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Gap Arthroplasty Versus Interpositional Arthroplasty For The Management Of TMJ Ankylosis- A Systematic Review

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Abstract
Objective*- To analyse the clinical outcomes of the following two methods for the management of Temporomandibular joint (TMJ) ankylosis: Gap arthroplasty (GA), Interpositional gap arthroplasty (IPG) of the TMJ.*
Materials and method*- A comprehensive electronic and manual search of the literature without date or language restriction was performed to identify randomized controlled trials, controlled clinical trials (CCTs), and retrospective studies with the aim of comparing the two surgical modalities for TMJ ankylosis. Publications included were one was RCT, five were retrospective study, and two were CCTs and one prospective study. The primary outcomes assessed was the rate of recurrence and the secondary outcomes assessed were post- operative maximum interincisal distance, and post- operative complications.*
Results*- The results of the systematic review showed that IPG results in a significant improvement in MIO and lower recurrence rate when compared to GA. However the overall outcome of the treatment depends on patient cooperation, active physiotherapy, and regular follow-up.*
Keywords- *Temperomandibular joint, TMJ ankylosis, Gap arthroplasty, Interpositional arthroplasty, Physiotherapy, Interincisal distance.*

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I. Introduction

A disorder that leads to a restriction of the mouth opening is called Temporomandibular joint (TMJ) ankylosis which results in reduced to complete loss of mobility ofjaw. According to location it can be classified as intra or extra-articular; according to surfaces it can be classified into bony, fibrous or fibro-osseous, and according to extent of fusion (complete or incomplete).

This disorder results in problems in mastication, speech, appearance and oral hygiene.Patients during their growth phase diagnosed with this disorder results in occlusal discrepancy or malocclusion.At present there is no accurate treatment plan for the TMJ ankylosis in the present day literature.Till today recurrence remains a major complication in the treatment of Temporomandibular joint ankylosis, hence many authors have put forward many studies on TMJ ankylosis.The operative procedures include gap arthroplasty, interpositional arthroplasty and resection of the ankylotic mass followed by reconstruction of the ramus–condyle unit with autogenous or alloplastic grafts. The present study was undertaken to compare gap arthroplasty (GA) and interpositional arthroplasty (IPA) for the management of TMJ ankylosis.

II. Materials And Method

A systematic review was conducted, wherever possible, in agreement with the Preferred Reporting of Systematic Reviews and Meta-analyses (PRISMA) statement.The review basically appraised controlled clinical trials, RCT, prospective as well as retrospective clinical trials and as stated earlier the research protocol followed the PICO format.The patients who were diagnosed with TMJ ankylosis when evaluated with history, physical and radiological examinations were included in the study.Patients diagnosed with TMJ ankylosis treated with Gap Arthroplasty were grouped in intervention group and control group included people with TMJ ankylosis undergoing Interpositional Arthroplasty.

Types of outcome measures
1. Primary outcome: Identify and compare recurrence after a follow up of 12 months.
2. Secondary outcome: Identify and compare the post-operative change in maximum mouth opening (dMMO). To identify if any post-operative complications such as Facial nerve injury, Frey's syndrome, infection etc.

Search strategy

A search was done on the electronic bibliographic databases: MEDLINE, Web of Science and Research gate along with a manual search in relevant peer review dental journals using the keywords: (((“Gap Arthroplasty” AND “ Interpositional arthroplasty” AND “ TMJ Ankylosis”[All Fields] OR “ Temporomandibular joint ankylosis”[All Fields]))). No data restrictions were used on the search. A manual search of oral and maxillofacial surgery journals, including the International Journal of Oral and Maxillofacial Surgery, British Journal of Oral and Maxillofacial Surgery, Journal of Oral and Maxillofacial Surgery, was also performed. The references fetched from each database was exported to Zotero Software and duplicates were removed.

ELIGIBILITY CRITERIA

Inclusion criteria-

Controlled clinical trials, Randomised clinical trial, Retrospective study and Prospective studyStudies comparing the clinical outcomes between Gap arthroplasty and Interpositional arthroplasty. Studies with a follow-up period of at least 12 months.Studies with outcome data including the maximal incisal opening (MIO) and reankylosis and post-operative complications.

