How to Cite:
Mousavi, S. M., Poursoltani, S., Shahsavaripour, S., & Harati, M. (2023). Compare the stability of sagittal skeletal and overjet anteroposterior correction of skeletal class III malocclusion in orthognathic procedures: A systematic review and meta-analysis. *International Journal of Health Sciences*, *7*(S1), 1249–1258. Retrieved from https://sciencescholar.us/journal/index.php/ijhs/article/view/14339

Compare the stability of sagittal skeletal and overjet anteroposterior correction of skeletal class III malocclusion in orthognathic procedures: A systematic review and meta-analysis

Seyedeh Maryam Mousavi
Resident of Oral and Maxillofacial Surgery, Tehran University of Medical Sciences, Tehran, Iran

Shadi Poursoltani*
DDS (doctor of dental surgery), Dentistry, College of Dentistry, Ajman University, Ajman, UAE
*Corresponding Author

Sheila Shahsavaripour
Assistant Professor of Oral and Maxillofacial Surgery, Department of Oral and Maxillofacial Surgery, School of Dentistry, Shiraz University of Medical Science, Shiraz Iran

Mohammad Harati
Postgraduate Student, Department of Prosthodontics, School of Dentistry, Mashhad University of Medical Sciences, Mashhad, Iran

Abstract---Background and aim: The purpose of this study was Compare the Stability of Sagittal Skeletal and Overjet Anteroposterior Correction of Skeletal Class III Malocclusion in Orthognathic Procedures.Method: Databases of PubMed, Scopus, Web of Science, EBSCO, ISI Web of knowledge and Embase were searched for systematic literature between 2011 to 30 November 2022. Data analysis was performed using STATA/MP V17 software. 95% confidence interval for mean difference with fixed effect model and Inverse-variance method were calculated. Result: In the initial review, duplicate studies were eliminated and abstracts of 303 studies were reviewed, the full text of 54 studies was reviewed by two authors, finally, five studies were selected. Mean differences of relapse in the ANB angle, A-point to horizontal and overjet was -0.15 (MD, -0.15

Manuscript submitted: 27 Feb 2023, Manuscript revised: 09 April 2023, Accepted for publication: 18 May 2023

95% CI -0.78, 0.47; p=0.64), -0.17 (MD, -0.17 95% CI -0.42, 0.08; p=0.19) and 0.22 (MD, 0.22 95% CI -0.26, 0.70; p=0.37), respectively. Conclusion: Based on the current meta-analysis, both the single-jaw surgery and the two-jaw surgery in anterior-posterior skeletal stability and overjet were similar.

Keywords---class III malocclusion, orthognathic, bilateral sagittal split osteotomy.

Introduction

Skeletal Class III malocclusion can be classified into retruded maxilla, protruded mandible, or a combination of the two according to cephalometric analysis(1). In creating skeletal Class III malocclusion, different components of the craniofacial complex contribute(2). Based on the existing literature, both environmental and genetic factors can be the cause of Class III malocclusion(2). Studies have shown that there is a significant genetic influence on the transmission of the malocclusion trait(3, 4). According to reports, 36% of patients with Class III malocclusion who have been treated need more surgical interventions(5). Studies have shown that the treatment is successful in the growing age and orthognathic surgery is performed after orthodontics in adults(6, 7). Generally, to correct sagittal imbalance, surgical methods such as Le Fort I osteotomy and Bilateral Sagittal Split Osteotomy (BSSO) are used, which can be performed alone together(8). Various factors can affect the results of treatment and cause recurrence after surgery, among these factors, we can mention the direction of movement, type of fixation, amount of movement and surgical technique. In the present study, an attempt has been made to compare both orthognathic methods in Class III surgical correction. The aim of this study is to compare the stability of Sagittal Skeletal and Overjet Anteroposterior Correction of Skeletal Class III Malocclusion in Orthognathic Procedures.

