Splint-assisted disc plication surgery

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Summary

Chronic disc displacement may lead to long-term pain. Temporomandibular joint surgery is reserved for those patients whose symptoms remain severe despite conservative treatment. We looked at the effect of modified meniscopexy on patients with chronic disc displacement without reduction who did not respond to non-surgical pain management treatment. In this retrospective study a total of 59 joints was treated and all patients except one underwent splint assisted bilateral meniscopexy: this patient had splint assisted unilateral meniscopexy. At the time of presentation and following treatment all patients underwent clinical examination and were required to complete a pain and functional questionnaire. All patients reported improvement following treatment.

Key words: temporomandibular joint, splint, meniscopexy.

Introduction

Temporomandibular disorders (TMD) are a heterogeneous group of pathologies and the most common orofacial pain conditions of non-dental origin affecting the temporomandibular joint (TMJ), the masticatory muscles or both (1). Signs and symptoms commonly include TMJ pain, muscle pain, clicking, crepitus, restricted mouth opening, deviation on opening or closing and headaches. Tinnitus has also been reported as symptom with studies reporting that when the most common causes of tinnitus are excluded, it is correct to evaluate the functionality of the temporomandibular joint (2).

Disruption of joint function by excessive/overloading causes chronic irritation to the discs and synovium resulting in inflammation and disc displacement (3). Up to 75% of the population exhibits one recordable sign of TMD with 5-33% of subjects reporting subjective symptoms. Symptoms peak between 20-40 years of age with a ratio of 3:3:1 females to males (4).

TMD is a multifactorial disease. Studies have quoted variable levels of trauma and dental treatment previous to the development of symptoms. Some patients also have an element of systemic disease such as joint hypermobility or arthritis with one study quoting the figure at 13.1% (5).

Given a lack of consensus regarding best treatment methods, the American Association of Oral and Maxillofacial Surgeons (AAOMS) issued a statement regarding TMD syndrome. This categories TMD into 1. extracapsular disorders, muscular in origin including parafunction and pain referred from systemic muscle conditions and 2. intracapsular disorders involving disc displacement. Degenerative changes including osteoarthritis, rheumatoid arthritis, TMJ dislocation, ankylosis and fractures are also responsible for TMD (6).

Initial management is non surgical and includes physical therapy, occlusal appliance therapy, drug therapy (topical and systemic), intraarticular injection and arthrocentesis, diet alteration and life style adaptation. Splint therapy has been reported with success by Tsuga 1989, Gray 1991, Davies 1997 and shows to reduce muscle activity and providing neuromuscular balance to the TMJ (7-9).

A Cochrane review of 12 randomised controlled trials demonstrated no significant difference in the effectiveness of stabilisation splint treatment compared to other active treatments. This review also stated that occlusal adjustments make no difference to outcome. TMJ surgery is reserved for those patients whose symptoms remain severe despite conservative treatment. Surgical options include:
- disc repair and disc repositioning procedures (meniscopexy)
- meniscectomy with/without autogenous implants
- condylectomy
- condylotomy
- eminectomy.
No one procedure is a panacea for all TMJ pathologies (10). In contrast to open joint procedures, arthrocentesis and arthroscopy are less invasive, comparatively easier and less expensive (11). A review of arthrocentesis and arthroscopy found no statistically significant difference between these interventions in terms of pain. However the complication rate for TMJ arthrocentesis is considered to be less than that for TMJ arthroscopy (12). Guo et al. (2009) state there is insufficient evidence (should conservative management fail) to support or refute other strategies (13).

Our retrospective study focused on disc displacement without reduction (DDWoR) which can happen when the ligaments are stretched beyond their elastic potential. It can be described as a ‘door jam’ preventing normal joint movement.

Materials and methods

Inclusion criteria:
Patients that had disc displacement without reduction confirmed on an MRI scan. Patients that did not respond to splint therapy.
Patients that did not respond to conservative measures such as physiotherapy for a minimum of 6 months, the average having such measures up to 18 months.
Various options for surgery including arthrocentesis and arthroscopy were discussed with the patients. Due to the prolonged nature of symptoms it was felt that modified meniscopexy to restore normal anatomy of the joint would provide the best result for these patients.

Prior to surgery, all patients underwent an MRI scan followed by 3 months of fulltime splint treatment. The scans of all but 7 patients were classified according to Wilkes below:
Patients were considered for surgery if demonstrating:
- decreased inter-incisal opening
- severe pain during function
- audible crepitus
- consistent muscle hyperactivity with unstable temporomandibular joints
- no medical contraindications to surgery
- no mental/emotional contraindications to surgery.

Patients

The study included 26 females and 4 males of which, 9 were self referred, 16 referred by their general dental practitioner, 5 from maxillofacial surgeons and 1 from a chiropractor. All patients completed:
- a TMJ medical, social and family history
- a diagnostic pain questionnaire
- a pictographic representation by the patient indicating pain sites (head, neck, face and shoulders)
- clinical examination of the head and neck including palpation of 90 osseous and muscular anatomical landmarks; a record was also made of maximum mouth opening, left and right lateral excursions, spontaneous pain, pain on movement, presence of clicking/crepitus and/or locking.

