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SHORT COMMUNICATION OPEN ACCESS

Conventional *versus* Modified Preauricular Incision Approaches to the Management of Temporomandibular Joint Ankylosis in Sana'a City, Yemen: A Comparative Clinical Study

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ABSTRACT

Objective: To compare between the conventional and modified preauricular incision approaches to the management of temporomandibular joint (TMJ) ankylosis among Yemeni patients in Sana'a city, Yemen.

Methods: This comparative clinical study recruited ten patients (7 males and 3 females; age range: 6–35 years) with true fully or partially bony or fibrous TMJ ankylosis. These patients were admitted to and followed up in the University of Science and Technology Hospital in Sana'a in the period from May 2013 to February 2016. Five patients with condylar capsule ankylosis were subjected to the conventional preauricular approach, while the other five cases with ankylosis that extends beyond the condylar capsule and reaches the zygomatic arch were subjected to the modified preauricular approach. Both approaches were evaluated and compared for the time required, intra- and post-operative complications and aesthetic results.

Results: The mean times required to carry out the operations were 4.45 and 3.20 hours for conventional and modified preauricular approaches, respectively.Facial nerve injury was present in two patients undergoing the conventional preauricular approach, but this reversed to normal after four to five months. Patient of both groups experienced no facial paralysis or post-operative auriculotemporal syndrome. Intra-operative bleeding was mild to moderate among the patients of both approaches, and none of the patients required blood transfusion intra- or post-operatively. Major blood vessels were injured in three cases undergoing the conventional preauricular approach. All patients subjected to both approaches showed satisfactory aesthetic end results.

Conclusions: Conventional and modified preauricular approaches provide excellent accessibility and visibility of the surgical field during the management of TMJ ankylosis among Yemeni patients, with the latter being slightly superior. In addition, the modified preauricular approach is associated with fewer complications, absence of facial nerve injury and reduced surgical time compared to the conventional approach.

Keywords: Temporomandibular joint ankylosis, Conventional preauricular approach, Modified preauricular approach, Sana'a

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1. Introduction

Temporomandibular joint (TMJ) is a compound articulation formed by the articular surfaces of the temporal bone and the mandibular condyle, which are covered by dense fibrocartilages. The mandibular condyle articulates with a large surface area of the temporal bone, which consists of the articular fossa and eminence as well as the preglenoid plane. It rotates within the fossa and translates anteriorly along the articular eminence. The condylar translation ability enables the mandible to make a maximal incisal opening greater than that would be achieved by mere rotation. Therefore, this joint is referred to as gynglimodiarthrodial; a combination of the terms ginglymoid (meaning rotation) and arthrodial (meaning translation) (1, 2).

TMJ ankylosis is the fibrous or bony adhesion of the joint associated with a restriction in mouth opening (3). In addition to its serious effects on mandibular growth, TMJ ankylosis leads to difficulties in vital functions such as mastication and speaking and in maintaining oral hygiene(3).The major factors associated with such ankylosis include age (<10 years), meniscal tear, prolonged intermaxillary fixation and intracapsular trauma (4). When it occurs during the childhood, it seriously influences the future growth of the jaws and teeth. Furthermore, it may greatly affect the psychosocial development of the patient due to facial deformity, which worsens with growth. Therefore, early diagnosis and treatment must be made to avoid worsening of the condition (5).

TMJ ankylosis is classified by location into intra-or extra-articular, by the type of affected tissue into bony, fibrous or fibro-osseous and by the extent of fusion into complete or incomplete (6). It is also classified as true or false (7), where true ankylosis results from the osseous or fibrous adhesion between the articular surfaces while false ankylosis results from indirect pathologic conditions of the joint (8). TMJ ankylosis can be managed by various surgical approaches. Of which, the conventional preauricular approach is the most widely used but usually leads to a number of complications if incorrectly performed. The most serious complication is facial paralysis due to facial nerve injury in nearly 5% of surgeries, resulting in the loss of the whole facial expression on the affected side and inability to close the corresponding eye (9–11).

Open reduction of mandibular condyle fracture and ankylosis depends on the type and extension of ankylosis. Generally, these management approaches could be preauricular, postauricular, submandibular, retromandibular, intraoral or combined. Therefore, the selection of the management approach should consider the type of fracture or ankylosis, fracture of other sites as well as the age and teeth condition of the patient (12).

The conventional preauricular approach is performed by making a skin incision in front of the ear through the superficial to temporal fascia. After the exposure of this layer downwards following the temporal vessels to the lower end of the incision, the posterior zygomatic arch can be easily palpated. Then, the temporal fascia can be separated into superficial and deep layers approximately two centimeters above the zygomatic arch (13). However, the modified preauricular approach is performed by making a skin incision starting about a pinna's length away from the ear, proceeding antero-superiorly just within the hairline and then curving backwards and downwards till it meets the upper attachment of the ear (14).

