Clinical experience in managing temporomandibular joint ankylosis: five-year appraisal in a Nigerian subpopulation

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Objectives: Temporomandibular joint ankylosis (TMJA) is a joint pathology caused by bony and/or fibrous adhesion of the joint apparatus, resulting in partial or total loss of function.

Materials and Methods: This is a retrospective study conducted between 2012 and 2016 in the northwest region of Nigeria. The data retrieved includes gender, age, etiology of ankylosis, duration of ankylosis, laterality of ankylosis, type of imaging technique, type of airway management, types of incision, surgical procedure, mouth opening, interpositional materials used, and complications. Results were presented as simple frequencies and descriptive statistics.

Results: Thirty-six patients with TMJA were evaluated during the study period. There were 21 males (58.3%) and 15 females (41.7%), yielding a male:female ratio of 1.4:1. The patients’ age ranged from 5 to 33 years with mean±standard deviation (13.8±6.6 years). Thirty-five cases (97.2%) were determined to be true/bony ankylosis, while only 1 case (2.8%) was false/fibrous ankylosis. Most of the TMJA cases (16 cases, 44.4%) were secondary to a fall. In our series, the most commonly utilized incision was the Bramley-Al-Kayat (15 cases, 41.7%). The mostly commonly performed procedures were condylectomies and upper ramus ostectomies (12 cases each, 33.3%), while the most commonly used interpositional material was temporalis fascia (14 cases, 38.9%). The complications that developed included 4 cases (11.1%) of severe hemorrhage, 1 case (2.8%) of facial nerve palsy, and 1 case (2.8%) of re-ankylosis.

Conclusion: Plain radiographs, with their shortcomings, still have significant roles in investigating TMJA. Aggressive postoperative physiotherapy for a minimum of 6 months is paramount for successful treatment.

Key words: Ankylosis, Arthroplasty, Incision, Osteotomy, Temporomandibular joint

I. Introduction

Temporomandibular joint ankylosis (TMJA) is a joint pa-
ther classified true ankylosis into types I, II, III, and IV. The management of TMJA poses a great challenge due to technical difficulties in investigating and treating the disease, as well as the high incidence of recurrence\(^9\). Several techniques have been reported in literature; however, no single method has produced a uniform success rate\(^10,11\). Such technical difficulties are further aggravated in resource- and personnel-scarce countries. Healthcare funding in sub-Saharan Africa, especially Nigeria, has often been described as grossly inadequate, with the budgetary provision to health hardly exceeding 3% of the nation’s total\(^12,13\). These issues are further compounded by the out-of-pocket payment system with inadequate health insurance coverage\(^12\).

The main aim of this study, therefore, is to present an audit of TMJA management in a resource-scarce population.

## II. Materials and Methods

This is a retrospective study conducted from 2012 to 2016 at two tertiary referral centers (Usman Danfodiyo University Teaching Hospital, Sokoto; Sokoto State and National Orthopaedic Hospital Dalla, Kano, Kano State) in the north-west region of Nigeria. The data collected includes gender, age, etiology of ankylosis, duration of ankylosis, laterality of ankylosis, type of imaging technique, type of airway management, types of incision, surgical procedure, mouth opening, interpositional materials used, and complications. Ethical approval was obtained from the ethics and research committee of Usman Danfodiyo University Teaching Hospital (UDUTH/HREC/2017/No. 590).

The data was analyzed using IBM SPSS Statistics for Windows (ver. 20.0; IBM Co., Armonk, NY, USA). Results were presented as simple frequencies and descriptive statistics. Tests of significance were used as appropriate, and a \( P \)-value of less than 0.05 was considered significant.