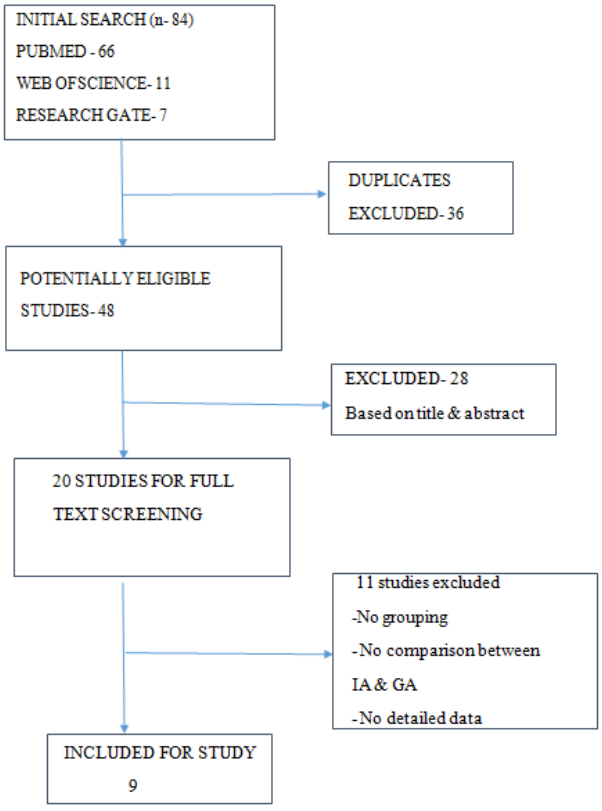
Exclusion criteria-

The study population comprising subjects with congenital TMJ ankylosis, TMJ ankylosis as part of any known syndrome or acquired TMJ ankylosis owing to systemic diseases were not eligible.Sub-groups intended to be part of the analysis with the number of subjects <5 were not included. All other types of study design, such as uncontrolled studies, meta-analysis, in vitro studies, animal studies, and studies not in the language English were excluded.

SCREENING AND SELECTION OF STUDIES:

Two independent authors (A.B and S.S) screened the titles and abstract in accordance with inclusion criteria mentioned earlier. Often some articles provided incomplete data in abstracts, in that scenario, full version of those articles were downloaded. Upon independent screening, full scale version of all qualified articles for this systematic review was downloaded and scrutinized by both reviewers for final selection.

PRISMA FLOW CHART



III. Data Extraction And Analysis

Data extraction was done independently by the chief investigator onto an excel sheet (Windows 10), in three categories, 1 demographic and 2 quantitative data, for each study as follows: Age, Year, study design, sample size, country, age group and follow up for the demographic evaluation.The risk of bias was calculated by using a computer program (Revman: Review Manager 5.3. The quality assessment was done using the CARE protocol. The reporting of this systematic review adhered to the PRISMA (Preferred Reporting Items for Systematic Review and Meta-analysis) statement. We didn't perform any meta-analysis yet we have elaborated the study characteristics and results qualitatively.

AUTHOR	YEAR	COUNTRY	SAMPLE SIZE	STUDY DESIGN	AGE GROUP
Bansal et al	2018	India	64	Prospective study	group 1- 10–47 years(27.9)
					group 2- 9-46 years(25.6)
Danda et al	2009	India	16	Controled clinical trail	6-21 years(10)
Guven	1999	Turkey	42	Retrospective study	11-20years
EROL et al	2006	Turkey	59	Retrospective study	1–10, 11–15, 16–18 and over 18
Zhi et al	2009	China	42	Retrospective study	5-55years(22.25)
Ramezanian et al	2006	Iran	48	Cross sectional study	19.5 ± 8.9 years
Elgazzar et al	2010	Egypt	101	Retrospective study	2-41years(NM)
Shaikh et al	2013	India	20	Controled clinical trail	5-25years(15.15)
Bhatt et al	2014	India	261	retrospective cohort study	1-49(years); 12.9 ± 7.1

