

Effectiveness of pre-surgical distraction osteogenesis and simultaneous distraction osteogenesis in temporomandibular joint ankyloses for mouth opening - A systematic review.

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Effectiveness of pre-surgical distraction osteogenesis and simultaneous distraction osteogenesis in temporomandibular joint ankyloses for mouth opening - A systematic review.

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Abstract

The aim of this systematic review was to evaluate the effectiveness of pre-surgical distraction osteogenesis and simultaneous distraction osteogenesis in temporomandibular joint ankyloses for mouth opening. A literature survey carried through Electronic search of PubMed, Google Scholar, Science Direct, Hinari from the inceptions to the last access on 31/06/2019 was performed to locate randomized control trials, controlled clinical trials and retrospective studies that compared the effectiveness of pre-surgical distraction osteogenesis and simultaneous distraction osteogenesis in temporomandibular joint ankyloses for mouth opening. 716 studies were obtained from all information sources and screened. Out of which 683 studies were excluded and the remaining 32 articles were screened for abstract and 5 articles were screened for full text of which 6 were excluded and removed for being duplicates. Thus, left 1 study was qualitatively synthesized after screening of full articles. The study selected concluded that both the groups were effective in correcting the function. But due to lack of data, further multicentric research is required involving large sample size and concentrating on those parameters which are less addressed till now.

Keywords: Temporomandibular joint ankylosis, Pre surgical distraction osteogenesis, Simultaneous distraction osteogenesis, Mouth opening

1. Introduction

Temporomandibular joint (TMJ), is affected by variety of pathoses collectively termed as TMJ disorders. One such disorder associated with hypomobility of the joint is TMJ ankylosis. TMJ ankylosis is defined as a disabling condition of mastication in which the condylar movement is limited by a mechanical problem in the joint (true ankylosis) or a mechanical cause not related to the joint components (false ankylosis). In TMJ ankylosis, patients are often distressed with mouth opening,

malocclusion, mastication, speech, breathing, sleep apnea, cosmetics, psychological stress and it interferes with nutrition, dental treatment and dentofacial deformity (**Shetty.P.2014**).

The first systematic approach for TMJ ankylosis management was given by Kaban et al in 1990 which consisted of 7 point program (**Kaban.LB.1990**). However patients of TMJ ankylosis with obstructive sleep apnea are known to have a narrow pharyngeal airway space that leads to the stimulation of the trigemino-cardiac reflex on post-operative physiotherapy. This leads to noncompliance during jaw stretching exercises and increases the risk re-ankylosis. In order to overcome these drawbacks.

In 1999, Dean A and Alamillos F used simultaneous gap arthroplasty and distraction osteogenesis for the treatment of mandibular deformity in temporomandibular joint ankylosis (**Dean.A.1999**). Sooner, in 2002 Post surgical distraction osteogenesis (PSDO) was carried out where arthroplasty was performed with the removal of the ankylotic block and intraoral osteo-distractor was positioned to lengthen the mandible (**Yoon.HJ.2002**).

In 2009, Kaban et al modified their classical protocol wherein this novel method to reconstruct the ramus condyle unit was integrated (**Kaban.LB.2009**). Pre-arthroplastic distraction osteogenesis (PADO) proves to be more effective as it has good control on the distraction and has less chances of recurrence. While Simultaneous arthroplastic distraction osteogenesis (SADO) having a shorter time period of management, it can lead to temporary decrease in function initially, more recurrence and is difficult to handle (**Chellappa.AL.2015**).

However, there are controversies on the choice of treatment for TMJ ankylosis whether to go for pre surgical distraction osteogenesis or simultaneous surgical distraction osteogenesis.

Thus, in this systematic review an attempt is being made to evaluate the effect of presurgical and simultaneous surgical distraction on mouth opening in TMJ ankylosis.

2. Materials and methods:

Eligibility criteria:

Before commencing, a set of norms were formulated to resolve the eligibility of articles those are to be included in this systematic review. These were divided as inclusion and exclusion criteria.

Inclusion:

- Articles published from 01/01/1998 to 31/07/2020
- Randomized control trials, controlled clinical trials and retrospective studies.
- Patients undergoing surgery for temporomandibular joint ankylosis.
- Articles in English language only.

Exclusion:

- Animal study
- Case report, review article, letter to editor.

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- Articles describing only pre surgical distraction osteogenesis.

PICOS:

A brief review of literature and central library of Dr.D.Y.Patil dental college and hospital revealed that there were resources comparing pre surgical DO and simultaneous DO. This made the authors to formulate PICO in following manner.

P = PARTICIPANTS: Patients with temporomandibular joint ankylosis.