Method

Search strategy

Present study is a systematic review and meta-analysis based on PRISMA 2020 Checklist(9), All international databases, PubMed, Scopus, Science Direct, ISI, Web of Knowledge, and Embase using keywords related to the objectives of the study between 2011 to 30 November 2022 were reviewed. Google Scholar search engine was also used to find related articles. PICO strategy to answer the research questions showed in Table1. MeSH key words: ((((((("Prostheses and Implants"[Mesh]) OR (“Prostheses and Implants/statistics and numerical data"[Mesh] OR "Prostheses and Implants/therapy"[Mesh])) OR "Dental Implants"[Mesh]) AND ("Periodontitis"[Mesh] OR "Chronic Periodontitis"[Mesh])) AND ("Mouth, Edentulous"[Mesh] OR "Jaw, Edentulous, Partially"[Mesh] OR "Jaw, Edentulous"[Mesh])) AND "Survival Rate"[Mesh]) AND "complications" [Subheading].

Selection criteria

Inclusion criteria: Clinical controlled trials studies, randomized controlled trials studies, cohort studies, adult age group (≥18), articles published in Englis.
Exclusion criteria: Case studies, case reports, reviews, letter to editor and studies without full text.

Table 1
PICO strategy

PICO strategy	Description
P	Population: patients with class III malocclusion
I	intervention: two-jaw surgery
C	Comparison: one-jaw surgery
O	Outcome: ANB angle, A and B-point to horizontal, overjet

Data items, Data collection and Selection process

Using a checklist that included the author's name, year of publication, sample size, study design, sex, mean of age, Type of surgery and follow-up period was extracted and reported in Table 2; Also, the data required for meta-analysis including ANB angle, A and B-point to horizontal, overjet were extracted from the studies. All articles were selected based on the inclusion criteria, two reviewers independently screened each record, and each report was retrieved.

Quality assessment

Newcastle-Ottawa Scale (NOS) (10) used to assessed quality of the cohort and cross-sectional studies, case-control and case series studies, This scale measures three dimensions (selection, comparability of cohorts and outcome) with a total of 9 items. In the analysis, any studies with NOS scores of 1-3, 4-6 and 7-9 were defined as low, medium and high quality, respectively. the quality of randomized control clinical trial studies was evaluated using the Cochrane Collaboration's tool(11). The scores of this tool are between 0 and 6, and higher score showed higher quality of study; the scoring of each item is 1 for low risk and 0 for high and unclear risk.

Data analysis

Data analysis was performed using STATA/MP. V17 software. 95% confidence interval for mean differences with fixed effect model and Inverse-variance method were calculated. To deal with potential heterogeneity, random effects were used and I^2 showed heterogeneity. I^2 values less than 50% indicate low heterogeneity and above 50% indicate moderate to high heterogeneity.

Result

Study selection

In the initial search, 328 articles related to the keywords were found. Of these, 10 studies were Duplicate records, 8 articles were removed due to Records marked as ineligible by automation tools, and 7 articles were records removed for other reasons. In the next step, abstracts of 303varticles were reviewed and finally 249 articles were excluded from the research according to the exclusion criteria. The full text of 54 articles was reviewed and according to the inclusion criteria, 49 studies were excluded and finally five studies were selected (Fig 1).