AUTHOR	GA GROUP	IPG GROUP	GENDER	AKYLOSIS	PRE-OP MIO(mm)	INTRA-OP MIO(mm)	POST-OP MIO(mm)	MATERIAL USED IN IPG
Bansal et al	30	30	GA- F-18,M-12	GA-9 unilateral, 21 bilateral	GA-10.3	GA- 29.58	GA- 25.96	TMF
			IPG- F-13,M- 17	IPA- 12unilateral, 18 bilateral	IPA- 11	IPA- 30.11	IPA-29.93	
Danda et al	8	8	F-7,M-9	GA- 7 unilateral,1 bilateral	GA- 3.75	NM	GA- 26.9	TMF
				IPA- 7 unilateral,1 bilateral	IPA- 3.5		IPA- 27.8	
Guven et al	18	24	F-23, M- 19	37- unilateral		NM	GA- 30-40	acrylic spacer,sylastic sheet
				5 bilateral			IPA->25	
EROL et al	34	25	F-36, M-23	40- unilateral	3.57+-1.7	NM	30.7+3.0	TMF, CCG
				19- bilateral				
Zhi et al	25	17	F- 22, M-20	19- Unilateral	GA-7mm	NM	GA- 25.58	TMF, CCG
				23- Bilateral	IPA-9		IPA-29.57	
Ramezania n et al	22	26	F-27, M-21	21- Unilateral	GA- 8.7 ± 4.9	GA-36.9 ± 5.3	GA-32.1 ± 7.8	vital graft
				27- Bilateral	IPA- 10.3 ± 3.9	IPA- 36.5 ± 4.5	IPA-33.9 ± 5.2	
Elgazzar et al	11	25	F-59,M-42	93- Unilateral	NM	NM	GA-29.1	TMF,Buccal fat pad
				8- Bilateral			IPA-30.7	
Shaikh et al	10	10	GA-F-6,M-4	GA-9unilateral,1 bilateral	GA- 3.90	GA- 32.40	GA- 33.30	TMF
			IPG-F-8, M-2	IPA- 8 unilateral, 2 bilateral	IPA- 0.50	IPA- 33.10	IPA- 33.40	
Bhatt et al	207	55	F- 125, M-137	NM	GA-3.55	GA-33.31		TMF
					IPA- 3.33	IPA-33.87		

GA- Gap arthroplasty; IPG- Interpositional arthroplasty; TMF- Temperomyofacial flap; CCG- Costochondral graft

AUTHORS	OPEN BITE	FACIAL NERVE PALSY	FREY'S SYNDROME	RECURRANCE	INFECTION
Bansal et al	GA-6	GA-1	GA-1	GA-8	
	IPA-1	IPA-1	IPA-0	IPA-0	
Danda et al		3		GA-1	2
				IPA-1	
Guven	NM	NIL	NIL	GA-3	NIL
EROL et al	5	NIL	1	3	NM
Zhi et al	2	3	NIL	GA-3	
Ramezanian et al	NM	NM	NM	GA-6	NM
				IPA-10	
Elgazzar et al	NM	12		5	5
Shaikh et al		NIL	NIL		NIL
Bhatt et al	GA-19	35	NM	GA-30	NM
	IPA-18			IPA- 3	

ASSESSMENT OF QUALITY OF INCLUDED STUDIES

Methodological quality and synthesis of above mentioned studies excluding RCT, CARE protocol was used to perform the quality assessment of the included studies. The domains which were applied to estimate the quality of selected studies are- Aurthor, Title, keywords, abstract, introduction, patient information, clinical findings, timeline, diagnostic assessment, therapeutic intervention, follow up and outcome, discussion, patient perspective and informed concent.