I = INTERVENTION: Pre- surgical distraction osteogenesis.

C= COMPARISON: Simultaneous distraction osteogenesis

O = OUTCOMES: Mouth opening.

Information sources:

A Complete literature search was undertaken where initially we began with electronic search using various search engines.

Electronic searches:

Searched the following electronic databases:

- PubMed NCBI (31st July 2020 last date of electronic data search)
- Google scholar (31st July 2020 last date of electronic data search)
- Science direct (Elsevier) (31st July 2020 last date of electronic data search)
- Hinari (31st July 2020 last date of electronic data search)

Hand searching:

The following journals were identified as being important to be hand searched for this review-

- British Journal of Oral and Maxillofacial Surgery
- International Journal of Oral and Maxillofacial Surgery
- Journal of Oral and Maxillofacial Surgery
- Institutional library data were also utilized in hand searching
- Bibliography of included studies were hand searched

Search:

The PubMed search MeSH were used for searching articles are presented in table no: 1. The PubMed search strategy is presented in table no: 2.

TABLE NO- 1: TABLE SHOWING KEY WORDS USED IN THIS SYSTEMATIC REVIEW

Temporomandibular joint ankylosis	Temporomandibular joint disorders, Temporomandibular joint Diseases
Pre surgical distraction osteogenesis	Pre-arthroplastic distraction (PAD)
Simultaneous distraction osteogenesis	Simultaneous-arthroplastic distraction (SAD)
Mouth opening	Trismus, Maximal inter incisal distance , Maximal inter incisal opening

Study selection: The titles obtained through selected search strategy and keywords were scanned independently by two review authors (AAG & VDR). Those articles which did not match with the search strategies or keywords were eliminated from this systematic review. The selected articles were again screened for duplication and were excluded.

After removal of the duplicates remaining articles were reviewed by two review authors (AAG & TEM) for title and abstracts. For studies that appeared to meet the eligibility criteria or for which there was insufficient information in the title or abstracts to make a clear decision, the full text was obtained. Abstract as well as the full text screening allowed these review authors to exclude those articles which did not compare the efficacy of pre-arthroplastic and simultaneous arthroplastic distraction osteogenesis in temporomandibular joint ankylosis. (Table no 2) Those articles which were included in this systematic review was individually checked by the mentor (SK) and used to compose the data extraction sheet.

TABLE NO- 2: TABLE REPRESENTING NUMBER OF ARTICLES ESTABLISHED USING SEARCH STRATEGY

ST no.	Search strategy	No of Hits	Selected By titles	Selected by abstract	Seen full text	Duplicate removal	Final study
1	temporomandibular joint ankylosis AND pre arthroplastic distraction osteogenesis AND simultaneous arthroplastic distraction osteogenesis AND mouth opening	1	1	1	1	0	1
2	temporomandibular joint ankylosis AND pre surgical distraction	1	1	1	1	1	0

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	osteogenesis AND simultaneous distraction osteogenesis AND mouth opening						
3	temporomandibular joint ankylosis AND pre arthroplastic distraction osteogenesis AND simultaneous distraction osteogenesis AND mouth opening	1	1	1	1	1	0
4	temporomandibular joint ankylosis AND pre surgical distraction osteogenesis AND simultaneous arthroplastic distraction osteogenesis AND mouth opening	1	1	1	1	1	0
	TOTAL	4	4	4	4	3	1

3. Data collection process:

A standard pilot form in excel sheet, for data extraction, was initially used and then all headings not applicable for the review were removed. Data extraction was done for one study and this form was reviewed by a mentor (SK) and finalized. From the studies included in the final analysis, the following data was extracted.

4. Results:

Study selection:

