

# Use of the Temporalis Myofascial Flap in Internal Derangement of the Temporomandibular Joint - An Evaluative Study

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## Abstract

**Introduction:** Internal derangement is an abnormal relationship between the articular disc and the mandibular condyle. The most common cause is trauma. Various classifications have been given for internal derangement. Initial management is done conservatively and if the disease is progressed, surgery is the option. Various surgical methods and interpositional materials following discectomy have been given in the literature. **Materials and Methods:** Over the past 15 years, we selected a group of 30 patients, Wilkes Class IV and V where conservative therapy had failed and were candidates for surgery. The patients had their disc repositioned, the damaged part of the disc was excised and disc was reinforced using the temporalis myofascial flap (TMF). In cases where the disc was non-salvageable, discectomy was done and TMF was placed between condyle and glenoid fossa, sutured with Prolene. The follow-up period was 3 years. **Results:** Of the 30 patients, there were 9 male and 21 female. Range of mouth opening was 3.3–3.8 cm with improvements in 1 year. The jaw relations gradually improved and were restored after 3 weeks. Patients were totally pain free in 6 months. **Discussion:** For the cases where surgery is the line of treatment, we strongly suggest disc repositioning and reinforcement with TMF as the flap is bulky, locally available and easy to harvest and causes no deformity at the donor site.

**Keywords:** Temporomandibular joint disc, temporomandibular joint disorders, temporomandibular joint

## INTRODUCTION

The term internal derangement of the temporomandibular joint (TMJ) relates to an abnormal relationship between the articular disc and the condyle, and the eminence that interferes with proper joint function.<sup>[1-4]</sup>

In TMJ internal derangement, meniscus loses coordination with condyle and disc condylar translation is affected. The possible aetiology is trauma at some stage. The other contributing factors include long dental treatment, clenching teeth and bruxism.<sup>[5,6]</sup>

The clinical manifestations appear after the disc gets anteriorly displaced in relation of condyle and eminence. This is probably due to loosening at the bilaminar zone where the upper lamina does not bring disc back to its normal position.

Disc displacement with reduction is defined as a condition in which the articular disc of TMJ is (most often anteriorly) displaced while the mouth is closed and the teeth are together in maximal occlusion. On opening, the condyle pushes against the posterior band of the disc until the condyle is able to snap under the posterior

band of the disc and the disc reduces to its position on top of the condyle. Overcoming the thick posterior band is responsible for the clicking or popping sound. On closing the mouth, the disc stays behind and slips off the condyle which may be accompanied by a clicking sound.<sup>[7]</sup> Disc displacement with reduction is reversible. Patient complains of pain, painful mouth opening and clicking but the routine function is not grossly affected. Medical treatment, arthrocentesis, lavage and arthroscopy help to relieve the pain and reverse the condition. In addition, dental occlusal splints are of help, although not universally accepted.

In disc derangement without reduction, the condyle is unable to slide back underneath the disc which is anteriorly or

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anteromedially or rarely anterolaterally displaced and does not reduce to its position on top of condyle during opening the mouth. The disc obstructs translation of condyle affecting the opening and contralateral movement. Patient complains of pain in TMJ, restricted joint movement, <20 mm mouth opening and inability to chew food. Patient shifts to a soft or liquid diet.

Diagnosis of disc displacement with or without reduction is based on a combination of the history, clinical examination and findings on an magnetic resonance imaging (MRI), which shows the position and shape of the disc in the open and closed-mouth position [Figure 1].<sup>[1,3,8]</sup>

Patients not benefitted by conservative therapies with long suffering are the candidates of surgical intervention.<sup>[9-15]</sup>

In surgical intervention, multiple procedures advised are condylotomy, condylectomy, condylar sag with anterior positioning, discoplasty, discectomy, replacement of disc with use of alloplastic material and autogenous grafts.

We present a study of 30 patients with disc displacement without reduction (Stage IV and V Wilkes)<sup>[16]</sup> treated over the past 15 years by condylar shaving with discoplasty or discectomy with interpositional temporalis myofascial flap (TMF). The minimum follow-up period was 3 years. We have been using TMF in ankylosis and found it to be viable and carrying out the functions on long-term basis. These patients had been treated conservatively before but since there was no improvement, they required surgery.