## III. Results

Thirty-six patients with TMJA were examined during the study period. There were 21 males (58.3%) and 15 females (41.7%), resulting in a male:female ratio of 1.4:1. Patients’ age ranged from 5 to 33 years, yielding a mean±standard deviation (SD) of 13.8±6.6 years. The duration of TMJA ranged from 1 to 28 years (mean±SD, 8.9±5.9 years). There was no significant difference associated with age and gender.\(^9\)

### Table 1. Age and gender distribution of patients with temporomandibular joint ankylosis

| Age group (yr) | Male | Female | Total |
|----------------|------|--------|-------|
| 5-10           | 7 (19.4) | 8 (22.2) | 15 (41.7) |
| 11-15          | 7 (19.4) | 1 (2.8)  | 8 (22.2)  |
| 16-20          | 4 (11.1) | 4 (11.1) | 8 (22.2)  |
| 21-25          | 2 (5.6)  | 1 (2.8)  | 3 (8.3)   |
| 26-30          | 0      | 1 (2.8)  | 1 (2.8)   |
| 31-35          | 1 (2.8) | 0        | 1 (2.8)   |
| Total          | 21 (58.3) | 15 (41.7) | 36 (100) |

Values are presented as number (%). \( \chi^2 = 6.069, \text{ degree of freedom}=5, P=0.300 \).

### Table 2. Distribution of site and etiology of temporomandibular joint ankylosis

| Site          | Fall | RTA | MEI | CO   | Total |
|---------------|------|-----|-----|------|-------|
| Right unilateral | 1 (2.8) | 1 (2.8) | 3 (8.3) | 0    | 5 (13.9) |
| Right unilateral+ maxilla | 0 | 0 | 0 | 3 (8.3) | 3 (8.3) |
| Left unilateral | 2 (5.6) | 1 (2.8) | 0 | 0 | 3 (8.3) |
| Left unilateral+ maxilla | 0 | 0 | 0 | 1 (2.8) | 1 (2.8) |
| Bilateral      | 13 (36.1) | 5 (13.9) | 3 (8.3) | 1 (2.8) | 22 (61.1) |
| Bilateral+ maxilla | 0 | 0 | 0 | 2 (5.6) | 2 (5.6) |
| Total          | 16 (44.4) | 7 (19.4) | 6 (16.7) | 7 (19.4) | 36 (100) |

(REST OF THE CONCENTRATED TEXT)
Fig. 1. A. Three-dimensional (3D) computed tomography (CT) view of right temporomandibular joint ankylosis (TMJA). B. 3D CT view of left TMJA. C. CT coronal view showing right TMJA.

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Fig. 2. A. Bramley-Al-Kayat incision for access to temporomandibular joint ankylosis (TMJA). B. Post-rami incision in gap arthroplasty for access to TMJA. C. Temporalis muscle/fascia for gap arthroplasty. D. Masseter muscle for gap arthroplasty.

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were condylectomies and upper ramus ostectomies (12 each; 33.3%), while the temporalis fascia (14 cases, 38.9%; Fig. 2. C) and masseter (11 cases, 30.6%; Fig. 2. D) were the most favored interpositional material used, with a significant difference of \( P=0.001 \). (Table 4) The maximum and minimum intraoperative mouth openings achieved were 5 cm and 3.2 cm, respectively (mean±SD, 4.01±0.54 cm). There was no significant difference when comparing degree of intraoperative mouth opening with type of procedure (\( P=0.333 \)). (Table 5)

Complications encountered include severe hemorrhage in 4 cases (11.1%), facial nerve palsy in 1 case (2.8%), and re-ankylosis in 1 case (2.8%). (Table 6) When comparing complications encountered with the type of procedure, there was a significant difference (\( \chi^2=45.28 \), degree of freedom=15, \( P=0.000 \)). (Table 6) Follow-up examinations occurred for all patients for a minimum of 10 months. Table 7 showed complications encountered with different types of incision done to expose the ankylotic site.