In total 59 joints were treated and all patients except one underwent bilateral meniscopexy, this patient had unilateral meniscopexy.

Following surgery all patients underwent clinical examination and were required to complete a pain and functional questionnaire. The categories in the pain questionnaire were None, Rare, Slight, Occasional, Moderate and Constant. The meantime interval from surgery to completing the questionnaire was 8.5 years, with a range of 22 months to 16 years.

Presurgical technique

Prior to surgery all patients underwent splint therapy for 3 months. The mandibular flat plane pivot-type splint was worn 24 hours a day, 7 days a week and only removed for cleaning. The purpose of the splint, the height of which is determined by the swallow technique, is to decompress the TMJ, thereby creating superior joint space, obviating the need for condylar surgery.

Only the upper mesiopalatal cusps of the terminal molars contact the splint creating a bilateral occlusal interference that limits postero-superior movement of the condyle and reducing loading forces on the condylar head (Fig. 1). Any osteoarthritic process in the inferior compartment is therefore reduced or even arrested. One week before surgery the splint is resurfaced to a highly indexed version locating the mandible into an idealised relationship to the maxilla and this so-called anterior repositioning splint is worn during surgery.

Surgical technique

A modified preauricular approach is used and then dissection proceeds to the superficial temporal fascia, then blunt dissection anteriorly in this plane. After identifying the lateral capsular ligament, a horizontal incision is required at its superior aspect to enter the superior joint space. The disc is then located (Fig. 2). Further dissection to the lateral aspect of the articular eminence and anterior to this may be required for this. The disc is then relocated and sutured laterally and posteriorly to the capsular ligament. No wedge resection of the retrodiscal tissues is needed unless they prevent relocation of the disc into its normal position.

Prior to closure the joint is flushed with 2% lignocaine and 1:100,000 adrenaline. The mandible manipulated up and down making sure that the occlusal surfaces of the maxillary teeth correspond to the index in the
mandibular repositioning splint. This allows open inspection for movement of the meniscus and determination of the stability of sutures and surgical repositioning.

**Postsurgical treatment**

Aggressive physical therapy is initiated within 24 hours of surgery with a Therabite Exerciser. Patients are instructed to use it for 5 minutes every half hour (during waking hours) for the first 2 weeks and for 5 minutes per hour for the following 10 weeks. Patients are expected to have an active mouth opening of 48-52 mm after 90 days. Most patients prefer a soft diet for the first few weeks although no restrictions are placed.

The repositioning splint is worn 24 hours a day including eating, for up to 12 months postoperatively. As postsurgical oedema reduces and the masticatory musculature relaxes, adjustments to the splint need to be undertaken initially every 3-4 weeks for the first few months. At 12 months when full healing has been attained, splint therapy is concluded and any restorative or orthodontic treatment can then be undertaken. Analyses of the results were conducted retrospectively by independent researchers. Information was obtained from the patients’ clinical notes, pre-treatment and post-treatment pain questionnaires, MRI and hospital reports. The determination for success of treatment was two fold, firstly the patients’ subjective evaluation and secondly the objective change in physical signs.

**Results**

The overall subjective improvement reported by the patients was measured on a visual analogue scale (VAS) as part of the post surgical questionnaire: in this study the mean improvement was 86% on a VAS of 1-10, with 1 being nil improvement and 10 maximum improvement. The minimum improvement was 40% and the maximum was 100%. The majority of patients felt that they had benefited from the procedure (Tab. 1).

Figure 1. Splint in situ demonstrating occlusal interference thereby decreasing load on condylar head.

Figure 2. Location of disc: relocation and suturing laterally and posteriorly to the capsular ligament.
that decreased to 50 mm. She had constant pain on opening and a dull ache at rest, this was reduced to rarely. The mean increase in mouth opening was 8.6 mm and the maximum increase was 20 mm (Tab. 2). The AAOMS states that the average inter-incisal distance is 50-60 mm and this measurement is an objective assessment of joint function. In this study the average pre-op distance=37.5 mm (range of 25-60 mm). This method improves mouth opening and function but not every patient achieved the 50-60 mm range reported by AAOMS.

Clicking of the TMJ was as reviewed and is presented in Table 3: 53.3% of patients reported constant clicking preoperatively whilst none reported constant clicking postoperatively, confirming a marked improvement in symptoms.

Table 4 shows that constant spontaneous jaw pain reduced in all but 3.3% of patients: 36.7% of patients presented with crepitus preoperatively with complete resolution for all patients after surgery.

Table 2. Global post-operative subjective impressions.