## MATERIALS AND METHODS

A retrospective audit of cases was done. We included 30 patients treated surgically by us over the past 15 years. Patients complained of pain over the TMJ, clicking sounds, restricted mouth opening of <20 mm and deviation on mouth opening. The patients were evaluated clinically and MRI was taken to confirm the clinical diagnosis. The MRI revealed displaced locked disc with pathologies such as fibrosis, adhesion, degeneration or osteoarthritic changes involving

the condyle. The patients had a long-standing disease and conservative treatment had failed. These patients were considered for surgery.

Patients were operated under general anaesthesia. Extended pre-auricular incision was taken. Dissection was done along the skin, superficial temporal fascia and temporalis fascia. Post-glenoid tubercle was identified. Subperiosteal dissection was done anteriorly on the zygomatic arch. The capsule was identified and incised, condyle was pulled down to expose and examine the disc. The displaced meniscus was identified and freed [Figure 2]. Fibrosed, degenerated part was excised, remaining meniscus found inadequate to cover the condylar head. The condylar head shaving for 2–3 mm was done [Figure 3]. The TMF was taken. Space was created for the flap by increasing the gap on posteromedial side of the arch with a rose head bur and the flap was transposed under the arch [Figure 4]. The flap was reinforced over the remaining disc by suturing it laterally, anteriorly and posteriorly. Free condylar movements were checked. The closure was done in layers.

Patient were kept on liquid diet for the first 3 days and then shifted to pureed diet for 10 days. Soft diet was later advised for 3 months.

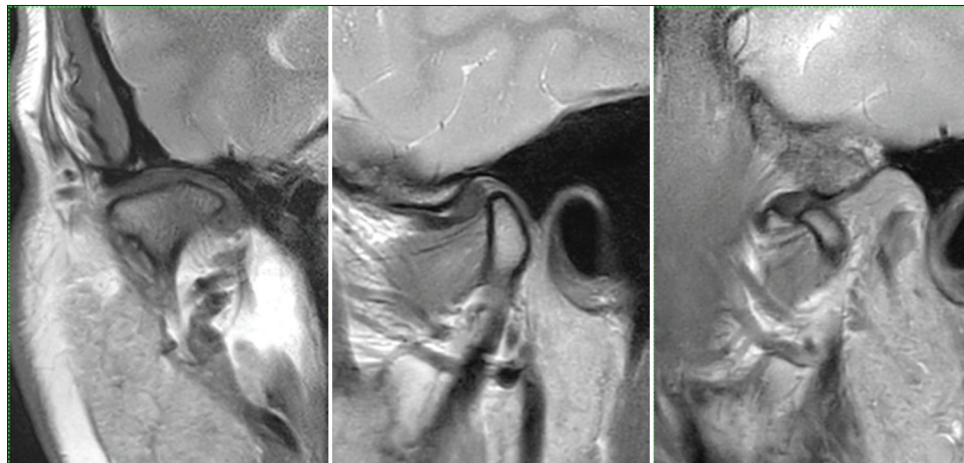
Patients were kept on regular follow-up for minimum 3 years.

All patients consented to the surgery and no identifiers were collected or used for this research work. As per the institutional policy, all retrospective audits of records are exempt from the institutional review board clearance.

## RESULTS

Out of 30 patients, there were 9 male and 21 female. It was more common in patients between 20 and 40 years of age [Table 1].

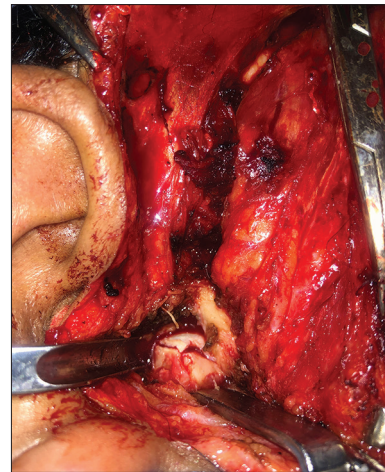
Five patients reported pain in the temporalis muscle region that was more felt during movements of the TMJ. Pain was controlled with diclofenac. Pain in the joint was grossly reduced and all patients were pain free within 6 months.



