International Platform of Registered Systematic Review and Meta-analysis Protocols

INPLASY

INPLASY202660054

doi: 10.37766/inplasy2026.6.0054

Received: 11 June 2026

Published: 12 June 2026

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This research did not receive any specific financial support.

Predictability of Bracket Transfer in Indirect Bonding Techniques: A Systematic Review and Meta-Analysis of Linear and Angular Deviations

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ADMINISTRATIVE INFORMATION

Support - Completed but not published.

Review Stage at time of this submission - Completed but not published.

Conflicts of interest - None declared.

INPLASY registration number: INPLASY202660054

Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 12 June 2026 and was last updated on 12 June 2026.

INTRODUCTION

Review question / Objective Do different indirect bonding techniques differ in their ability to accurately transfer orthodontic brackets to the planned position?

Rationale This study was conducted to update the available evidence on current indirect bonding techniques, compare their bracket transfer accuracy across all spatial dimensions, and provide clinicians with reliable data to optimize their clinical practice.

Condition being studied Linear deviations (mesiodistal, vertical, buccolingual) and angular deviations (tip, rotation, torque) of orthodontic bracket transfer variable.

METHODS

Search strategy An electronic search was conducted in PubMed, Scopus, and Web of Science to identify all relevant studies published up to March 2026. The search strategy combined Medical Subject Headings (MeSH) and free-text terms related to indirect orthodontic bonding and bracket transfer accuracy. The following terms and their combinations were used: ("orthodontics" OR "orthodontic treatment") AND ("brackets" OR "orthodontic brackets") AND ("indirect bonding" OR "indirect bracket bonding" OR "digital indirect bonding") AND ("accuracy" OR "transfer accuracy" OR "bracket positioning" OR "bracket placement" OR "predictability") AND ("CAD/CAM" OR "digital workflow" OR "transfer tray" OR "virtual setup"). Boolean operators ("AND", "OR") were applied to combine the search terms appropriately.key words etc.

Participant or population The population consisted of in vitro experimental models or setups evaluating orthodontic bracket placement using indirect bonding techniq.

Intervention Indirect bonding techniques (CAD/CAM, 3D-printed trays, silicone trays, digital workflows).

Comparator The comparison consisted of different indirect bonding techniques, transfer tray designs, materials, or manufacturing workflows.

Study designs to be included In vitro experimental studies evaluating the transfer accuracy of indirect bonding techniques for fixed buccal multibracket orthodontic appliances.we selected In vitro studies.

Eligibility criteria T he inclusion criteria were as follows: in vitro studies evaluating the accuracy, effectiveness, reproducibility, or transfer precision of indirect bonding techniques for the placement of fixed buccal multibracket orthodontic appliances. Studies assessing different transfer tray materials, fabrication methods, digital workflows, CAD/CAM systems, or bracket transfer protocols were considered eligible. No restrictions were applied regarding language or year of publication, although studies published in English were expected to predominate due to the greater availability of scientific literature in this field.
The exclusion criteria were as follows: systematic reviews, meta-analyses, clinical studies, randomized controlled clinical trials, case reports, case series, conference abstracts, letters to the editor, editorials, and studies not directly evaluating indirect bonding procedures or bracket transfer accuracy.

Information sources An electronic search was conducted in PubMed, Scopus, and Web of Science to identify all relevant studies published up to March 2026.

Main outcome(s) To evaluate the transfer accuracy of different indirect bonding techniques for fixed buccal multibracket orthodontic appliances and to compare their performance regarding linear and angular bracket deviations.

Quality assessment / Risk of bias analysis The methodological quality of the included in vitro studies was assessed using the Current Research Information System (CRIS) scale for methodological quality assessment of experimental trials.
Publication bias was assessed using the Trim and Fill method, and the results were graphically represented using funnel plots.

Strategy of data synthesis The meta-analysis was performed using a random-effects model with the inverse variance method to estimate mean differences (MD) between groups.

Subgroup analysis Not applicable.

Sensitivity analysis Not applicable.

Language restriction None.

Country(ies) involved France, Spain.

Keywords Orthodontics; Indirect bonding; Bracket transfer accuracy; CAD/CAM; Digital orthodontics; Systematic review; Meta-analysis.

Contributions of each author

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