https://doi.org/10.48047/AFJBS.6.15.2024.14894-14906

African Journal of Biological Sciences

Journal homepage: http://www.afjbs.com

Research Paper Open Access

Lateral Thigh Dermis Fat As Interpositional Graft In The Management Of Temporomandibular Joint Ankylosis

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Volume 6, Issue 15, Nov 2024

Received: 27 Oct 2024

Accepted: 24 Nov 2024

Published: 06 Dec 2024

doi: 10.48047/AFJBS.6.16.2024.14894-14906

Abstract

Objective: This article presents the use of dermis fat grafts from the thigh as an alternative site for treating TMJ ankylosis. It highlights the advantages of using grafts from the lateral thigh compared to other harvesting sites.

Materials and Methods: Ten patients with TMJ ankylosis underwent surgical release and received dermis-fat grafts from the lateral thigh. Patients were monitored for at least 6 months. Evaluation criteria included maximum inter-incisal opening (MIO), pain during physiotherapy, scar perception at the donor site, complications, and ankylosis recurrence.

Results: All 10 patients had unilateral TMJ ankylosis. The initial mean inter-incisal opening was 5.0 mm, significantly improving to 35.7 mm after surgery. No re-ankylosis occurred during the one-year follow-up. Post-operative was associated with reduced pain, and patients showed improved compliance (as reflected by mean VAS score: 4). Two patients had hypertrophic scars, managed with steroid injections. Donor site scars on the lateral thigh were inconspicuous due to clothing, with no impact on daily life.

Conclusion: Utilizing dermis-fat grafts from the lateral thigh in TMJ ankylosis surgery yields comparable mouth-opening outcomes to other graft sites. Additional benefits include greater fat quantity for better cushioning, minimal scar visibility, and improved patient acceptance.

Keywords: Dermal Fat Graft, Interpositional arthroplasty, Lateral Thigh Dermal Fat graft, TMJ Ankylosis.

Introduction

Temporomandibular joint ankylosis is a condition characterized by the fusion of joint components, resulting in functional impairment caused by either bony or fibrous adhesions [1]. Surgical interventions for TMJ ankylosis commonly involve either gap arthroplasty or interpositional grafting [2]. Over the years, various interpositional grafts have been employed, including indigenous pterygo-masseteric slings, temporomandibular meniscus, temporalis muscle/fascia, skin, auricular cartilage, fat, and dermis-fat [2].

Recent studies [2 - 4] have highlighted the potential of dermal fat grafts as a promising option. Dimitroulis first described the use of abdominal dermis-fat grafts as interpositional material for TMJ ankylosis in 2004 [2]. The most commonly utilized sites for harvesting dermal fat have traditionally been the abdomen and groin. However, these areas often present challenges, such as visible scars, especially in female patients due to cultural dressing norms in our country. Additionally, lean patients may have limited fat availability in the abdomen. Considering the associated issues with existing donor sites, this study explores the use of dermal fat harvested from the lateral thigh as an alternative site. The advantages of obtaining dermal fat from the lateral thigh are noteworthy. The thigh provides a substantial amount of dermal fat, and the hidden donor site scar is advantageous, particularly for female patients in cultures where abdominal scars may be visible due to dress preferences. To the best of our knowledge, there have been no reports in the literature discussing the advantages and disadvantages of dermal fat grafts harvested from different sites for use as interposition material in the surgical management of TMJ ankylosis.

This article aims to present the utilization of dermal fat grafts obtained from the thigh as an alternative site for harvesting dermal fat as interposition material for the treatment of TMJ ankylosis. The paper highlights the advantages of utilizing dermal fat grafts harvested from the lateral thigh compared to previously employed sites such as abdomen and iliac crest region.

Material and Methods

Patient Selection: A total of 10 clinically and radiologically confirmed cases of temporomandibular joint ankylosis, consisting of 6 cases of right TMJ ankylosis and 4 cases of left TMJ ankylosis, were included in the study. These cases were identified between the years 2020 and 2022, and the patients' ages ranged from 10 to 20 years, with a mean age of 13.5 years. The patients attended the OPD of the Department of Oral and Maxillofacial Surgery at our institute, presenting with a chief complaint of reduced mouth opening. The study was carried out after obtaining institutional ethical clearance and written consent was obtained from all the participants.