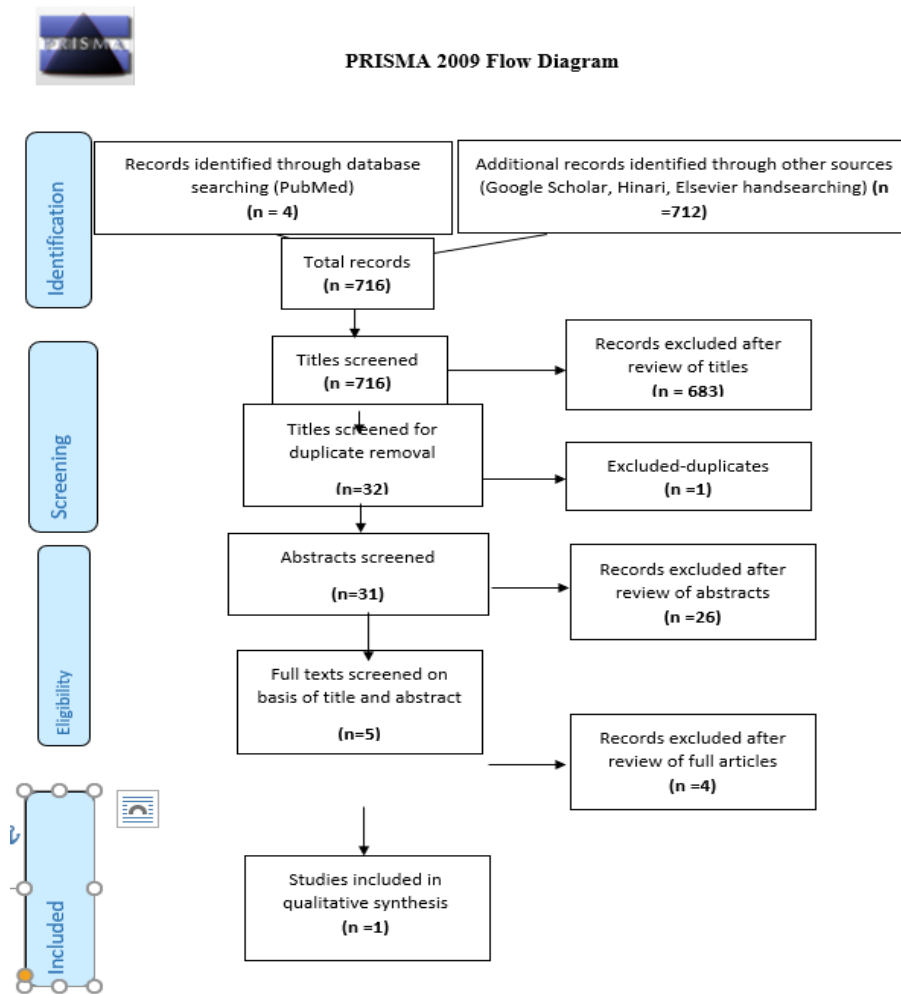
- This systematic review followed the guidelines of PRISMA (Preferred Reporting Items for systematic Reviews and Meta- analysis) statement.
- 716 studies were obtained from information sources such as PubMed, Google Scholar, Hinari, Science Direct and hand search. 683 studies were excluded for not meeting the eligibility criteria after thorough screening of the titles. Remaining 32 articles were checked for duplication and a single article was removed. 26 studies were excluded after abstract screening for not meeting the inclusion criteria. Remaining 5 articles were screened for full text of which 4 were excluded (Table no-3).

TABLE NO- 3: TABLE SHOWING EXCLUDED ARTICLES FROM THE SYSTEMATIC REVIEW

SR NO	AUTHOR	YEAR OF PUBLICATION	REASON FOR EXCLUSION
1	Mehrotra D et.al	2016	This article has only used simultaneous arthroplastic distraction osteogenesis in the study.
2	Giraddi GB et.al	2016	This article has only evaluated the efficacy of simultaneous arthroplastic distraction osteogenesis.
3	Rao K et.al	2004	This article has only used simultaneous arthroplastic distraction osteogenesis in the study.
4	Cascone P et.al	2002	This article has only used simultaneous arthroplastic distraction osteogenesis in the study.

- A total of single study included in this systematic review was analyzed (Figure no 1).

FIGURE NO- 1



Effectiveness of pre-surgical distraction osteogenesis and simultaneous distraction osteogenesis in temporomandibular joint ankyloses for mouth opening - A systematic review.

5. Discussion:

Temporomandibular joint ankylosis is a difficult pathological condition to address, due to the multiple consequences that it entails, both functionally and aesthetically (**Alister.JP.**) Also it is one of the most difficult and complex problems managed by oral and maxillofacial surgeons (**Qiao.J.2018**). Surgery plays an integral role in the management of TMJ ankylosis. The 2 primary objectives of surgery are to establish jaw movement and jaw function by surgical release of the ankylosis and to prevent relapse and re-ankylosis (**Hegab.AF.2015**).

The literature described various treatment modalities for the treatment of temporomandibular joint ankylosis such as condylectomy, gap arthroplasty and inter-positional arthroplasty for release of ankylotic mass and condylar reconstruction followed by orthognathic surgery or distraction osteogenesis for the correction of facial deformity. Many surgeons tend to choose a staged plan in which distraction osteogenesis performed before, simultaneously or after the release of ankylotic joint (**Zhang.XH.2012**).

After a thorough and systematic literature search revealed only one article abiding the inclusion criteria. The selected study was a prospective randomized experimental study. A total of 20 patients were included in this study. This study was carried out in a hospital setup at Lucknow, Uttar Pradesh, India.

