using the Newcastle-Ottawa Scale, and a third reviewer resolved any disagreements.

The risk of bias in randomized clinical trials will be evaluated using the ROB 2 scale. The evaluation considered specific factors, including bias due to deviations from intended interventions, bias due to loss of outcome data, bias due to measurement of outcomes, and bias due to selection of reported outcomes. Each factor and the overall risk of bias in randomized clinical trials will be categorized as high, moderate, or low risk. <https://www.riskofbias.info/welcome/rob-2-0-too>.

**Strategy of data synthesis** The study heterogeneity will be assessed by inspecting the forest plots and quantified using Tau<sup>2</sup>, Chi<sup>2</sup>, and I<sup>2</sup> statistics. Thus, I<sup>2</sup> = 0–40% was classified as non-important heterogeneity; I<sup>2</sup> = 30–60% as moderate heterogeneity; I<sup>2</sup> = 50–90% as substantial heterogeneity; and I<sup>2</sup> = 75–100% as considerable heterogeneity. If is possible, a metanalysis will be evaluated.

**Subgroup analysis** Likewise, the study heterogeneity will be assessed by inspecting the forest plots and quantified using Tau<sup>2</sup>, Chi<sup>2</sup>, and I<sup>2</sup> statistics. Thus, I<sup>2</sup> = 0–40% was classified as non-important heterogeneity; I<sup>2</sup> = 30–60% as moderate heterogeneity; I<sup>2</sup> = 50–90% as substantial heterogeneity; and I<sup>2</sup> = 75–100% as considerable heterogeneity.

**Sensitivity analysis** The certainty of the evidence produced was assessed using the Grade of Recommendation, Evaluation, Development, and Evaluation (GRADE) approach. Agreement between reviewers was assessed using Cohen's weighted kappa test.

All analyses were performed using Review Manager (RevMan, version 5.3, Copenhagen, The Cochrane Collaboration) ( $P < 0.05$ ).

**Language restriction** None.

**Country(ies) involved** Perú, Brazil, USA.

**Other relevant information** None.

**Keywords** Impacted maxillary incisors; impacted tooth; systematic review.

**Dissemination plans** We will attempt to publish this research as a peer-reviewed article in a scientific journal.

#### Contributions of each author

Author 1 - Luis Ernesto Arriola-Guillén - Definition of the research question. Search Literature. Articles review. Writing Article. Project approval.  
Email: luchoarriola@gmail.com

Author 2 - Aron Aliaga-Del Castillo - Definition of the research question. Search Literature. Articles review. Writing Article. Project approval.  
Email: aaliagad@umich.edu

Author 3 - Yalil Rodríguez-Cárdenas - Articles review. Writing Article. Project approval.  
Email: yalilrodriguez@gmail.com

Author 4 - Gustavo Ruíz-Mora - Articles review. Writing Article. Project approval.  
Email: garruiz@gmail.com

Author 5 - Heraldo Dias-Da Silveira - Articles review. Writing Article. Project approval.  
Email: heraldo.silveira@ufrgs.br

Author 6 - Vinicius Dutra - Definition of the research question. Search Literature. Articles review. Writing Article. Project approval.  
Email: vidutra@iu.edu