Investigations and Consent: History, clinical examination, and additional investigations such as Orthopantomogram (OPG) or CECT of Face and Neck with 3D Recon were conducted to finalize the diagnosis (Figure 1). Written consents were obtained from all patients, outlining the surgical method to be used and potential associated complications. The treatment plan involved interpositional arthroplasty using dermal grafts from the lateral thigh. Different sites for harvesting dermal fat were discussed with each patient, and only those who provided consent for the lateral thigh dermal fat procedure were included in the study.

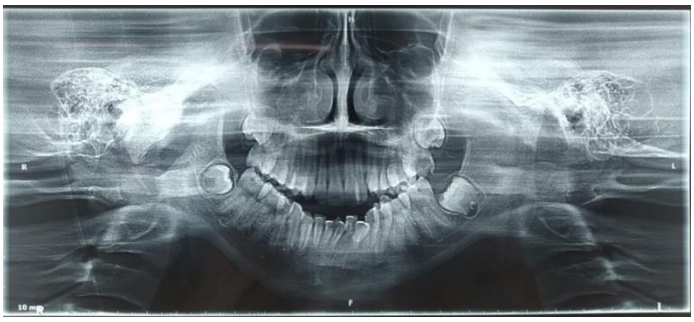

Fig. 1: Preoperative orthopantomogram (OPG) showing Right side TMJ ankylosis.

Surgical Technique: All surgeries were performed under general anesthesia by a single surgeon. The joints were exposed through an extended pre-auricular incision, and a gap arthroplasty was performed to create a minimum gap of 1–1.5 cm, achieving the desired mouth opening according to Kaban's protocol (Figure 2). Dermis-fat grafts were harvested from the lateral thigh at the vastus lateralis through an elliptical incision measuring 6 cm x 3 cm (Figure 3). The dermis was carefully exposed by de-epithelializing the area while preserving the dermis and the required volume of dermis fat graft was obtained. The graft was folded onto itself with the dermis surfaces apposed and passively placed into the defect, ensuring complete filling of the gap or cavity and elimination of any dead space. No effort was made to anchor or suture the graft. The wound margins at the donor site were undermined, and layered closure was performed. A vacuum suction drain was placed, and the pre-auricular incision was closed in layers, followed by the application of a pressure bandage.

Figure 2: intra-operative mouth opening after creating sufficient gap.

Figure 3: Harvesting of dermal fat from lateral thigh.

Postoperative Care: The suction drain was removed after 48 hours, and the sutures from the preauricular region were removed after 1 week, while those from the lateral thigh were removed after 10 days. All cases showed uneventful healing. Physiotherapy was initiated 7 days postoperatively and continued for several months. The patients were provided with small wooden spatulas (each 1 mm thick) to incrementally increase the mouth opening by 1 mm per day. Periodic follow-ups were conducted at 1 month and six months postoperatively.

Assessment of parameters: The patients were evaluated for maximum inter-incisal opening (MIO), pain during physiotherapy, perception of postoperative scar at the donor site, donor site complications, and recurrence of ankylosis. MIO was measured as the distance between the upper and lower incisors when the mouth was opened to maximum (Figure 4). Pain was measured by a 10-point visual analogue scale (VAS) in which a score of 0 was recorded as no pain, score 1–4 as mild pain, 5–7 as moderate pain and 8–10 as severe pain. Donor site scar perception was assessed using patient feedback (Figure 5). Patients were encouraged to express their thoughts and feelings regarding the scar visibility, whether they find it noticeable or inconspicuous, and any concerns or satisfaction they may have.

Figure 4: Mouth opening at 1 year of follow-up.

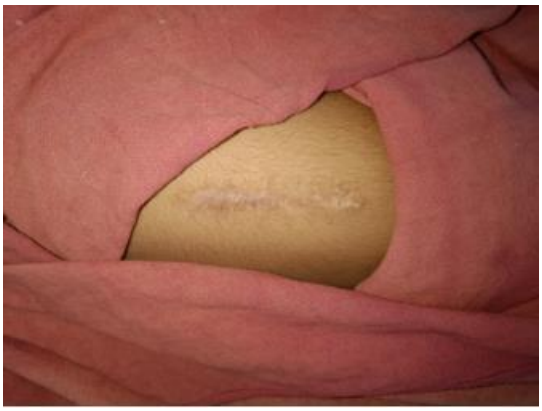

Figure 5: Scar at donor site (Lateral thigh) after harvesting dermal fat.

