

# Buccal Fat Pad for Interpositional Arthroplasty in Temporomandibular Joint Ankylosis

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## Abstract

**Aim** The buccal fat pad (BPF) is a readily accessible mass of adipose tissue in the oro-maxillofacial region. It is a specialized type of fat tissue that enhances intermuscular motion. It has been used extensively for reconstruction of oral cavity defects with satisfactory outcomes. However, its use as an interpositional material in the management of temporomandibular joint ankylosis is not widespread. This report aims to present our experience with its use as an interpositional tissue in the management of temporomandibular joint ankylosis.

**Materials and Methods** A total of four patients who presented with either unilateral or bilateral temporomandibular joint ankylosis were included in this study. Three patients presented with bilateral temporomandibular joint ankylosis while one patient had right unilateral bony ankylosis of the temporomandibular joint. All the patients were treated under general anaesthesia during which airway was maintained intraoperatively using tracheostomy tubes. In all cases, interpositional arthroplasty using BPF as the interpositional material was done.

**Results** There were two males and two females with age range between 4 and 24 years and a median age of 12.5 years. Trauma was the aetiological factor in all cases. There were a total of seven ankylosed joints. Autogenous pedicled BPF was used in five joints, while BPF graft was utilized in two joints. Maximal interincisal opening of

35 mm or more was achieved intraoperatively before placement of the BPF in all cases. Immediate postoperative jaw exercise was commenced. Mouth opening remained satisfactory at all postoperative reviews.

**Conclusion** Buccal fat pad is a reliable option for interpositional arthroplasty in the management of TMJ ankylosis, and it can be used either as a free graft or as a pedicled flap.

**Keywords** Ankylosis · Buccal fat pad · Temporomandibular joint

## Introduction

Temporomandibular joint (TMJ) ankylosis is a pathological condition characterized by abnormal consolidation or fusion between the mandibular condyle and the glenoid fossa or base of the skull with resultant limitation or complete failure of TMJ movement and mouth opening ability [1–3]. This fusion may be fibrous or bony depending on a variety of factors [4, 5]. It is one of the most frequently encountered pathologies of the facial bones, with potentially devastating effects on the patients [2, 6]. These include functional disability, aesthetic challenges, and psychological limitations [6]. Management of TMJ ankylosis poses a challenge to the surgeon. Perhaps the most prominent of these is the risk of re-ankylosis. Frequently used surgical techniques for treatment of TMJ ankylosis include gap arthroplasty, interpositional arthroplasty, and joint reconstruction among others.

Gap arthroplasty and interpositional arthroplasty are commonly used surgical techniques in the management of TMJ ankylosis. Both of these techniques are fraught with the risk of re-ankylosis [5]. However, Ma et al. [7] in a

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meta-analysis concluded that patients benefited more from interpositional arthroplasty than gap arthroplasty. Different types of interpositional materials have been used over the years, which may be biological or non-biological [8, 9]. Examples of biological materials used include temporalis fascia, fascia lata, muscle, skin graft and cartilage [8, 9]. A study by Chossegross et al. [10] concluded that skin grafts offer better results than the use of cartilage or temporal muscle flap. More recently, the buccal fat pad (BFP) was introduced as an alternative to these options. The BFP also called the Bichat fat pad is a lobulated, encapsulated, vascularized aggregate of fat which is present at infancy and whose volume increases with age [11–14]. It has been employed in the management of several oral defects since the first report of its use in this regard by Egyedi [13]. It has been used in the management of oro-antral fistulae, palatal clefts, and even submucosal fibrosis [13, 15]. However, its use as an interpositional biologic material in the management of TMJ ankylosis has seldom been reported. One of the few reports on it was that by Rattan et al. [16], which stated its successful use as an interpositional tissue. This report is aimed at disseminating our experience with the use of BFP as an interpositional tissue in the management of TMJ ankylosis.

## Materials and Methods

Ethical approval for this study was obtained from the Health Research and Ethics Committee of the Lagos University Teaching Hospital. A total of four patients who presented with either unilateral or bilateral bony ankylosis of the TMJ were included in this study. Three patients presented with bilateral TMJ ankylosis, while one patient presented with unilateral bony ankylosis of the TMJ. Tracheostomy was performed electively preoperatively in order to facilitate airway maintenance for general anaesthesia. The surgical approach in all cases was the standard preauricular incision. In all cases, an initial gap arthroplasty was done, following which the BFP was introduced as an interpositional tissue. The BFP was introduced either as a pedicled flap or as a graft in all the cases. The age, sex, and postoperative interincisal mouth opening were recorded. All patients had aggressive postoperative jaw exercise and are still being followed up.

