Comparison of Predicted and Achieved Outcome of Overbite with the Invisalign Therapy: A Systematic Review

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A B S T R A C T

Objectives: Comparison of predicted and actual outcome of overbite in Non-extraction cases in treatment of Invisalign therapy.

Material & Methods: All patients of 18 - 40 years who underwent Invisalign therapy taken for conduct of study. Overbite predicted using softwares. Actual outcome of treatment also measures using softwares. Compared predicted and actual outcome of treatment. Search engines like PubMed, Google scholar, Cochrane, Illac data base were used for conduct study.

Results: Comparison of predicted outcome with actual outcome of overbite measurement after completion of Invisalign treatment.

Conclusion: On comparison prediction and outcome of overbite correction using Invisalign therapy validity was unpredicted.

Keywords: Clear aligner therapy, Invisalign, Orthodontic treatment outcome, Overbite, Prediction

1.INTRODUCTION

 Most accepted treatment in modern orthodontic practice was Invisalign therapy.[1,2] Most commonly & universal use of Clear Aligner therapy also comes under Invisalign.[1,3,4] The main reason for preference of Invisalign treatment was esthetic aspect, less chair time, east oral hygiene.[2,5–7] Invisalign facilitates in digital interface for treatment plan, series of aligner fabrication which replaces in patient every month[2,5,8]

Some of the measurement of output results like Peer Assessment Rating index, softwares, ABO – model grading system outcome very rarely achieved.[9–14] Invisalign technology provides predicted treatment output results using Geomagic softwares[7,13] Actual output of treatment outcome also evaluated using softwares. Hence, this study comparing both predicted with actual outcome of treatment of overbite malocclusion.

The objective of study was to Comparison of predicted and actual outcome of overbite in Non-extraction cases in treatment of Invisalign therapy

2. NEED OF THE STUDY

The purpose of study was for validation of predicted and actual outcome of treatment with Invisalign therapy

3. MATERIAL & METHODOLOGY

3.1. Population & age

 Population treated with Invisalign therapy. Age range: 18 years – 70 years i.e. nongrowing patient who underwent Invisalign therapy. All cases are skeletal Class I malocclusion without craniofacial deformity & Non extraction treatment plan included.

3.2. Data and Sources of Data

All data obtained from past to mid of February 2024. Source of Data include Google Scholar, PubMed, Cochrane, Science direct, Illac data base helps in retrieve studies.

Table 1: Search Strategy for this study

S. No	Search Engines	Keywords used in combinations	No. Of articles retrieved
1	Google scholar	1. Clear aligner therapy	1790
2	PubMed	2. Invisalign,	356
3	Science direct	3.Orthodontic treatment outcome,	180
4	Cochrane	4. Overbite	1
5	ILLAC data base	5. Prediction	237
Total			2564

3.3 Theoretical framework

Table 2. PICO format framework of current systematic study

Population	Population aged 18 years – 70 years
Intervention	Intervening of non-extraction plan patients measure overbite with software before treatment and after treatment
Control group	No control group, comparing before and after treatment in same group
Outcome	Measuring 2 overbite of before and after treatment

3.4 Methodology

Study Design include all studies of Prospective, retrospective, case-control, cross-sectional studies, randomized and controlled clinical trials taken. Excluded Studies include all case reports, all animal studies, all Systematic review cases eliminated. Inclusive study criteria (1) Invisalign therapy only (2) Dental treatment only (3) Patient with complete teeth of permanent dentition. Exclusion criteria of current study (1) Treatment including Orthopedic/ Orthognathic surgery procedure involving skeletal base correction (2) No history of Orthodontic treatment (3) Craniofacial anomalies & syndromes (4) Past medical history drugs like Bisphonates etc. Prisma flow chart for obtaining study mentioned in Figure 1. Included studies mentioned in Table 3. Excluded studies mentioned in Table 4. Material and methodology for this systematic review was mentioned in Table 5.
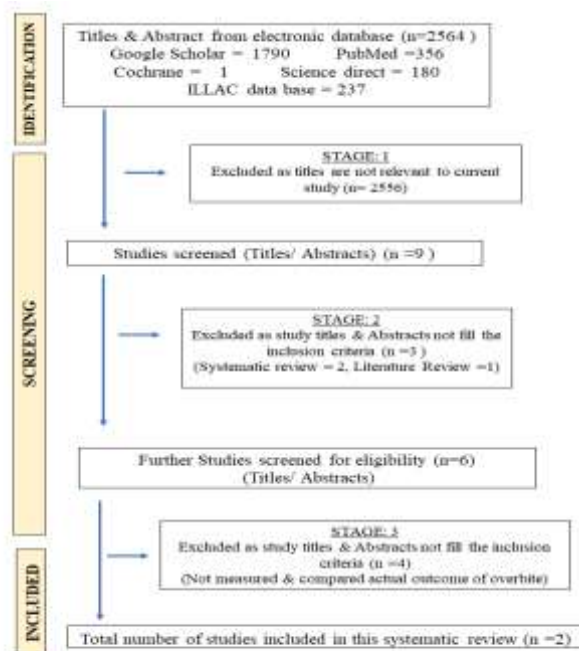