Results

A total of 10 patients with TMJ ankylosis were enrolled in the study. Unilateral ankylosis was observed in all cases, with 6 patients affected on the right side and 4 patients on the left side (Table 1, Figures 6 &7). The gender distribution included 6 females and 4 males, with ages ranging from 10 to 20 years and a mean age of 14.5 years. Trauma resulting from motor vehicle accidents or falls was ankylosis in all cases.

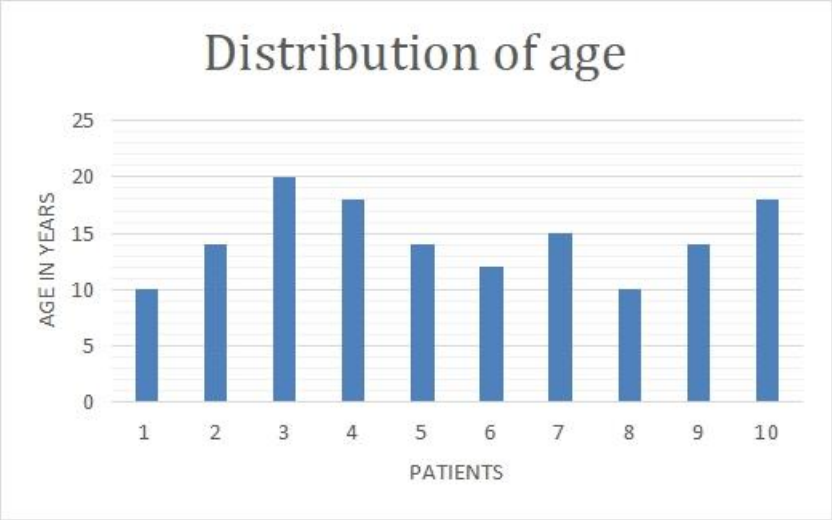

Figure 6: Graph demonstrating distribution of age of the patients (n=10).

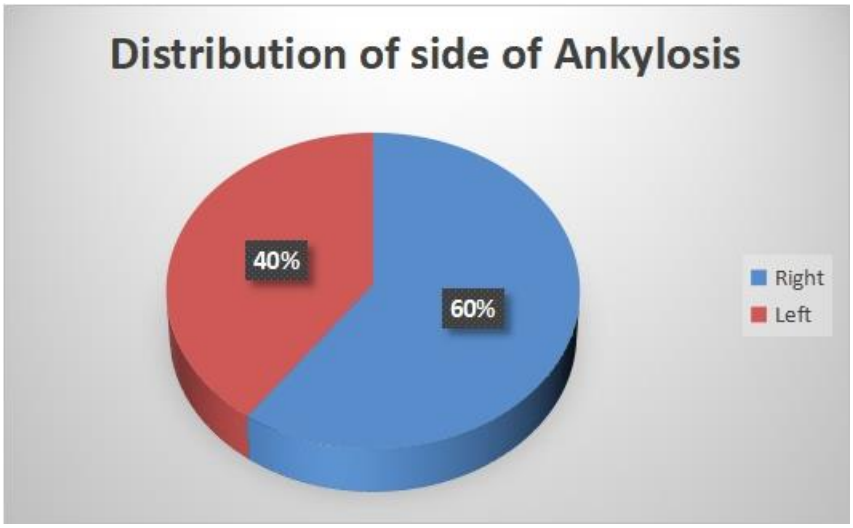

Figure 7: Pie diagram showing distribution of side of TMJ ankylosis (n=10).

Prior to surgery, the pre-operative inter-incisal mouth opening (MMO) ranged from 2 to 8 mm, with an average MMO of 5 mm. Following the surgical release of TMJ ankylosis, the unassisted MMO achieved varied between 36 and 42 mm, with an average of 39.2 mm. At the 1-year follow-up, the postoperative MMO remained relatively stable compared to the immediate postoperative measurement, ranging from 36 to 42 mm, with an average of 38.2 mm (Table 1, Figure 8).