## Surgical Technique

The joints were approached via standard preauricular incisions, after which blunt dissection and careful avoidance of important anatomical structures were done until the TMJ was accessed. Dissection was continued inferiorly until normal mandibular bone inferior to the ankylotic mass

was encountered. A flat, broad and thin instrument such as a tongue blade was then introduced deep to the mandible, just inferior to the ankylotic mass, after which a block of bone was sectioned off to create a gap of 1.5–2.0 cm between the resulting bone segments. Sectioning was done with the aid of a rotary surgical drill under copious irrigation with normal saline. In bilateral ankylosis, the patient was repositioned and the same procedure was carried out on the other side. Mouth opening was then evaluated, where unsatisfactory, coronoidectomy was performed either bilaterally or unilaterally. The mouth was constantly opened and closed to verify the absence of any impediment to joint movement.

In all cases, the BFP was harvested via the intraoral approach. Prior to making the incision, 5 ml of 1:200,000 Adrenaline was infiltrated into the upper buccal sulcus opposite the upper second permanent molar. In children, this was done just posterior to the upper deciduous second molar. A 2-cm-long horizontal incision was then placed in the trough of the upper vestibule; blunt dissection was then done to expose the BFP. A non-toothed tissue forceps was then introduced through the extraoral incision, passing in between the created interbony gap. The BFP was carefully picked with the non-toothed forceps and withdrawn into the surgically created interbony gap where it is inset (Fig. 1). Moreover, it was sutured to the surrounding soft tissue to avoid its displacement.

In cases where the BFP was used as a graft, it was completely extracted through the intraoral approach described and then inset into the interbony gap via the



**Fig. 1** BFP inset into the gap

extraoral incision. It was also sutured in place as described. Mouth opening was re-evaluated, and suturing of the surgical incisions was done appropriately. Maximum interincisal opening of at least 35 mm was achieved intraoperatively. Aggressive jaw exercise using a stack of wooden spatula was initiated at the within the first 24 h postoperatively to maintain the mouth opening ( $\geq 35$  mm) (Fig. 2).

## Results

Four patients (two males and two females) with age range of 4–24 years were included. A total of seven ankylosed joints were treated (Table 1). Three patients (two males and one female) presented with bilateral TMJ ankylosis, while one female presented with unilateral TMJ ankylosis. Interincisal distance (IID) at presentation ranged between 0 mm and 8 mm (Table 1 and Fig. 3). Trauma was the identified aetiological factor in all cases. The BFP was used as a pedicled flap and a graft in four (4) and three (3) joints, respectively (Table 1).

An interincisal mouth opening of not less than 35 mm was obtained intraoperatively and maintained or improved upon postoperatively by the immediate postoperative commencement of jaw exercise (Fig. 2). All patients were followed up for a minimum of 1 year, during which reviews were satisfactory (Table 1, Figs. 4, 5). No case of

re-ankylosis was recorded. Some of them were lost to follow-up thereafter due to various reasons.

## Discussion

All the patients had severe limitation of their mouth opening ability, thus making airway management during general anaesthesia a serious challenge. Different options for intraoperative airway maintenance have been documented in the literature [17]. This includes the use of blind nasal intubation, retrograde intubation, naso-tracheal fiberoptic intubation and tracheostomy [17, 18]. Each method has its merits and demerits. The blind nasal intubation technique frequently involves repeated attempts at intubation, which may lead to significant laryngeal oedema and loss of airway [18].

Retrograde intubation is generally an intricate manoeuvre that requires a certain level of skill [18, 19]. Moreover, it is especially difficult to execute in patients with limited mouth opening [18]. Naso-tracheal fiberoptic intubation under sedation with spontaneous ventilation is recommended as the method of choice for airway maintenance in patients with TMJ ankylosis [18]. This method reduces the tendency for muscle relaxation and consequent airway collapse to a minimum [18]. Tracheostomy is a surgically created airway that is relatively cheap, accessible and does not require sophisticated equipment [20]. However, it is fraught with associated morbidities [20]. Tracheostomy was utilized in these cases due to the non-availability of fiberoptics in our centre.

Gap arthroplasty and interpositional arthroplasty are the most frequently utilized surgical techniques for treatment of TMJ ankylosis [7]. Perhaps the most challenging postoperative complication of surgical treatment of TMJ ankylosis is re-ankylosis [5, 21, 22]. To prevent this, different authors have postulated various methods of reducing the occurrence of this tricky complication [4, 7]. Interpositional arthroplasty has been reported to give better long-term outcome in comparison with gap arthroplasty [7].

The inevitable presence of dead space following gap arthroplasty is believed to encourage organization and subsequent re-ankylosis [23, 24]. Several interpositional materials have been reported in the literature, ranging from biologic to non-biologic types [8, 10, 25]. Biologic tissues have distinct advantages over their non-biologic counterparts. These advantages are even more pronounced when the biologic tissue is autogenous in nature.