To achieve good anatomic reduction using the conventional preauricular approach, it is necessary to completely expose the surgical field for the direct visibility of the fractured ends and approximation of the two ends. To gain good surgical visi-

bility, the large distance between the incision line and the fixation level often requires heavy and continuous retraction of tissues, which can lead to facial nerve injury and tissue damage (13). The choice of the incision approach for the management of TMJ ankylosis is important to reduce post-operative complications (15). Therefore, the present study aimed to clinically compare between the conventional and modified preauricular incision approaches to the management of TMJ ankylosis among patients in Sana'a city - Yemen, regarding the accessibility, visibility, operation time, nerve complications, intra- and post-operative bleeding and aesthetic result.

2. Methods

2.1. Study design and case grouping

This comparative clinical study recruited ten patients (7 males and 3 females; age range: 6–35 years) with true fully or partially bony or fibrous TMJ ankylosis. These patients were admitted to and followed up in Department of Biological and Preventive Sciences, College of Dentistry, University of Science and Technology Hospital in Sana'a in the period from May 2013 to February 2016.

Patients with condylar capsule ankylosis were subjected to the conventional preauricular approach (Figure 1) as mentioned by Al-Kayat and Bramley (13), while those with ankylosis that extends beyond the condylar capsule and reaches the zygomatic arch were subjected to the modified preauricular approach (Figure 2). Patients with pseudo-ankylosis due to a problem outside the TMJ or with interincisal opening exceeding 20 mm were excluded.

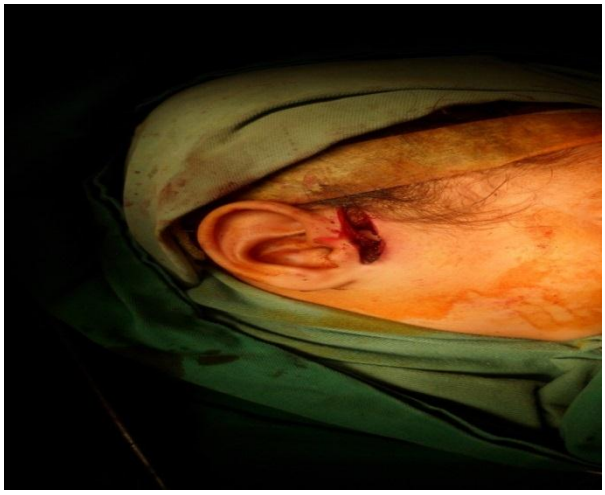

Figure 1. Conventional preauricular approach

Figure 2. Modified preauricular approach

2.2. Data collection and incision procedures

Socio-demographic data about the patient's gender, age, in addition to data on the history, type, duration and cause of ankylosis were collected using a pre-designed data collection sheet. In addition, the amount and extension of ankylosis were measured radiographically using extraoral films (panoramic radiographs and three-dimensional computed tomography scans (Figure 3).

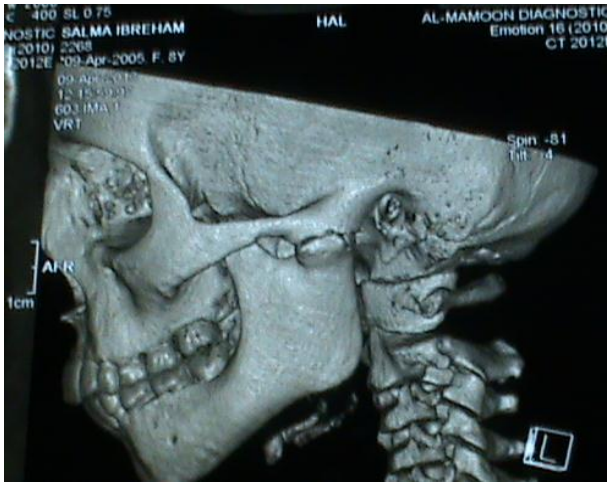

Figure 3. A three-dimensional CT scan showing TMJ ankylosis

Surgical operations were performed under general anesthesia via nasotracheal endoscopy or tracheostomy. Condylectomy was performed in four steps: skin incision, resection of the ankylosed condyle, preparation of the metatarsal bone graft and its fixation to the site. For both approaches, wounds were closed using vicryl sutures for cutaneous and subcutaneous tissues and proline sutures for the skin. The accessibility, visibility and hemorrhage were evaluated intra-operatively, while the presence or absence of infection, sinus/fistula or dehiscence, interincisal opening, facial nerve palsy and surgical scar were evaluated post-operatively.

Post-operatively, amoxicillin-clavulanate antibiotic and diclofenac sodium analgesic were prescribed according to the age and body weight of the patients. Soft diets were also recommended for six weeks. The patients were advised to avoid hard foods or trauma to the operative site as possible. All patients were followed up for five months.

2.3. Statistical analysis

The mean times required for conducting the two approaches were compared using the independent sample *t*-test. The difference was considered statistically significant at $P < 0.05$. IBM SPSS Statistics software, version 2.01 (IBM Corp., Armonk, NY, USA) was used to analyze the data.