Figure 8: Graph showing preoperative, intra-operative and post-operative mouth opening (n=10).

Physiotherapy was initiated 7 days postoperatively and continued for several months. Patients were provided with small wooden spatulas, each 1 mm thick, to incrementally increase mouth opening by 1 mm per day. Pain experienced during exercise was assessed using the Visual Analog Scale (VAS), with scores ranging from 2 to 4 and an average score of 3. Initially, mild pain was observed during the early days of postoperative mouth opening exercises; however, most patients became pain-free after 2 to 3 weeks, resulting in improved compliance with the physiotherapy regimen (Table 2, Figure 9).

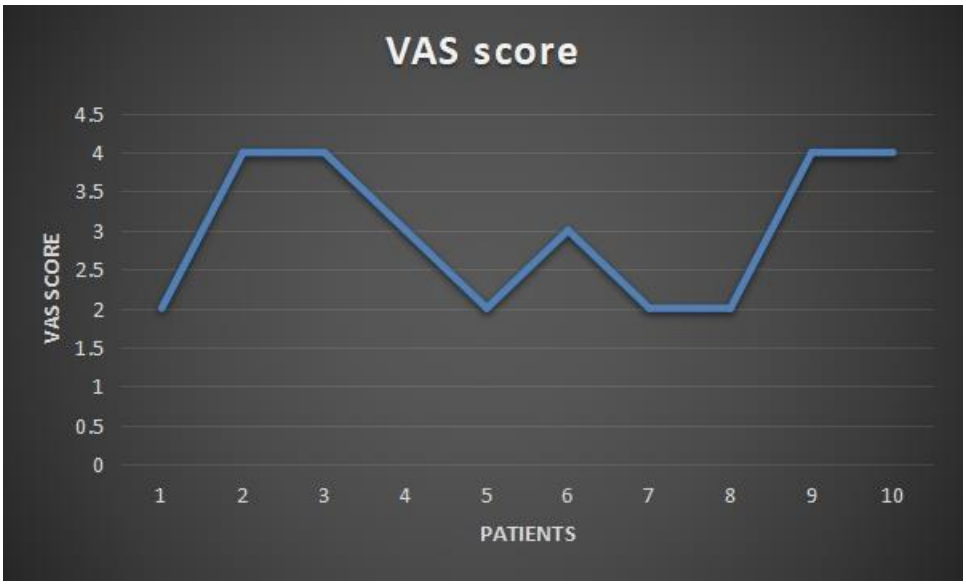

Figure 9: Graph showing visual analogue score for pain assessment during post-operative physiotherapy (n=10).

Patient feedback regarding donor site scar perception indicated that all patients perceived the scar as inconspicuous (Table 3, Figure 10). None of the patients expressed any concerns or emotional impact related to the donor site scars, which were located on the lateral thigh and rarely noticeable due to the clothing worn by the patients. In two patients who expressed concerns about hypertrophic scar development, the issue was resolved through intra-lesional steroid injections. No cases of postoperative donor site infection were reported.

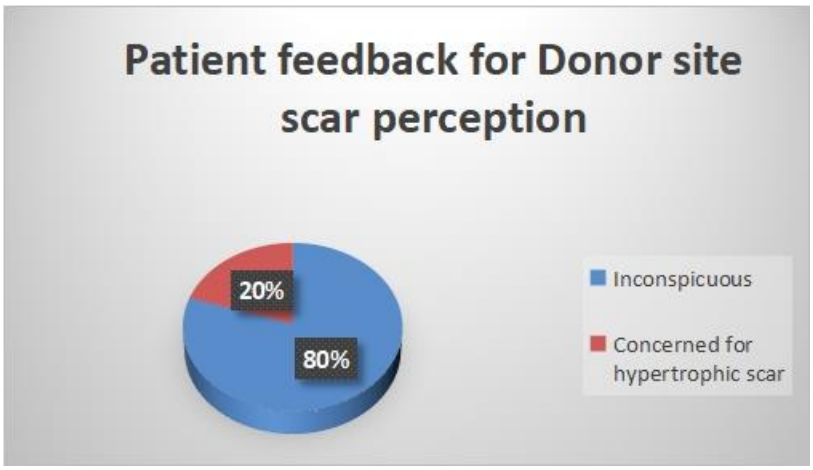

Figure 10: Pie diagram showing distribution of feedback for donor site scar perception (n=10).