Summary of evidence:

Chellappa AL. et al (2015) conducted a prospective randomized experimental study which included children and adolescents suffering from facial deformity due to long standing unilateral TMJ ankylosis. They were randomly allocated to the two surgical groups with ten in each group. In Group I, a two-stage protocol was followed. Initially in the first stage surgery, the distractor was placed via submandibular approach. The second stage surgery was performed after a consolidation period of 4–6 weeks, wherein temporalis fascia interpositional arthroplasty was performed via Al-Kayat Bramley approach and the distractor was removed. In Group II, temporalis fascia interpositional arthroplasty and distractor placement was done in a single stage. Both groups resulted in good facial symmetry and aesthetics. Initially, during the distraction period, mouth opening of Simultaneous arthroplastic distraction (SAD) group scored less than that of Pre-arthroplastic distraction (PAD) group but became comparable in 30 days. More pain at the distraction site and over the normal TMJ was observed in PAD group. The excursive movements were almost comparable in both the groups. The data analysis showed that both procedures are effective in correcting the post-ankylotic deformity and improving function. Although PAD has better control over movement of the distracting segment, the contralateral TMJ may experience pain. SAD requires a shorter management period but is associated with a temporary decrease in function. Also, control of distraction may be difficult and chances of re-ankylosis are always there (**Chellappa.AL.2015**).

The success of surgical management of TMJ ankylosis is completely dependent on the restoration of the TMJ function (i.e., mouth opening). Mouth opening is usually measured using a caliper or a millimeter scale to obtain maximum inter incisal distance (MID) or inter incisal opening (IIO). The mouth opening is usually affected in patients who undergo osteo-arthroplastic procedures followed by

maxillo-mandibular osteotomies. This led to the popularity of pre-arthroplastic distraction osteogenesis (**Andrade.NN.2018**).

Rao K et al performed SAD in 6 patients with pre-operative average mouth opening of 1.6mm and postoperative average mouth opening was 28mm at 3 months these results were comparable with Chellappa AL et al with mean post-operative mouth opening of 31.8mm in PAD and 32.4mm in SAD 3 months (**Rao.K.2004**).

In Chellappa AL et al the average mouth opening at 6 months was 34.3 ± 0.44 mm in PAD group and 35.9 ± 0.83 mm in SAD group (**Chellappa.AL.2015**). Yu H et al favored simultaneous distraction osteogenesis with gap arthroplasty and presented a similar mouth opening of 32.4 (28-37) mm (**Yu.H.2009**). Similarly Zhang XH et al conducted a study showed progressively increased mouth opening from 25mm pre operatively to 30mm post operatively after 1 year and was 31.5mm on average 3 years after surgery (**Zhang.XH.2012**). Qiao J et al performed post-surgical distraction osteogenesis with inter positional arthroplasty and presented similar mouth opening of 35.67 ± 3.39 mm post operatively (**Qiao.J.2018**).

Nevertheless, in 2015 Mehrotra D et al conducted another prospective study including 10 patients with unilateral temporomandibular joint (TMJ) ankylosis who presented with a facial deformity and a maxillary cant. In this study they planned only simultaneous maxilla-mandibular distraction and the only parameter in question was facial esthetics. Therefore this article was excluded from our study (**Mehrotra.D.2016**).

Rao K et al in 2015 conducted a study which was done on six children with temporomandibular joint ankylosis and mandibular deformity. Even in this study they planned only simultaneous gap arthroplasty followed by distraction osteogenesis. Therefore this article was excluded from our study (**Rao.K.2004**).

Zhang XH et al in 2012 conducted a study including 4 patients with unilateral temporomandibular joint ankylosis associated with severe dentofacial deformities. All the patients underwent simultaneous costochondral graft (CCG) and distraction osteogenesis (DO) for the management of TMJ ankylosis. However in this study the effectiveness of PAD and SAD was not evaluated therefore this article was excluded from our study (**Zhang.XH.2012**).

In this systematic review data itself is limited so within this limited data we are not able to conclude anything, so we suggest that further studies are essential to determine the effectiveness of pre-arthroplastic distraction osteogenesis and simultaneous arthroplastic distraction osteogenesis in temporomandibular joint ankylosis

6 .Conclusion

Implications for practice: It is controversial due lack of data in spite of this limitation, the study selected concluded that both the groups were effective in correcting the function.

Future implications for research: Only one study is available so further comparative clinical studies are required in the field of temporomandibular joint ankylosis involving large sample size and concentrating on those parameters which all are less addressed till now.

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Conflict of interest: None

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