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Interpositional arthroplasty versus reconstruction arthroplasty for temporomandibular joint ankylosis: A systematic review and meta-analysis

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ABSTRACT

Background: Interpositional arthroplasty (IA) and reconstruction arthroplasty (RA) are widely used in treating temporomandibular joint ankylosis (TMJA). But the reported clinical outcomes are controversial, the debate over which one is better remains.

Methods: The Pubmed, EMBASE, OVID EBM Reviews, and Web of science were searched up to Oct 11 2014 without limitation on year, language. Only randomized controlled trials and observational cohort studies with a follow-up of at least 12 months were included.

Results: A total of 8 retrospective cohort studies with 234 patients with TMJA were included in meta-analysis. Pooled analysis showed no significant differences in reankylosis (RD: −0.00; 95% CI: −0.08, 0.07; Z=0.06; P =0.95; I^2 =0%), and maximum incisal opening (MD=0.99; 95% CI: −1.43, 3.4, Z=0.8, p=0.42; I^2 =74%) between the IA and RA groups.

Conclusions: IA and RA could produce similar outcomes in treating TMJA regarding to rankylosis and maximum incisal opening. Other postoperative complications, such as overgrowth of cartilage, malocclusion and the status of facial development should be evaluated more thoroughly.

1. Introduction

Temporomandibular joint ankylosis (TMJA) is the functional disability of the mandible, caused by the fibrous or bony adhesion among the condyle, disc, glenoid fossa, and eminence (Long et al., 2005). Trauma is the most common etiologic factor, documented in 13%–100% cases of TMJA. Local or systemic infection is the second most common etiology. In rare circumstances, systemic diseases, such as ankylosing spondylitis, rheumatoid arthritis, and psoriasis, may also lead to TMJ ankylosis (Chidzonga, 1999; Vasconcelos et al., 2009).

TMJA causes functional impairment in mastication and speech; in addition, it poses a severe threat to facial development in children. In unilateral cases, TMJA can cause hypoplasia of the mandible and deviation to the affected side. In bilateral cases, a typical bird-face appearance with retrognathia, mandibular alveolar protrusion, and open bite may appear (Güven, 2008).

Currently, the following three techniques are most often used: gap arthroplasty (GA); interpositional arthroplasty (IA); and reconstruction arthroplasty (RA). However, none of these three techniques has been accepted as a universally successful method for various type of TMJA. Reankylosis is the most common and troubling postoperative complications encountered in clinical practice.

GA is the oldest type of surgery for treating TMJA; however, due to the high incidence of recurrence and malocclusion caused by shortened mandibular ramus, its application is becoming limited, and some authors have even suggested abandoning GA (Kaban et al., 1990; Matsuura et al., 2001). Currently, IA and RA are more popular, especially for children with TMJA. Although successful application of IA and RA have been widely reported, direct comparison between RA and IA is rare and results are controversial, which leads to a dilemma for surgeons when choosing certain treatment modalities (Sahoo et al., 2012).

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Therefore we conducted this systematic review and meta-analysis to compare the outcomes of IA and RA to provide some evidence-based suggestions for clinicians.

2. Material and methods

2.1. Literature search

The PubMed, EMBASE, OVID EBM Reviews, and Web of Science were searched up to October 11, 2014, using the following key words with combinations: temporomandibular joint, TMJ, ankylosis, interpositional arthroplasty, interposition arthroplasty; joint reconstruction, articulation reconstruction, joint replacement, autogenous graft, alloplastic graft, costochondral graft. The references lists of included studies were also manually searched.

2.2. Inclusion criteria and quality assessment

The inclusion criteria were as follows: randomized controlled trial (RCT) or observational cohort study with a follow-up of at least 12 months; and comparison of clinical outcomes between the patients who received IA and those who received RA, including reankylosis or maximal incisal opening (MIO). Potentially eligible studies were assessed by two authors (J.M., H.J.) independently. Any uncertainty regarding eligibility was discussed in consultation with a third reviewer (L.L.) to make a decision. The methodological quality of the included studies was evaluated at this stage using the Newcastle-Ottawa Scale (NOS); scores are listed in Table 1.

2.3. Data extraction

An Excel spreadsheet was designed to record the following data: the name of the first author, year of publication, materials used in IA and RA, mean age at operation, sample size, outcomes, size of cartilage, size of gap created, and length of follow-up. Two reviewers (J.M., H.J.) performed data extraction independently. All of the data were from those published in the included studies. The recorded data were compared by the third reviewer (L.L.) to prevent omissions and errors.