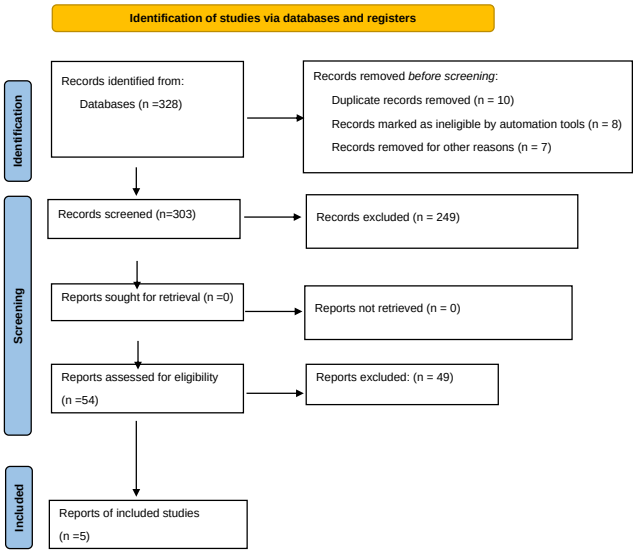

Figure 1. PRISMA 2020 Checklist

Study characteristics

seven case series studies were selected and included in the study. A total of 202 patients (intervention: 132; control: 70) between the mean ages of 19.9 years and 25.26 years were examined. Table 2 shows a summary of Data extracted.

Table 2
Data extracted from studies selected for systematic review and meta-analysis

Study. Years	Study design	Number of patients		sex				Mean of age		Type of surgery		Follow-up
		In	C	male		Female		In	C	In	C	
				In	C	In	C					
Ooi et al., 2020 (12)	Re	8	9	3	3	5	6	24	23	Le Fort I mx/BSSO	BSSO	2 weeks postoperatively and 1 year postoperatively
Han et al.,	Re	14	16	8	12	6	4	19.9	22.2	Le Fort I	BSSO	1 week postoperatively,

2019 (13)										mx/BSSO		immediately after the debonding
Larson et al., 2017 (14)	Re	15	16	NR	NR	NR	NR	23.47	21.16	Le Fort I mx/BSSO	BSSO	1 month postoperatively and orthodontic debonding stage
Al-Delayme et al.,2013 (15)	RCT	12	12	8	7	4	5	25.26	23.8	Le Fort I mx/BSSO	BSSO	1 week postoperatively, after intermaxillary fixation removal and 1 year postoperatively
Proffit et al. 2012 (16)	Re	83	17	30	7	53	10	20.2	21.8	Maxillary advancement / Mandibular setback	Mandibular setback	immediately after surgery and 1 year postoperatively

RCT: randomized clinical trial; Re: retrospective cohort; NR: not reported; In: intervention group; C: control group; BSSO: bilateral sagittal split osteotomy.

Risk assessment

According to Cochrane Collaboration's tool, one randomized clinical trial study had moderate quality and according to NOS tool, two studies had a total score of 6/9 and 5/9 (moderate quality). This result showed moderate risk of bias in included studies (Table 3 and 4).

Table 3
Risk of bias assessment (Cochrane Collaboration's tool)

study	Random sequence generation	allocation concealment	blinding of participants and personnel	blinding of outcome assessment	incomplete outcome data	selective reporting	Total score
Al-Delayme et al.,2013 (15)	+	+	?	+	?	+	4

Table 4
Risk of bias assessment (NOS tool)

Study. Years	Selection (5 score)				Comparability (2 score)	Outcome (2 score)		Total score
	representative sample	Sample size	Non respondent	Ascertainment of the exposure	Based on design and analysis	Assessment of outcome	Statistical test	
Ooi et al., 2020 (12)	1	1	1	0	1	0	1	5
Han et al., 2019 (13)	1	1	1	0	1	0	1	6
Larson et al., 2017 (14)	1	1	1	0	1	1	1	6
Proffit et al. 2012 (16)	1	1	0	0	1	1	1	5

ANB angle

Mean differences of relapse in the ANB angle was -0.15 (MD, -0.15 95% CI -0.78, 0.47; p=0.64) with high heterogeneity (I^2=79.80%; P =0.03) (Fig.2). According to the findings, it was observed that there was no significant difference between the two-jaw surgery and one-jaw surgery in terms of relapse in the ANB angle (p=0.64).