IV. Discussion

If it is not treated early, TMJA is the most common cause of acquired mandibular deformity in both children and adults. The main objectives of ankylosis treatment are to achieve maximum mouth opening and optimal joint mobility, avoid inflammation and pain, and restore the initial occlusion in order to obtain facial symmetry. Successful treatment of TMJA requires detailed preoperative assessment of the type and degree of deformity. The most common etiopathogeneses of TMJA have previously been reported to be preceding trauma (road traffic accidents and falls), closely followed by infection. In the present study, most TMJA cases were caused by preceding trauma (23 cases, 63.9%) or infection (middle ear infection and cancrum oris; 13 cases, 36.1%).

CT has been reported as the most important imaging technique for accurate surgical management of TMJA. Unfortunately, this mode of investigation is inadequate in resource-scarce countries, and, where available, it is out of the financial reach of a majority of citizens due to out-of-pocket payment systems in healthcare delivery. Most of our patients (75%) could only afford plain radiographs; only 25% could afford CT. Conventional radiographs have been reported to misjudge the extent of bony ankylosis that is discovered during surgery. However, Posnick and Goldstein have reported that CT scans provide some added information to plain radiographs. The authors of this study differ on this position because, in our series, the extent of ankylotic mass was discovered during surgery. Imaging is not beneficial in the case of fibrous ankylosis because only osseous ankylosis presents on radiographs. Therefore, fibrous ankylosis is more of a clinical diagnosis than a radiographic one. We found only 1 case (2.8%) of fibrous ankylosis in our series, and, corresponding with literature, plain radiographs were unable to characterize it.

TMJA can negatively affect a growing child, as shortening of mandibular rami can narrow airways and reduce space between the mandibular angles. These structural abnormalities, combined with a limited or no mouth opening, cause difficulties in securing the airway. A tracheotomy was necessary in half of the cases in our series (18 cases, 50.0%). Several techniques have been described for airway management in TMJA, including blind or fiber optic guided awake nasal intubation, retrograde intubation, and tracheostomy. Tracheostomy is generally regarded as a last option because of the severe morbidity, long-term side effects, and high mortality rates associated with the procedure; however, with limited options for fiber optics, this method has been our primary choice for airway management. Previous reports have indicated that the complications associated with tracheostomy can be minimized by early decannulation in the immediate postoperative stage, usually within 24 hours.

The type of surgical incision used to expose the ankylotic mass is largely determined by the extent of ankylosis. The Bramley-Al-Kayat incision was used when the ankylotic mass was limited to the joint space and condylar head (15 cases, 41.7%). This incision type has been reported to provide outstanding visibility due to a larger flap while maintaining an intact temporal fascia that is not reflected with the incision.
### Table 4. Distribution of procedure conducted and interpositional material utilized

| Procedure                  | Masseter | Temporalis fascia | Temporalis muscle | None | Total |
|----------------------------|----------|-------------------|-------------------|------|-------|
| Ramus+condyle              | 9 (25.0) | 2 (5.6)           | 0                 | 1 (2.8) | 12 (33.3) |
| Ramus+maxilla              | 2 (5.6)  | 2 (5.6)           | 1 (2.8)           | 1 (2.8) | 6 (16.7)  |
| Ramus+coronoid             | 0        | 1 (2.8)           | 2 (5.6)           | 2 (5.6) | 5 (13.9)  |
| Condyle                    | 0        | 9 (25.0)          | 2 (5.6)           | 1 (2.8) | 12 (33.3) |
| None                       | 0        | 0                 | 0                 | 1 (2.8) | 1 (2.8)   |
| Total                      | 11 (30.6)| 14 (38.9)         | 5 (13.9)          | 6 (16.7) | 36 (100)  |

Values are presented as number (%).