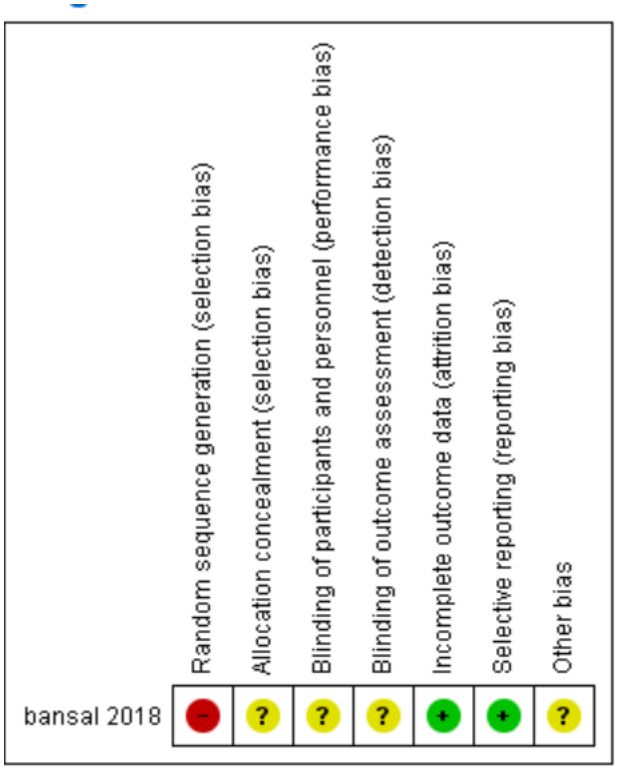
Author	Title	Key Words	Abstract	Introduction	Patient Information	Clinical Findings	Timeline	Diagnostic Assessment	Therapeutic Intervention	Follow-up and Outcomes	Discussion	Patient Perspective	Informed Consent	
Bansal et al	√	√	√	√	√				√	√	√		√	
Danda et al	√		√	√	√	√			√	√	√			
Gu¨ven et al			√	√	√				√	√	√			
EROL et al		√	√	√	√	√			√	√	√			
Zhi et al				√	√				√	√				
Rameza nian et al	√	√	√	√	√	√	√		√	√	√		√	
Elgazza r et al		√	√	√	√	√			√	√	√			
Shaikh et al	√	√	√	√				√	√	√	√			
Bhatt et al	√		√	√					√	√				

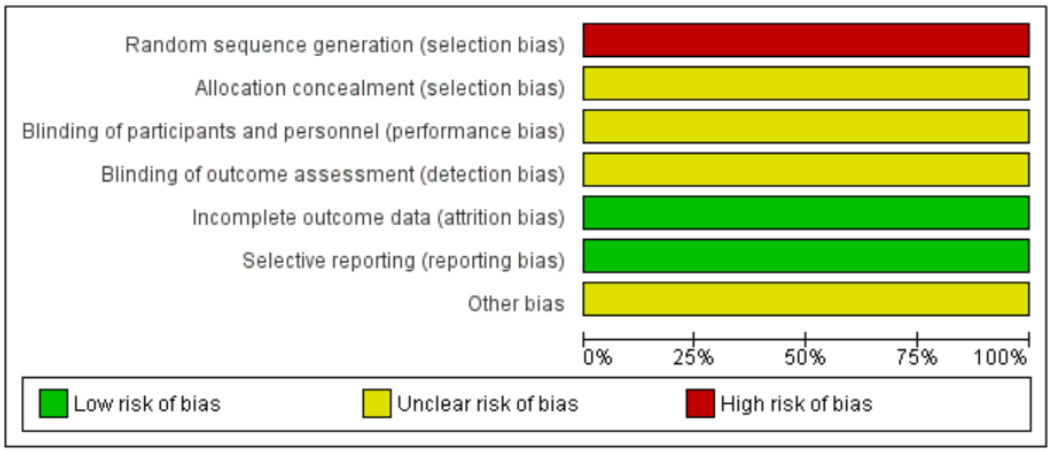
RISK OF BIAS

Since the SR constituted of maximum non-randomized clinical trials, Robins- I Risk of Bias tool was used for risk analysis of the studies. The ROBINS- I tool for NRSI is based on QUADAS 2 tool to evaluate diagnostic accuracy of the interventions used and also to evaluate the internal validity of the studies. It assesses the quality of the studies by preparing signalling questions whose answers will detect the potential bias in the study. The following domains for evaluation were considered: Confounding Bias, Bias in selection, Bias due to adjustment for departures from intended interventions, Information Bias, Bias due to missing data, Bias due to outcome measurement and Reporting Bias.