The BFP is a biologic tissue, which can be harvested autogenously, thus offering distinctive advantages [13, 26]. It is an anatomically complex locus of fatty tissue that is situated between the masseter and buccinator muscles [26]. BFP possesses a centrally positioned body which is just



**Fig. 2** Satisfactory 24 h postoperative mouth opening (IID of at least, 35 mm)

**Table 1** Shows the age, preoperative mouth opening measurement and postoperative mouth opening measurements among the patients

Age (years)	Interpositional material	Preoperative interincisal mouth opening (mm)	Postoperative mouth opening at 1 month review (mm)	Postoperative mouth opening at 3 month review (mm)	Postoperative mouth opening at 7 month review (mm)	Postoperative mouth opening at 12 months review (mm)	Mean ( $\pm$ SD) of postoperative mouth openings (mm)
4	Graft	2	36.00	33.00	36.00	35.00	35 ( $\pm$ 1.41)
9	Graft	0	35.00	37.00	38.00	38.00	37 ( $\pm$ 1.41)
16	Flap	4	38.00	37.00	38.00	37.00	37.5 ( $\pm$ 0.58)
24	Flap	8	35.00	35.00	35.00	36.00	35.3 ( $\pm$ 0.5)



**Fig. 3** Preoperative interincisal distance (IID) of a 24-year-old female with bilateral bony Ankylosis



**Fig. 5** Postoperative mouth opening at 7 months (IID = 35 mm)



**Fig. 4** Postoperative mouth opening at 3 months (IID = 35 mm)

superior to the parotid duct and anterior to the superior aspect of the masseter [27]. Four extensions (temporal, pterygoid, pterygopalatine, and buccal) emanate from the central body of the BFP into intermuscular spaces, thus

aiding intermuscular movement [14, 26, 28]. It has a robust blood supply, which is majorly from branches of the facial and maxillary arteries, thus imbuing it with some resilience [29].

Its functions include adding to the cheek prominence observed in infants and acting as a cushion or gliding pad between muscles [14]. Reports indicate that when the BFP graft is left uncovered, it gradually undergoes surface epithelialization within 6–8 weeks and eventual replacement by fibrous tissue [30]. When used as an intervening material, such as in TMJ ankylosis, it has been reported to maintain its viability and prevent heterotopic bone formation [31].

Its ability to epithelialize may be an indication of the BFP’s capacity to persist as an interpositional material in situ, thereby forming an effective barrier between the raw bone edges until there is little or no risk of re-ankylosis [11, 13, 29]. Wolford et al. [23] reported that interposing autogenous fat grafts around TMJ prosthetic replacements improved patients’ postoperative mouth opening ability significantly. They concluded that interposing autogenous fat graft between TMJ prostheses and the adjacent tissues resulted in reduced formation of postoperative fibrosis and/or heterotopic calcification, resulting in a comparatively better mouth opening ability [23]. This is supported by the observation that patients’ mouth opening ability in this

study was satisfactory ( $\geq 35$  mm) at all postoperative evaluation visits.

Studies on the fate of transplanted grafts to other sites have reported that the BFP exhibits a decrease in volume ranging from 25 to 75% over time [32–34]. Although volumetric changes in the BFP graft or flap were not assessed in this study, we opine that the BFP serves as an interpositional tissue long enough to allow eburnation of the bone segments to occur, thus reducing the chances of re-ankylosis considerably. Hariram et al. [35], in a comparison of the effectiveness of BFP and sandwich graft (hydroxyapatite crystals embedded within collagen sheath) used in the closure of oro-antral defects, concluded that the BFP is superior to the sandwich graft.

The foregoing is an indication of the ability of BFP to remain viable even when used as a graft. The success of the BFP is perhaps a reflection of its ease of harvest, vascularity, ability to epithelialize and its encapsulation [13, 36]. Moreover, it is autogenous; therefore, it has no risk of graft rejection by the host. It may also leverage on its good blood supply for survival especially when harvested as a pedicled flap [37].

The use of the BFP as an interpositional material may pose certain challenges. Interposing the BFP between the surgically created interosseous gap requires care in order to maintain the integrity of the BFP. In addition, the friable nature of the BFP makes it susceptible to torsion or tension forces, which may result in its fragmentation. To avoid this, a non-toothed forceps was used with minimal force, in positioning the BFP. Additionally, it was observed that ensuring that the BFP remains in the interosseous gap as intended requires placement of stay-sutures aimed at securing it within the gap. In our series, BFP was sutured to the adjacent soft tissues in order to secure and maintain it within the gap.

Some of the patients were lost to follow-up after 1 year of regular reviews. Loss of patients to follow-up is a common occurrence in our environment, where once patients are free of complaints, they do not keep appointments regularly or stop coming for reviews altogether [38, 39]. Other proposed reasons for non-compliance with appointments include sociocultural influences and financial limitations [38, 39].

## Conclusion

Buccal fat pad was successfully used either as a free or as pedicled flap in the seven ankylosed temporomandibular joints. Interincisal mouth opening was satisfactory 1 year after surgery, and also no case of re-ankylosis was recorded after 1-year follow-up review. Buccal fat pad is an easily accessible, viable and reliable option for interpositional

arthroplasty in the management of TMJ ankylosis, and it can be used either as a free graft or as a pedicled flap.

## Compliance with Ethical Standards

**Conflict of interest** Adebayo A Ibikunle, O James and W. L. Adeyemo declare that they have no conflict of interest.

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