During the 1-year follow-up period, none of the patients experienced re-ankylosis, and no other complications were recorded.

Discussion:

TMJ ankylosis, a condition that severely impacts chewing, speaking, and oral health, can cause substantial psychological issues. During the growth phase, TMJ ankylosis can lead to facial deformities, particularly affecting the jaw [5]. The objectives of treating TMJ ankylosis involve enhancing mouth opening, jaw functionality, and preventing reankylosis, while also accounting for potential jaw growth in younger individuals [6]. The primary method for managing TMJ ankylosis involves a combination of surgical intervention and postoperative physiotherapy.

The surgical procedure aims to achieve two primary objectives: releasing the ankylosis to restore jaw movement and function, and preventing relapse through interpositional grafting, early jaw mobilization, and intensive physiotherapy. Various interpositional materials have been used, including alloplastic materials (e.g., silastic, silicone, proplast, Teflon, acrylic, metals) and autogenous materials (e.g., muscle, fascia, cartilage, fat, costochondral grafts, metatarsals, metacarpophalangeal joint transfer, sternoclavicular joint transfer, full-thickness skin graft, temporalis myofascial flap, and dermis fat) each with its own advantages and disadvantages [7-12].

Nonetheless, at present, there is a lack of an optimal interpositional graft option [5, 13]. The current grafts available have certain limitations, including muscle shrinkage and fibrosis [11], insufficient bulk in fascia [14], fibrosis and calcification in cartilage [13, 15], as well as disintegration and foreign body reactions when subjected to functional loads in the case of alloplastic implants [16, 17]. While temporalis flaps are commonly utilized, dissecting the temporalis muscle can result in scar contracture at the donor site, potentially exacerbating trismus unless an ipsilateral coronoidectomy is performed [11].

The use of dermis grafts raises a significant concern regarding the adverse effects at the donor site. Additionally, challenges arise when attempting to secure the graft to the surrounding tissues, and there is a rare incidence of dermoid cysts [18]. In a study conducted by Dimitroulis, magnetic resonance imaging (MRI) was employed to assess dermis as an interpositional material. The study revealed that dermis lacks the ability to bear loads, as evidenced by the absence of dermis tissue in the MRI scans of numerous patients [19].

Studies have indicated that autogenous free fat grafts possess the ability to inhibit scar formation by serving as proficient agents for hemostasis and filling spaces, thereby impeding the build-up of scar tissue or bone [20, 21]. Nevertheless, managing autogenous fat grafts can present difficulties, and extensive research has revealed that when placed within the joint cavity, fat grafts tend to fragment over time, leading to an average volume reduction of 45% due to shrinkage [22, 23].

The utilization of abdominal dermis fat grafts in TMJ surgery for patients with ankylosis was first documented by Dimitroulis in 2004. He noted that fat grafts alone were prone to fragmentation, but when combined with dermis, the fat exhibited enhanced stability and reduced susceptibility to fragmentation during handling and manipulation. This particular graft presents several advantages, including its ability to conform to contours, a high survival rate (aided by early vascular ingrowth resulting from the removal of the surface epidermis), and the maintenance of volume (with dermis fat experiencing a mere 15% resorption rate) [2].

While the abdomen and groin have traditionally been the most commonly used sites for harvesting dermal fat grafts, they present challenges such as visible scars, particularly in female patients, due to cultural dressing norms. Additionally, lean patients may have limited fat

availability in the abdomen. Considering the issues associated with existing donor sites, this study explores the use of dermal fat harvested from the lateral thigh as an alternative site. Harvesting dermal fat from the lateral thigh offers significant advantages, including a substantial amount of available dermal fat and a hidden donor site scar, which is especially advantageous for female patients in cultures where abdominal scars may be visible due to dress preferences.