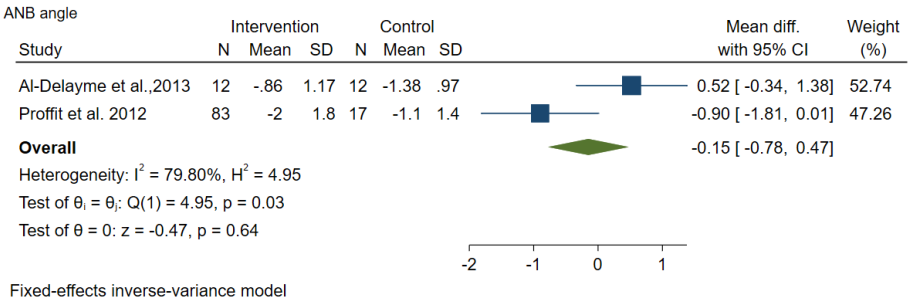

Figure 2. forest plot showed Mean differences of relapse in the ANB angle

A-point to horizontal

Mean differences of relapse in A-point to horizontal was -0.17 (MD, -0.17 95% CI -0.42, 0.08; p=0.19) with moderate heterogeneity (I^2=56.69%; P =0.10) (Fig.3). According to the findings, it was observed that there was no significant difference between the two-jaw surgery and one-jaw surgery in terms of relapse in A-point to horizontal (p=0.19).

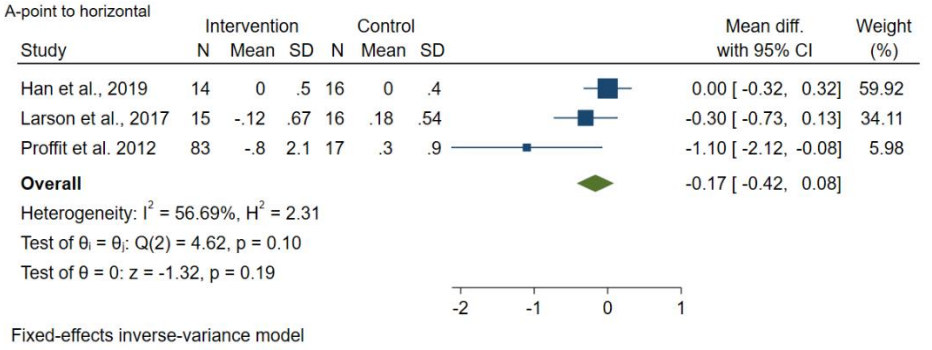

Figure 3. forest plot showed Mean differences of relapse in A-point to horizontal

B-point to horizontal

Mean differences of relapse in B-point to horizontal was 0.05 (MD, 0.05 95% CI -0.77, 0.87; p=0.91) with low heterogeneity (I^2=0%; P =0.72) (Fig.4). According to the findings, it was observed that there was no significant difference between the two-jaw surgery and one-jaw surgery in terms of relapse in B-point to horizontal (p=0.91).

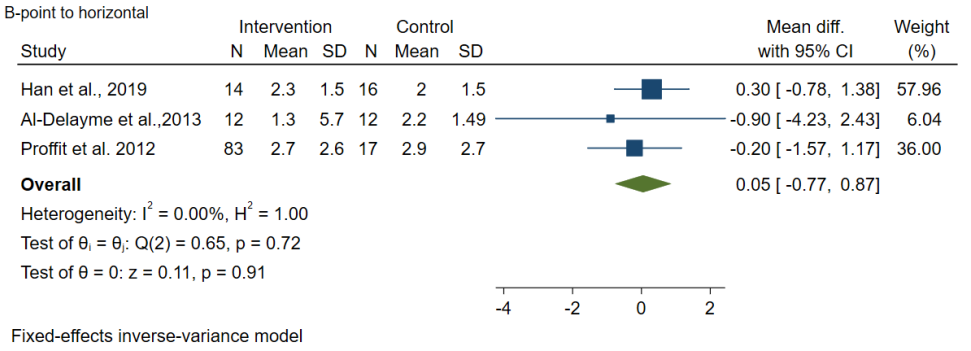

Figure 4. forest plot showed Mean differences of relapse in B-point to horizontal

Overjet

Mean differences of relapse in overjet was 0.22 (MD, 0.22 95% CI -0.26, 0.70; p=0.37) with low heterogeneity (I^2=0%; P =0.61) (Fig.5). According to the findings, it was observed that there was no significant difference between the two-jaw surgery and one-jaw surgery in terms of relapse in Overjet (p=0.37).