2.4. Assessment of heterogeneity

The heterogeneity was evaluated by the χ^2 and I^2 tests. Substantial heterogeneity was defined as $I^2 > 50\%$.

2.5. Outcome measures

Two main outcomes of interest were the incidence of reankylosis and the MIO, other postoperative complications (malocclusion and overgrowth of cartilage) were also documented.

2.6. Statistical analysis

RevMan 5.3 software (Cochrane Collaboration, Software Update, Oxford, UK) and Stat 12 (StataCorp, College Station, TX) were used in this meta-analysis. Risk difference (RD) with a 95% confidence interval (95% CI) was calculated for binary outcomes, and mean differences (MDs) with 95% confidence intervals (CIs) for continuous outcomes. A fixed-effects model (Mantel-Haenszel method) was used if there was no heterogeneity; otherwise a random-effects model (Der Simonian-Laird method) was used. Pooled RDs and MDs were calculated, and a two-sided $P < 0.05$ was considered statistically significant. Publication bias was evaluated using a funnel plot and Egger test. A symmetric funnel-shaped distribution and $P > 0.10$ in the Egger test indicated the absence of publication bias.

3. Results

3.1. Study characteristics

The selection process is shown in Fig. 1. Eight studies with a total of 234 patients were included in this meta-analysis (Balaji, 2003; Manganello-Souza and Mariani, 2003; Qudah et al., 2005; Tanrikulu et al., 2005; Erol et al., 2006; Elgazzar et al., 2010; Loveless et al., 2010; Sahho et al., 2012). All of these were retrospective cohort studies; no RCT was found. The clinical characteristics and the methodological qualities of these studies are listed in Table 1.

Temporalis myofascial flap (TMF) was the main interpositional material used in 7 of 8 studies. Other materials included silicone, dermis/fat, and cartilage. Costochondral graft (CCG) was chosen in 7 studies to reconstruct condyle (Balaji, 2003; Manganello-Souza and Mariani, 2003; Qudah et al., 2005; Tanrikulu et al., 2005; Erol et al., 2006; Elgazzar et al., 2010; Sahho et al., 2012). Nearly all of the patients who received CCG were children, although adult bilateral cases also received this technique (Erol et al., 2006). Prosthetic total joint replacement was used only in adults in the study by Loveless et al. (Loveless et al., 2010). In the RA group, TMF or other materials were also used to fill the space between graft and articulation fossa in 3 studies (Balaji, 2003; Manganello-Souza and Mariani, 2003; Elgazzar et al., 2010). Specific information on mean age at operation and length of follow-up for each technique was partially missing.

Table 1
Clinical characteristics of the included studies.

First author (year)	IA material	RA material	Mean age at operation IA/RA	Sample size IA/RA	Follow-up IA/RA	Study quality (max = 9)	OG of CCG (cartilage size)	Malocclusion (gap size)
Erol (2006)	TMF	CCG	18 y	15/10	12–144 mo	7	NA (NA)	Open bite (NA)
Loveless 2010	TMF[a]	TJR	36.6/45.6 y	14/22	12 mo	6	NA (NA)	NA (NA)
Balaji (2003)	TMF	CCG + TMF	27.6/9.6 y	9/22	6 y	7	NA (NA)	NA (NA)
Manganello (2003)	Silicone	CCG + TMF	32/12.8 y	5/9	28.2 mo	7	NO (1.5 cm)	Mandibular deviation (NA)
Tanrikulu (2005)	TMF	CCG	12.7/10.9 y	9/7	18.9/20.1 mo	7	NA(NA)	NA (NA)
Elgazzar (2010)	TMF	CCG △	NA	14/20	14–96 mo	6	1 (3–6 mm)	Open bite (1.5–2 cm)
Qudah (2005)	TMF	CCG	9/8 y	8/14	22.8/24.3 mo	7	2 (2–3 mm)	NA (1.5–2 cm)
Sahoo (2012)	TMF	CCG	13.2 y	19/37	4.7 y	6	NO (6–8 mm)	NA (1.5 cm)

IA: Interpositional arthroplasty; RA: Reconstruction arthroplasty; Max = maximum; TMF: Temporalis myofascial flap; TJR: Total joint replacement; OG: Overgrowth; CCG: Costochondral graft.

[a] TMF + dermis/fat, silicone, cartilage graft, meniscal placation. △: 1.CCG +/− TMF/buccal pad fat/original disc. 2. Surgibone. 3. Coronoid process graft and TMF. 4. IA with TMF + distraction osteogenesis.