In this study, we enrolled a total of 10 patients with TMJ ankylosis. All patients had unilateral ankylosis, with 6 patients affected on the right side and 4 patients on the left side (Table 3). The gender distribution included 6 females and 4 males, with ages ranging from 10 to 20 years and a mean age of 14.5 years. Trauma resulting from motor vehicle accidents or falls was identified as the cause of ankylosis in all cases. These results are consistent with previous studies [6, 7, 24].

Prior to surgery, the pre-operative inter-incisal mouth opening (MMO) ranged from 2 to 8 mm, with an average MMO of 5 mm (Table 1). Following surgical release of TMJ ankylosis, unassisted MMO ranged from 36 to 42 mm, with an average of 39.2 mm. At the 1-year follow-up, the postoperative MMO remained relatively stable compared to the immediate postoperative measurement, ranging from 36 to 42 mm, with an average of 38.2 mm (Table 1). These findings are comparable to Dimitroulis' 2004 study [2].

Pain experienced during exercise was assessed using the Visual Analog Scale (VAS), with scores ranging from 2 to 4 and an average score of 3. Initially, mild pain was observed during the early days of postoperative mouth-opening exercises; however, most patients became pain-free after 2 to 3 weeks, resulting in improved compliance with the physiotherapy regimen (Table 2).

The lower pain scores observed in the dermis-fat graft group can be explained by the fact that dermis-fat grafts quickly adapt to any surface, providing a cushioning effect and resistance to impact and pressure [25]. Recent studies have demonstrated that dermis fat remains viable with good volume retention and does not fibrosed [26].

Although abdominal dermis fat grafts show promise as the material of choice with superior characteristics, the major drawback is the visible abdominal scar, which is a significant concern, especially for young patients. In our study, patient feedback regarding donor site scar perception indicated that all patients found the scar inconspicuous. None of the patients expressed concerns or emotional impacts related to the donor site scars, which were located on the lateral thigh and rarely noticeable due to the clothing worn by the patients. In cases where two patients expressed concerns about hypertrophic scar development, intra-lesional steroid injections successfully resolved the issue. No cases of postoperative donor site infection were reported.

During the 1-year follow-up period, none of the patients experienced re-ankylosis, and no other complications were recorded.

Based on our observations, it can be concluded that dermal fat graft harvested from the lateral thigh yields comparable results to other sites such as the abdomen and iliac crest, with the additional advantages of a hidden scar, which is more acceptable to patients compared to scars on the abdomen and iliac crest. Moreover, a greater amount of fat can be harvested from the lateral thigh, even in lean patients. Scars on the lateral thigh are rarely noticeable due to the clothing worn by the patients. However, further long-term comparative studies with larger sample sizes are needed to precisely assess the advantages and disadvantages of harvesting

dermal fat from different sites as an interpositional material in the management of TMJ ankylosis.

Conclusion:

Comparing the use of dermal fat grafts harvested from the lateral thigh to those obtained from the abdomen and groin regions, several significant advantages emerge. These include:

Increased graft availability: The lateral thigh region provides a greater volume of adipose tissue, thus offering a more abundant source for dermal fat grafts compared to the abdomen and groin regions.

Enhanced graft stability and reduced fragmentation: Consistent with the observations by Dimitroulis, the incorporation of dermis with lateral thigh-derived grafts demonstrates improved stability and decreased susceptibility to fragmentation during handling and manipulation.

Optimization of scar concealment: Harvesting dermal fat grafts from the lateral thigh allows for superior scar concealment in comparison to the abdomen and groin regions. Precise incision placement in the lateral thigh area contributes to improved aesthetic outcomes by minimizing visible scarring.

Reduced donor site morbidity: Selecting the lateral thigh as the donor site for dermal fat graft harvesting may result in decreased donor site morbidity relative to the abdomen and groin regions. This can manifest as diminished postoperative pain, expedited wound healing, and a lower incidence of complications.

However, it is important to note that the selection of the most suitable donor site for dermal fat graft harvesting should be based on individual patient characteristics, surgeon expertise, and specific surgical requirements.

Funding

No funding provided for the study.

Declaration of Conflicting Interests

The Authors declares that there is no conflict of interest.

Ethical Approval and Consent

The study was carried out after obtaining institutional ethical clearance and written consent was obtained from all the participants.

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