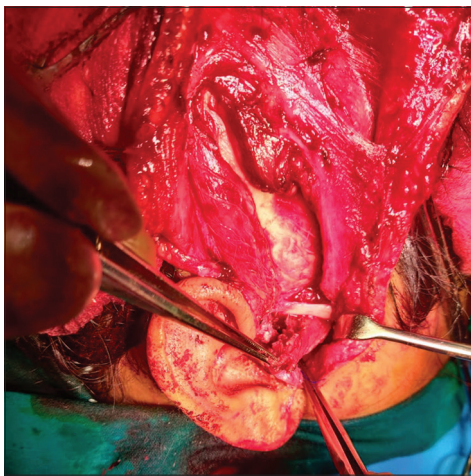
**Figure 1:** Magnetic resonance imaging of patient showing position and shape of the disc in open and closed-mouth position



**Figure 2:** Disc identified and freed



**Figure 3:** Condylar shaving



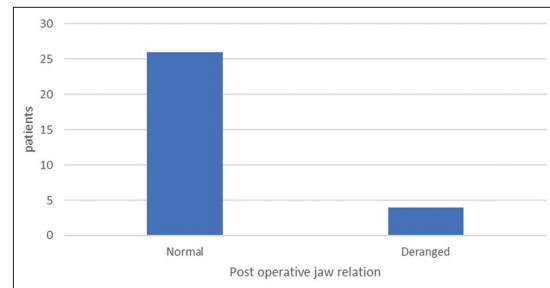
**Figure 4:** Temporalis myofascial flap is taken under the zygomatic arch

The mean incisal opening after 3 months was 35.4 mm. Range of mouth opening was 3.3–3.8 cm with improvements in 1 year. Patients were able to chew soft food gradually returning to normal in 6 months to 1 year.

A Chi-square test was performed, with null hypothesis as there is no significant increase in mouth opening after surgery. The desired mouth opening was taken as 35 mm. As the critical value observed from table was 2.7 for 0.1 level of significance and 3.84 for 0.05 level of significance [Table 2]. As  $\chi^2 = 4.8$  which was much greater than the critical value; hence, the null hypothesis was rejected. Thus, we conclude there was a significant increase in mouth opening after surgery.

Four patients showed mild derangement in occlusion immediate post-operatively which gradually improved and normal occlusion was restored in 3 weeks [Figure 5].

Three of our patients had transient weakness of the zygomaticotemporal branch of the facial nerve which resolved completely in 3 months [Figure 6].



**Figure 5:** Bar graph depicting postoperative jaw relation

In our follow-up, we took MRI after 2 years in eight of our patients and findings were suggestive of viable muscle functioning well like a disc while condylar morphology looked altered.

Two patients returned with pain in opposite side. They had opposite sides affected before first surgery. MRI had shown changes confirming non-reducing disc. Both patients underwent suggested treatment and are pain free with normal jaw function.

## DISCUSSION

In TMJ internal derangement, meniscus condyle complex translation gets affected as the meniscus loses its normal relationship with condyle, eminence creating a situation of dysfunction.

When patient treated conservatively or arthroscopically continues to suffer, TMJ surgery is indicated to relieve them from prolonged pain and dysfunction. These patients complain of persistent pain in TMJ, restricted mouth opening for the past months, shift to soft or liquid diet and poor oral hygiene. Sometimes patients also develop psychological problems.

Before deciding the line of treatment, the clinical diagnosis should be supported with findings in MRI, which clearly delineates the status of meniscus as closed lock, non-reducible, deformed, fibrosed, perforated, having adhesions, showing

**Table 1: Master chart showing all the patients preoperative and postoperative mouth opening, occlusion and facial nerve function**