FIGURE 1. PRISMA FLOW CHART

Table: 3: Studies included in this systematic review

S. No	Author & Year	Study design	Title
1	Meade & Weir. [2] & 2024	Retrospective study	Predicted and achieved overjet and overbite measurements with the Invisalign appliance: a retrospective study
2	Meade et al.[13] 2024	Retrospective study	Predicted overbite and overjet changes with the Invisalign appliance: a validation study

Table 4. Exclusion of studies for current systematic review

S. No	Study & Year	Reason for exclusion of study
1	Papageorgiou et al.[15] & 2020	Systematic review
2	Bowman et al.[9] & 2023	No overbite involved
3	Smith et al.[16] & 2022	Not measured overbite outcome
4	Blundell et al. [14] & 2021	Not calculated & compared with actual outcome of overbite
5	Tsai et al.[17] & 2020	Review of literature
6	Lombardo et al.[18] 2017	Not measure actual outcome of overbite
7	Lagravère et al.[19] & 2013	Systematic review

Table 5. Material and methodology in this study

S. No	Study & Year	Design of study	Material & Methodology (Total, Males, Females, Malocclusion)	Software used for prediction Outcome	Result & Conclusion
1	Meade & Weir.[2] 2024	Retrospective study	Total sample of Non extraction n=101 No gender mentioned Mean age of patients - 30.14 years All files are stored in STL format	Predicted with ClinCheck software Actual outcome measured with GraphPrism	Statistically significant difference showed between predicted and actual outcome of Overbite
2	Meade et al. [13] & 2024	Retrospective study	Total sample: 76 Males =23, Females = 53 Mean age of patients 35.17 years Skeletal Class I malocclusion All files are stored in STL format	Predicted overbite with Geomagic metrology software Actual outcome overbite with ClinCheck software	The mean and standard overbite measured by Geomagic software was 1.66 ± 0.81 mm & ClinCheck was 1.61 ± 0.92 mm Study concluded that on comparison of overbite prediction with Geomagic metrology software and actual outcome of overbite with ClinCheck software are Valid

4. RESULTS

Total of 2564 articles screened. In first stage, 2556 articles removed due to irrelevant & duplicated studies. In second stage three articles were exclude due to systematic reviews and review of literature studies. In third stage, four articles were excluded due to not fit in inclusive criteria. Total of two articles included in this study in which both are respective studies.

Among results of comparison of predicted & actual outcome of overbite with Invisalign were 1.66 ± 0.81 and 1.61 ± 0.92 mm respectively.[13] In other study, predicted overbite was 45.83% of actual outcome.[2]

5. DISCUSSION

Reason for selecting selective treatment plan of Invisalign therapy

Overjet and overbite malocclusion cannot separate, but in this current systematic study only overbite malocclusion included. The main reason was correction of gross overjet involvement of Orthopedic and Orthognathic surgical treatment. Hence, only overbite include since patient taking only dental arch treatment. Extraction treatment plan also not considered as due to different springs; auxiliaries used for retraction mechanics. Hence, only non-extraction, dental arch treatment included in this systematic study.

Limited studies conducted on improvement of Class III malocclusion overbite[2,20] and no studies conducted comparison of predicted and actual outcome of overbite measurement in Class III malocclusion patients.

Several studies conducted with Peer Assessment Rating scale, ABO grading scale that overbite measurement not improve with Invisalign therapy.[2,21–24] However, improved software's and efficient protocol makes overbite changes valid with Invisalign therapy.[2,25,26]

Optimal overbite provides minimal stress on anterior teeth during function & crucial for stable orthodontic outcome.[9,27–29] The achieved overbite with Invisalign therapy compared with predicted overbite with software makes more validity in practical life.[9]

Prediction and actual outcome changes with the Invisalign appliances

Meade et al.[13] (2024) did study on comparison of predicted and actual outcome changes of overbite with Invisalign therapy. For prediction of overbite ClinCheck software used, measurement of actual outcome of overbite Geomagic software used. The mean and standard deviation of overbite with Geomagic software was 1.66 ± 0.81 mm & ClinCheck was 1.61 ± 0.92 mm. For measurement of Overbite no proportional bias for overbite. Finally, concluded that prediction and outcome for measurement of overbite with Invisalign treatment was valid.

Meade & Weir[2] (2024) did study comparison of prediction and actual outcome of overbite with Invisalign therapy. Concluded that overbite reduction outcome is challenging when compare with predicted overbite. Predicted overbite with non-extraction treatment plan was 45.83%. In some studies predicted overbite was range from 39.2% - 45%.[10,14,30] In some cases planned extraction of predicted overbite reduction was 8.69%.[1,2,14]

Limitation of studies

Limited studies were conducted on comparison of predicted Vs actual outcome with Invisalign therapy.[2,13] come other were conducted on occlusal contact with Invisalign therapy.[9,15,31] Some studies were conducted only for prediction of outcome of treatment using Invisalign therapy.[16,18]

This current study suggests that prediction and outcome of overbite with Invisalign was unpredicted. The main reason was limited number of literatures, Overreaction of overbite malocclusion escape from relapse. Hence, all the factors lead to unpredictable validation of actual outcome with predicted outcome.

Furthermore, studies needed for validity to conduct studies on comparison of overbite prediction with actual outcome with Invisalign therapy.

6. CONCLUSION

Prediction and outcome of overbite with Invisalign therapy was unpredicted as overcorrection to escape from relapse purpose.

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