3. Results

3.1. Mean operation times

The surgical procedures were completed on all patients successfully. The average postoperative interincisal opening was 30.45 mm in preauricular approach and 31.50 in modified per auricular approach. The mean times required to carry out the operations were 4.45 and 3.20 hours for conventional and modified preauricular approaches, respectively. Table (1) shows that the difference between the mean times required for the two types of incision approaches was statistically significant ($P = 0.019$).

Table 1. Mean times required by conventional and modified preauricular approaches to the management of TMJ ankylosis among Yemeni patients

Type of incision approach	Mean time (h)± SD	*P* value
Preauricular	4.45± 0.76	0.019
Modified preauricular	3.20 ± 0.57	

SD, Standard deviation.

3.2. Clinical comparison between the two approaches

Facial nerve injury was present in two patients undergoing the conventional preauricular approach, where both of them lost the ability to wrinkle the forehead. However, this reversed to normal after four to five months. No facial paralysis was noted after surgery in both groups, where all the patients smiled symmetrically. Patient of both groups experienced no post-operative auriculotemporal syndrome.

On the other hand, intra-operative bleeding was mild to moderate, and none of the patients re-

quired blood transfusion intra- or post-operatively. Major blood vessels were injured in three cases undergoing the conventional preauricular approach, where two injuries occurred in the maxillary artery and one occurred in the superficial temporal artery. However, no blood vessels were injured in patients undergoing the modified preauricular approach. All patients subjected to both approaches showed satisfactory aesthetic end results (Figure 4).

Figure 4. Healing process during the follow-up period

4. Discussion

Surgical approaches to the mandibular condylar process must avoid injury to the branching facial nerve, which commonly requires a dissection between the zygomatic and frontal branches. The anatomic variations of the temporal branch of the facial nerve make it vulnerable to injury during surgical dissection in the temporal region. The nerve occasionally lies within the superficial temporal fat pad, and its damage leads to an asymmetric appearance and dysfunction, represented by the inability to wrinkle the ipsilateral forehead or reduction in its wrinkle depths, inability to raise the eyebrows or ptosis (16–18). Therefore, the integrity of facial nerves and the success of TMJ ankylosis surgery are compromised with the conventional preauricular approach. In the present study, comparison between the conventional and modified preauricular approaches could not ascertain the superiority of either approach since the differences were not statistically significant. However, visual judging reveals that the modified preauricular approach permits a more direct field vision and an almost straight line access for the ankylosis, particularly when the ankylosis extends more laterally towards the zygomatic arch. It also seems to be safer than the conventional approach because facial nerves can be visualized and avoided, and the major blood vessels, such as the maxillary and superficial temporal arteries, are away from the incision site.

Although both approaches gave excellent accessibility and visibility of the TMJ ankylosis, limitations and minimal intra- and post-operative complications were encountered in both approaches. Nevertheless, the time required to perform the conventional preauricular procedure was much longer than that for the modified preauricular approach. Facial nerve paralysis was more common among patients treated with the conventional preauricular approach, but it was improved over time and then completely recovered. Post-operative scar was unnoticeable in all cases and good aesthetic results were observed with both approaches, even though the conventional preauricular approach was superior to the modified preauricular approach with this respect. Mouth opening, mandibular movements and occlusion were more or less same in both the approaches.

The conventional preauricular approach has been the mainstay of TMJ ankylosis management that was modified not only for better accessibility and visibility but also for the protection of facial nerve branches. Among modifications of this approach, Al-Kayat and Bramley (1979) modifications (13) have been very popular and are the most widely used at present. These modifications

help to protect the facial nerve branches and provide good access to the condylar process, but the extremely limited area of ramal exposure makes the plate fixation technically difficult (15).

Retromandibular approach provides better access as it exposes the entire ramus from behind and is therefore useful for procedures involving the area on or near the condylar neck/head, or the ramus itself (19). It is important that consider two key points when using either method for graft fixation. First, the surgeon should be experienced, especially in exposing the ankylosis as well as identifying and dissecting the facial nerves. Second, the surgeon should avoid excessive traction of the facial nerve to reduce its potential damage.

The present study is limited by the small number of cases, which was due to the high cost of the operations and the rejection by the patients for fear of the anticipated complications. Obstacles also included taking the bone graft from the foot and difficulty in follow-up due to the disturbed situation of the country during the study.

5. Conclusions

Conventional and modified preauricular approaches provide excellent accessibility and visibility to the surgical field during the management of TMJ ankylosis among Yemeni patients, with the latter being slightly superior. In addition, the modified preauricular approach is associated with fewer complications, absence of facial nerve injury and reduced surgical time compared to the conventional approach.

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Authors' contributions

All authors contributed equally to the design, implementation, statistical analysis and manuscript drafting. They also read and approved the final version of the submitted manuscript.

Competing interests

The authors declare that they have no competing interests associated with this article.

Ethical approval

The present study was approved by the Research Ethics Committee of the College of Dentistry, University of Science and Technology, Sana'a, Yemen (No.: 2016/21). Before operations, detailed informed consent was taken from the patients or their parents.

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