\( \chi^2 = 38.479, \text{ degree of freedom}=15, P=0.001. \)

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### Table 5. Distribution of degree of intraoperative mouth opening and type of procedure

| Mouth opening (cm) | Ramus | Ramus+maxilla | Ramus+condyle | Ramus+coronoid | Condylar | None | Total |
|--------------------|-------|---------------|---------------|----------------|----------|------|-------|
| 3.2                | 0     | 0             | 1 (2.8)       | 0              | 0        | 1 (2.8) | 1 (2.8) |
| 3.4                | 0     | 0             | 1 (2.8)       | 1 (2.8)        | 0        | 2 (5.6) | 2 (5.6) |
| 3.5                | 3 (8.3)| 0             | 0             | 3 (8.3)        | 0        | 6 (16.7)| 6 (16.7)|
| 3.6                | 0     | 1 (2.8)       | 1 (2.8)       | 0              | 0        | 2 (5.6) | 2 (5.6) |
| 3.8                | 2 (5.6)| 0             | 2 (5.6)       | 3 (8.3)        | 0        | 7 (19.4)| 7 (19.4)|
| 4.0                | 1 (2.8)| 3 (8.3)       | 0             | 2 (5.6)        | 1 (2.8)  | 7 (19.4)| 7 (19.4)|
| 4.2                | 1 (2.8)| 0             | 2 (5.6)       | 0              | 0        | 3 (8.3) | 3 (8.3) |
| 4.5                | 1 (2.8)| 0             | 0             | 0              | 0        | 1 (2.8) | 1 (2.8) |
| 4.6                | 0     | 1 (2.8)       | 0             | 0              | 0        | 1 (2.8) | 1 (2.8) |
| 5.0                | 2 (5.6)| 2 (5.6)       | 1 (2.8)       | 1 (2.8)        | 0        | 6 (16.7)| 6 (16.7)|
| Total              | 10 (27.8)| 6 (16.7)     | 5 (13.9)      | 12 (33.3)      | 1 (2.8)  | 36 (100)|       |

Values are presented as number (%).

\( \chi^2 = 45.614, \text{ degree of freedom}=45, P=0.333. \)

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### Table 6. Distribution of procedure conducted and complications

| Procedure                  | Hemorrhage | Facial nerve palsy | Re-ankylosis | None | Total |
|----------------------------|------------|--------------------|--------------|------|-------|
| Ramus+condyle              | 0          | 1 (2.8)            | 0            | 11 (30.6)| 12 (33.3)|
| Ramus+maxilla              | 0          | 0                  | 0            | 6 (16.7)| 6 (16.7)|
| Ramus+coronoid             | 2 (5.6)    | 0                  | 3 (8.3)      | 5 (13.9)|
| Condyle                    | 2 (5.6)    | 0                  | 10 (27.8)    | 12 (33.3)|
| None                       | 0          | 1 (2.8)            | 0            | 1 (2.8)|
| Total                      | 4 (11.1)   | 1 (2.8)            | 30 (83.3)    | 36 (100)|

Values are presented as number (%).

\( \chi^2 = 45.28, \text{ degree of freedom}=15, P=0.000. \)

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### Table 7. Distribution of type of incision and complications

| Type of incision           | Hemorrhage | Facial nerve palsy | Re-ankylosis | None | Total |
|----------------------------|------------|--------------------|--------------|------|-------|
| Post-ramus                 | 0          | 0                  | 9 (25.0)     |      | 9 (25.0)|
| Post-ramus+upper buccal sulcus | 0     | 0                  | 12 (33.3)    |      | 12 (33.3)|
| Bramley-Al-Kayat           | 4 (11.1)   | 0                  | 11 (30.6)    | 15 (41.7)|
| Bramley-Al-Kayat+upper buccal sulcus | 0      | 1 (2.8)            | 1 (2.8)      |      | 1 (2.8)|
| Bramley-Al-Kayat+post-ramus| 0          | 1 (2.8)            | 0            | 1 (2.8)|
| Brisement                  | 0          | 1 (2.8)            | 0            | 1 (2.8)|
| Preauricular               | 0          | 0                  | 7 (19.4)     |      | 7 (19.4)|
| Total                      | 4 (11.1)   | 1 (2.8)            | 30 (83.3)    | 36 (100)|

Values are presented as number (%).