Patient number	Age	Sex	Pre-operative mouth opening	Post-operative facial nerve function	Post-operative occlusion	Mouth opening at 3 months (mm)
1	42	Female	20	Normal	Normal	35
2	33	Female	19.5	Normal	Normal	34.5
3	36	Male	20	Normal	Normal	34
4	38	Male	20	Weakness	Normal	33
5	18	Female	20	Normal	Normal	35
6	29	Female	18	Normal	Open bite	38
7	37	Female	18	Weakness	Normal	34
8	28	Male	19	Normal	Normal	36
9	30	Female	20	Normal	Normal	35
10	26	Female	20	Normal	Normal	35.5
11	37	Male	20	Normal	Normal	35
12	39	Female	19	Normal	Normal	36
13	44	Female	19	Normal	Normal	34
14	29	Female	18	Normal	Normal	34
15	35	Female	18	Normal	Normal	36
16	38	Male	19	Normal	Normal	37.5
17	27	Female	18	Normal	Open bite	38
18	26	Female	17	Normal	Normal	34.5
19	33	Male	18	Normal	Normal	36
20	38	Female	17	Normal	Normal	35.5
21	29	Female	16	Normal	Normal	33.5
22	27	Female	16	Normal	Open bite	33
23	34	Female	18	Normal	Normal	36
24	27	Female	16	Weakness	Normal	36
25	41	Female	18	Normal	Open bite	35
26	26	Female	19	Normal	Normal	37.5
27	34	Female	16	Normal	Normal	36.5
28	37	Male	18	Normal	Normal	35
29	29	Male	16	Normal	Normal	37
30	30	Male	20	Normal	Normal	36

**Table 2: Chi-Square analysis**

Mouth opening	Number of patients $f_0$	$f_e$	$f_0 - f_e$	$(f_0 - f_e)^2$	$(f_0 - f_e)^2 / f_e$
<35 (mm)	9	15	-6	36	2.4
≥35 (mm)	21	15	6	36	2.4
	30	30			

degeneration, affected bilaminar zone. It is essential to assess patient’s psychological status before contemplating surgery.

The surgical objective is to eliminate TMJ pain and to improve function.<sup>[10]</sup> Different surgical procedures suggested for managing TMJ internal derangement include condylotomy, modified condylar sag, discoplasty and discectomy; with or without disc replacement.

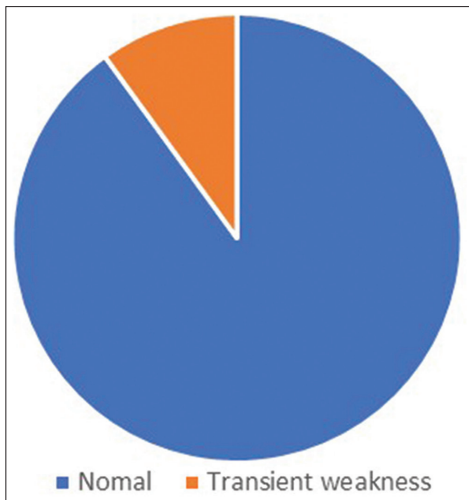
Disc preservation procedure should only be carried out if disc is salvageable. It is suggested that when adequate size of disc is available after excising the loose damaged tissue it can be repositioned but it is important that the repositioned disc should have free movements to carry out normal function. When the

remaining disc was inadequate, it was sutured with TMF and sutured laterally and posteriorly with retrodiscal tissue.

A diseased or deformed disc that interferes with the smooth, pain-free function of the TMJ and is beyond salvage, is a candidate for discectomy.<sup>[10]</sup>

Although the procedure of discectomy without any replacement was first described by Boman in 1947, concern about subsequent advanced degenerative changes in the condyle and persistent symptoms in some patients led surgeons to believe that replacement was necessary.<sup>[1,11,17]</sup> It has been reported that after discectomy, heterotopic bone formation interferes with free movement of the joint and can also lead to TMJ ankylosis. This could be due to a reactive reparative process, thus strongly suggesting having a neo disc to prevent this complication caused by two bony surfaces rubbing against each other.

Literature reports discectomy with interpositional material using alloplastic materials such as silicone, Silastic, Teflon and Proplast or autogenous dermal graft, dermal fat graft, auricular cartilage graft, temporoparietal fascia and TMF. Alloplastic



**Figure 6:** Pie chart showing postoperative facial nerve function

materials had the highest complications such as displacement dislocation and foreign body reactions, resulting in removal, whereas autogenous materials are associated with morbidity when subjected to functional loads.<sup>[18-20]</sup> Auricular cartilage grafts were susceptible to fragmentation and resulted in fibrous ankylosis.<sup>[18,21,22]</sup> Dermis graft had insufficient bulk, was difficult to anchor and failed to prevent regressive remodelling of condyle.<sup>[23]</sup> Dermis fat graft was not always successful, as they failed to protect the condyle from further degeneration and caused abdominal scarring.<sup>[18,24]</sup>

Looking at the functional needs of TMJ, the disc replaced with autogenous material should stand the functional forces and support the TMJ function on long-term basis.