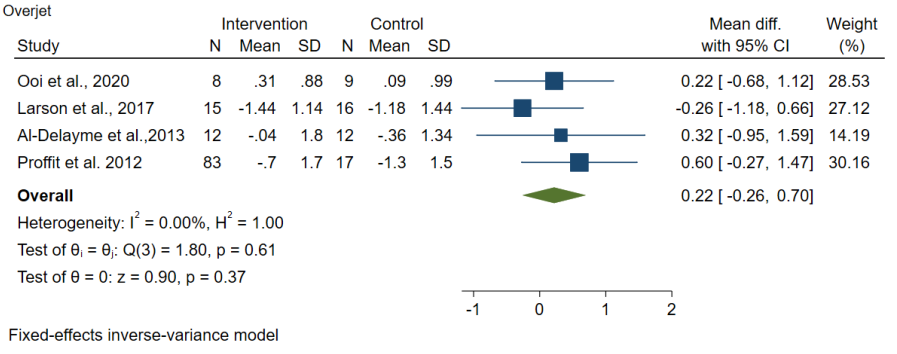

Figure 4. forest plot showed Mean differences of relapse in overjet

Discussion

The aim of present study was comparing the stability of Sagittal Skeletal and Overjet Anteroposterior Correction of Skeletal Class III Malocclusion in Orthognathic Procedures. In the search, five related articles were found, one study was a randomized clinical trial and four articles were retrospective. The sample size of the studies was small and the follow-up period of the studies was not the same, also due to the high heterogeneity between the studies, the interpretation of the present findings should be done with caution. Orthognathic surgery is generally used to correct class III malocclusion.

Meta-analysis showed that comparing two-jaw and one-jaw surgery groups, no difference was observed in terms of ANB angle, A-point to horizontal, B-point to horizontal, and Overjet. The mean changes observed in the meta-analysis occurred in the short term, and further studies with long-term follow-up are needed. A study showed that the rate of recurrence is proportional to the amount of anteroposterior correction and there is a relationship between the amount of

surgical movement and skeletal recurrence in single jaw surgery following mandibular recession(17). Based on the available evidence, this factor is the most effective factor on postoperative recurrence in individual mandibular retraction operations. Overjet recurrence can be associated with skeletal recurrence at point B along with dental recurrence. Meta-analysis showed that there was no difference between the two groups.

Considering the limitations of the current study and the small number of RCT studies and the small sample size, it is necessary to conduct prospective longitudinal studies and increase the sample size of the studies. Also, the follow-up period should be adjusted and the length of long-term follow-up should be considered. It is also suggested to investigate the effect of fixation methods, the amount of surgical movement and orthodontics after surgery on recurrence after surgery. It should also be mentioned that the patients' quality of life and their comfort regarding surgical interventions should be checked.

Conclusion

Based on the present meta-analysis, it was observed that in both the single-jaw surgery and the two-jaw surgery, the anterior-posterior skeletal stability and overjet were similar, these findings were made in the short-term follow-up period and indicate recurrence in the short-term. To confirm the present findings, prospective studies with a higher sample size and accurate methodology are needed.