\( \chi^2 = 78.080, \text{ degree of freedom}=18, P=0.000. \)

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Balaji addressed this issue by anchoring the temporalis muscle flap to the submandibular region in order to inhibit the aforementioned postoperative muscle contraction. Other graft materials include the masseter muscle, fascia lata, and auricular cartilage. Silastic, Proplast-Teflon, and metallic fossa implants and acrylic marbles have also been used as alloplastic interpositional materials; however, use of these materials is fraught with high failure rates. No alloplastic material was used in our series.

The oldest method of managing fibrous ankylosis involves the application of brisement force using instruments to force the mouth open while the patient is under local or general anesthesia. The only patient with fibrous ankylosis in our series was treated in this manner.

Massive intraoperative hemorrhaging was observed as a complication in 4 patients (11.1%) who underwent condylar and coronoid ostectomies (2 each, 5.6%). We reason that, because most of our patients could not afford CT, using plain radiographs limited the extent of preoperative assessment. Furthermore, Metwalli have reported that the distances between the internal carotid artery, the internal jugular vein, the maxillary artery, and the medial pole of the mandibular condyle were reduced in TMJA patients when compared to patients without ankylosis. The severe hemorrhaging was managed by blocking the bridged sigmoid sinus with bone wax and a pressure pack. The use of bone wax in controlling osseous bleeding has been documented in literature. However, this process is fraught with complications like delayed bone healing, surgical site infection, and osteomyelitis. In our case, however, these complications were not observed. The pressure pack was removed 5 days after the operation. The patient, who was suffering from facial nerve palsy, was prescribed and administered vitamin B complex followed by physical therapy of the facial muscles. The patient’s condi-
tion improved with time as injury to the facial nerve was neuropraxia. Temporal loss of motor function of a nerve due to blockage of nerve conduction from compression of the nerve by bruising of the nerve or by inflammatory edema. A bilateral condylectomy was planned for the patient with re-ankylosis, but the patient did not report back to the hospital. During the follow-up period, almost all patients (35 patients, 97.2%) did not have a reduced mouth opening compared to the intraoperative measurement. We attribute this to the strict instructions they received on the importance of jaw physiotherapy for at least 6 months. Only 1 case (2.8%) of re-ankylosis was observed in our series, and it occurred in the patient with fibrous ankylosis. This patient is a young boy in secondary school who is living in the school student house with no supervision on jaw physiotherapy, which may have led to re-ankylosis. The patient’s compliance to aggressive physiotherapy is essential to prevent re-ankylosis in the case of either bony or fibrous ankylosis.

V. Conclusion

Although CT is the standard investigative procedure for TMJA, plain radiographs, with their shortcomings, have a significant role in resource-scarce environments. Interpositional gap arthroplasty using a temporalis fascia/muscle flap is a viable treatment choice in managing TMJA due to its excellent vascular supply and association with minimal complications and morbidity. Anchoring the flap to the sub-mandibular region is encouraged. Furthermore, aggressive postoperative physiotherapy for a sufficient period of time (minimum of 6 months) is paramount.

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Authors’ Contributions

R.B. was the initiator of the concept, involved in the design, definition of intellectual content, literature search, manuscript preparation, manuscript editing and manuscript review. A.T. was involved in definition of intellectual content, manuscript preparation, and manuscript review. A.I. was involved in definition of intellectual content, manuscript preparation, and manuscript review. T.O. was involved in the data collection, definition of intellectual content, manuscript preparation and manuscript review. M.A. was involved in definition of intellectual content, manuscript preparation, and manuscript editing. F.A. was involved in the data collection, manuscript editing and manuscript review, while S.A. was involved in data collection, manuscript editing and manuscript review. All authors read and approved the final manuscript.

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Ethics Approval and Consent to Participate

Ethical approval was obtained from the ethics and research committee of Usmanu Danfodiyo University Teaching Hospital (UDUTH/HREC/2017/No. 590).

Consent for Publishing Photographs

Written informed consent was obtained from the patients for publication of this article and accompanying images.

Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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