Prof Cecil Wakely in 1939 was the first to take TMF under the zygomatic arch. He also commented on the use of allografts as the body does not tolerate them well.<sup>[25]</sup>

In 1989 Feinberg and Larsen<sup>[26]</sup> used the temporalis muscle pericranial flap for disc replacement. The donor site and recipient bed are close to each other and TMF creates disc-like separation of articular surfaces decreasing adhesion formation or ankylosis after surgery prevents articular flattening remodelling of condyle also.<sup>[11]</sup> The TMF attached to coronoid process anteriorly simulate disc-like movements with anterior translation. They found clinically TMF had greater relief of pain with marginally greater increase in maximal mouth opening compared to abdominal fat.

Smith *et al.* in 1999 used TMF as interpositional material in 23 patients who had undergone previous surgeries. They osteotomised the zygomatic arch transpositioning the mid portion of temporalis muscle.<sup>[27]</sup>

Rotskoff stressed TMF tend to fail on medial aspect of TMJ. This area is difficult to access for suturing and most often the thinnest portion of flap medially tend to undergo degeneration due to decreased joint space and pressure. Rotskoff stressed the importance of creating adequate space in the fossa for the

placement of the flap, along with proper visualisation using optical magnification.<sup>[11,28]</sup>

In 1993, the viability of the temporalis flap has been studied in humans. Umeda *et al.* reported on status of the temporalis flap in seven patients. Four patients underwent TMJ MRI, which revealed a soft-tissue signal consistent with muscle and/or fat in the joint. In addition, the operative findings in four patients revealed a well-positioned flap lining glenoid fossa that bleed on incision. Histologic assessment from biopsy specimens of the temporalis muscle flap showed viable muscle tissue with nuclei. They concluded that the temporalis flap remains biologically active and serves as a satisfactory TMJ lining when inferiorly based.<sup>[29]</sup>

Study by DeMerle on the use of abdominal fat graft versus TMF found significant improvement in pain scores and mouth opening after TMJ arthroplasty with discectomy and TMF reconstruction. Their study had the limitation of short-term follow-up.<sup>[11]</sup>

There is no clinical study recommending specific surgical treatment in TMJ internal derangement not responding to conservative line of treatment.<sup>[30,31]</sup> Suggested surgical procedures are purely based on individual surgeons experience based on the outcome of the procedure followed.

We observed that one common point in all surgical procedures is increase in the intra-articular space which helps in eliminating the mechanical obstruction caused by deranged disc relieves the pain and helps restore TMJ function to some extent.

In our study, 30 patients treated conservatively with no relief were selected for TMJ surgery. After clinical evaluation and confirmatory MRI findings, we treated these patients surgically. We removed the damaged part of the disc and retained the healthy portion or in worse cases discectomy was done. The inadequate disc was supported by the TMF to cover the condyle and get sutured with retrodiscal tissue. TMF flap containing temporalis fascia, muscle and pericranium stitched together was taken under the zygomatic arch after increasing the space under the arch. This strong viable flap carries the blood supply from posterior deep temporal vessels and has the ability to withstand the functional load in our long experience in TMJ ankylosis.

The three layers of temporalis fascia, muscle and pericranium give enough strength to the flap and temporalis fascia facilitates smooth movements of the condyle. Flap is designed as per the requirement of the procedure.

It was observed by us that when discoplasty was carried out the remaining disc was not covering condyle adequately, getting stretched and having the possibility of tearing and loosening during function. Thus, we saved the healthy part of disc. This disc was adequately sutured with a strong three-layered flap and together adequately covering condyle sutured anteriorly, medially by taking sutures laterally and posteriorly allowing free movements.

We support increasing the intra-articular space by carrying out high condylotomy reducing not more than 3 mm. This contours the condylar head, removing any osteophytes or subcysts

and increasing the intra-articular space. This also aids in the placement and suturing of the TMF. The height disparity of ramus was compensated by the bulk of the flap.

## CONCLUSION

We recommend the use of TMF as it is locally available, can be designed as per requirement, is easy to harvest, and causes no obvious deformity at donor site. Once settled in the recipient area, it maintains viability, and adequately carries out the function. By our procedure, the mean incisal opening of all patients improved, patients had complete resolution of pain and functionally recovered well.

## Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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## Conflicts of interest

There are no conflicts of interest.

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