References

1. Jaradat M. An overview of Class III malocclusion (prevalence, etiology and management). development. 2018;7:8.
2. Dehesa-Santos A, Iber-Diaz P, Iglesias-Linares A. Genetic factors contributing to skeletal class III malocclusion: A systematic review and meta-analysis. Clinical Oral Investigations. 2021;25(4):1587-612.
3. Watanabe M, Suda N, Ohyama K. Mandibular prognathism in Japanese families ascertained through orthognathically treated patients. American journal of orthodontics and dentofacial orthopedics. 2005;128(4):466-70.
4. Proffit WR, Fields Jr H, Moray L. Prevalence of malocclusion and orthodontic treatment need in the United States: estimates from the NHANES III survey. The International journal of adult orthodontics and orthognathic surgery. 1998;13(2):97-106.
5. Mandall N, Cousley R, DiBiase A, Dyer F, Littlewood S, Mattick R, et al. Early class III protraction facemask treatment reduces the need for orthognathic surgery: a multi-centre, two-arm parallel randomized, controlled trial. Journal of orthodontics. 2016;43(3):164-75.
6. Khan R, Horrocks E. A study of adult orthodontic patients and their treatment. British journal of orthodontics. 1991;18(3):183-94.
7. Lee R, Hwang S, Lim H, Cha J-Y, Kim K-H, Chung CJ. Treatment satisfaction and its influencing factors among adult orthodontic patients. American Journal of Orthodontics and Dentofacial Orthopedics. 2018;153(6):808-17.

8. Arnett GW, Trevisiol L, Grendene E, McLaughlin RP, D'Agostino A. Combined orthodontic and surgical open bite correction: Principles for success. Part 1. The Angle Orthodontist. 2022;92(2):161-72.
9. Tugwell P, Tovey D. PRISMA 2020. Journal of Clinical Epidemiology. 2021;134:A5-A6.
10. Stang A. Critical evaluation of the Newcastle-Ottawa scale for the assessment of the quality of nonrandomized studies in meta-analyses. European journal of epidemiology. 2010;25(9):603-5.
11. Higgins J, Altman D, Gøtzsche P, Jüni P, Moher D, Oxman A, et al. Cochrane bias methods group; cochrane statistical methods group. The Cochrane Collaboration's tool for assessing risk of bias in randomised trials BMJ. 2011;343(7829):d5928.
12. Ooi K, Inoue N, Matsushita K, Yamaguchi H-o, Mikoya T, Kawashiri S, et al. Comparison of postoperative stability between BSSRO and Le Fort 1 Osteotomy with BSSRO in Skeletal Class III Malocclusion with severe open bite. Journal of Maxillofacial and Oral Surgery. 2020;19(4):591-5.
13. Han JJ, Jung S, Park H-J, Oh H-K, Kook M-S. Evaluation of postoperative mandibular positional changes after mandibular setback surgery in a surgery-first approach: isolated mandibular surgery versus bimaxillary surgery. Journal of Oral and Maxillofacial Surgery. 2019;77(1):181. e1-. e12.
14. Larson BE, Lee N-K, Jang M-J, Yun P-Y, Kim J-W, Kim Y-K. Comparing stability of mandibular setback versus 2-jaw surgery in Class III patients with minimal presurgical orthodontics. Journal of Oral and Maxillofacial Surgery. 2017;75(6):1240-8.
15. Al-Delayme R, Al-Khen M, Hamdoon Z, Jerjes W. Skeletal and dental relapses after skeletal class III deformity correction surgery: single-jaw versus double-jaw procedures. Oral surgery, oral medicine, oral pathology and oral radiology. 2013;115(4):466-72.
16. Proffit WR, Phillips C, Turvey TA. Stability after mandibular setback: mandible-only versus 2-jaw surgery. Journal of Oral and Maxillofacial Surgery. 2012;70(7):e408-e14.
17. Kobayashi T, Watanabe I, Ueda K, Nakajima T. Stability of the mandible after sagittal ramus osteotomy for correction of prognathism. Journal of Oral and Maxillofacial Surgery. 1986;44(9):698-702.