Interpretation of Risk of Bias Analysis:

While assessing an outcome, the domain selected will mean that the study as a whole is at that particular severity of risk of bias. For example, if the study has 'serious RoB' for a particular outcome, it will be implicated in the whole study. The study is judged as low risk if the study will have low risk in all outcome domains. If in all domains low to moderate RoB are present, the study is judged to be with moderate RoB. The study will be of Serious RoB, if Serious RoB is present in at least any one domain. If serious RoB is stated in all domains, the study is judged to have 'critical' RoB. The study can also be stated as 'Critical' if any one of the domains is having 'critical RoB'. If the base of judgement is unclear, the judgement is given as 'No information'. RoB analysis of the randomised studies were done using RevMan 5.3 software.





IV. Result

This systematic review depicted that interpositional arthroplasty had a significant improvement in MIO and had decreased recurrence rate compared to gap arthroplasty.However the outcome of the treatment depends on patient cooperation, active physiotherapy, and regular follow-up. Ankylosis should be treated as soon as identified, because they might lead to various functional as well as esthetic errors. In order to prevent reankylosis, it is mandatory to maintain a minimum of 35mm of interincisal opening.

V. Discussion

Ankylosis is a disorder of joint leading to major psychosocial issues. Hence, the study and treatment of TMJ ankylosis are important. Early effective treatment are advisable for these disorders. Mostly used surgical methods for TMJ ankylosis are: gap arthroplasty, interpositional arthroplasty, and reconstruction of the joint using autogenous or alloplastic materials (Kummoona, 1986; Kaban et al., 1990; Schobel et al., 1992; Feinerman and Piecuch, 1993; Matsuura et al., 2001; Su-Gwan, 2001; Karaca et al., 2004).. Many researchers have also stressed the importance of early mobilization and aggressive physiotherapy for successful treatment (Sawhney, 1986; Kaban et al., 1990; Su-Gwan, 2001)

The aim of TMJ ankylosis treatment are to attain adequate mouth opening and functional occlusion, and prevent from recurrence, to promote mandibular growth in the pediatric population, and to correct asymmetry in adults. It is a challenge to keep the procedure simplistic and minimal, avoiding morbidity and repeat procedures.

In this systematic review nine studies are included. This review included one prospective study and one cross sectional study, four retrospective studies and two clinical trials. Temporalis myofascial flap has been used in most of the cases in the interpositional arthroplasty. Other interpositional materials that were used include CCG, acrylic space, buccal fat pad etc. Post-operative complications such as open bite were seen mostly in the Gap arthroplasty. Permanent nerve palsy was not recorded in any cases. Rate of recurrence was mostly seen in Gap arthroplasty as compared to interpositional arthroplasty.

This review showed that interpositional arthroplasty showed a significant improvement in maxiuminterincisial opening and had a lower rate of recurrence. However overall outcome depends on active physiotherapy and regular follow up.

VI. Conclusion

The results of the systematic review showed that interpositional arthroplasty results in a significant improvement in MIO and lower recurrence rate when compared to gap arthroplasty.However the overall outcome of the treatment depends on patient cooperation, active physiotherapy, and regular follow-up.

On the basic of result of the present study, suggest these recommendations:

1) Because ankylosis can cause functional and aesthetic problems due to impairment of normal growth in affected side with time, surgery for treatment of ankylosis should be done once ankylosis was diagnosed.

2) The rate of maximum interincisal opening during operation is more important than the type of surgical technique, which must be at least 35 mm. The major cause of failure in treatment or "reankylosis" is little intraoperative maximum interincisal opening.

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