<table>
<thead>
<tr>
<th>Overall improvement</th>
<th>Question:</th>
<th>Better</th>
<th>Same</th>
<th>Worse</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall my physical well-being is?</td>
<td>74%</td>
<td>19.3%</td>
<td>6%</td>
<td></td>
</tr>
<tr>
<td>Overall my mental/emotional state is?</td>
<td>64.5%</td>
<td>29%</td>
<td>6%</td>
<td></td>
</tr>
<tr>
<td>Overall my ability to deal with stress is?</td>
<td>48.3%</td>
<td>48.3%</td>
<td>4.4%</td>
<td></td>
</tr>
<tr>
<td>Overall my enjoyment of life is?</td>
<td>70.9%</td>
<td>22.5%</td>
<td>6.6%</td>
<td></td>
</tr>
<tr>
<td>Overall my quality of life is?</td>
<td>77%</td>
<td>19%</td>
<td>4%</td>
<td></td>
</tr>
</tbody>
</table>

Table 4. Spontaneous jaw pain Pre and Post treatment.

<table>
<thead>
<tr>
<th>Frequency of clicking</th>
<th>Constant</th>
<th>Rare</th>
<th>Occasionally</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre op Clicking</td>
<td>53.3%</td>
<td>13.3%</td>
<td>3.3%</td>
<td>30%</td>
</tr>
<tr>
<td>Post-op Clicking</td>
<td>0%</td>
<td>0%</td>
<td>6.7%</td>
<td>93.3%</td>
</tr>
</tbody>
</table>

Table 1. Pre-treatment Wilkes classification.

<table>
<thead>
<tr>
<th>Stage 1</th>
<th>Stage 2</th>
<th>Stage 3</th>
<th>Stage 4</th>
<th>Stage 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>14</td>
<td>22</td>
<td>9</td>
</tr>
</tbody>
</table>

TMJ locking prior to treatment was a constant problem for 20% of the patient group with 33.3% stating this was of moderate or occasional concern. Following surgery, TMJ locking and crepitus was resolved for the entire group.

Both locking and crepitus are objective observations and less open to bias or interpretation unlike psychological factors which may depend on the patients’ status at the time of questioning.

Neck pain is frequently associated with TMJ pain. TMJD whilst not causative can exacerbate an existing neck pain. 60% of patients reported constant neck pain pre-treatment, with only 3.3% of patients reporting constant pain post-treatment. However, after treatment 70% still experienced occasional/rare pain. Pain is the most reported symptom of TMJD (6). The improvement in reported pain pre and post treatment.

14 of the 30 patients reported constant joint pain preoperatively while 4 never reported pain. Post-opera-
tively 7 patients never experienced joint pain and only 1 patient reported constant pain (Tab. 5).
Chronic pain sufferers did not report complete resolution of symptoms which may suggest that the most significant improvement is conferred on those patients with a lower pre-operative level of pain.
One patient suffered temporary right facial nerve palsy post-surgery with loss of ability to raise the right eyebrow. There were no post-treatment orthodontic complications. At the time of surgery two tears were seen in the disc itself and two tears in retro-discal tissue.

Discussion

This study reviewed a group of patients (n=30) treated by the senior Authors who presented with disc displacement without reduction, either unilateral or bilateral. Anterior repositioning splints can be used to create superior joint space as well as an idealised maxillo-mandibular relationship which is subsequently stabilized by disc relocation. The need to wear the splint prior to surgery is mandatory as it is during surgery to prevent relapse of the disc into the painful pre-surgical position.
Patients with disc displacement without reduction show condyles that are superiorly positioned in the fossa reducing superior joint space. Occlusion, although not a causative factor, maintains the pathological condyle/fossa relationship by virtue of intercuspation. Creation of superior joint space is key to providing disc space and stability thereafter. Previous attempts at creating space have involved condylar surgery but this does not address muscle spasm.
Furthermore, such surgery carries complications including adhesion formation, bone degeneration and ankyloses (14).
Splint therapy allows non-invasive creation of superior joint space, elongation of the masticatory muscles together with a functional maxillo-mandibular relationship. The surgeon and orthodontist opted for the minimally invasive soft tissue procedure of disc plication as it poses fewer post-surgical complications as compared with more invasive techniques. Invasive techniques can damage the connective tissue covering of osseous tissues thereby reducing the possibility for remodeling and healing (15).
The surgical protocol differs from other published studies in the following ways:
- access is confined to the superior joint space;
- the relocated disc is sutured posterolaterally to the capsule and not posteriorly to the retrodiscal tissues;
- the splint is worn during surgery;
- aggressive physical therapy commences 24 hours post surgery (16, 17);
- the splint is worn full-time post surgery for 12 months prior to any orthodontic/restorative procedures;
- As postsurgical oedema reduces and the masticatory musculature relaxes, the splint is adjusted every 3-4 weeks for the first few months.

The multiple adjustments of the splint gradually reduce superior joint space allowing the disc to retain its correct anatomical position and prevent the disc relapsing anteriorly, preventing a relatively common complication. The suture posterolaterally also aids this. Other studies have discussed the use of Mitek screws and double pass sutures to stabilise the articular disc in its correct anatomical position. However very rarely did these methods result in a ‘click free’ joint for every patient post surgery in their respective study groups (18-20).

The weakness of the study is that the pre- and post-surgical questionnaire was not aligned with OHIP and therefore limited in scope.
Furthermore, outcomes were reliant on subjective and functional improvements which could not be directly associated to disc repositioning, since no post-operative MRI scans were taken.

Conclusion

To ensure long-term stability and relief of symptoms, all aspects of disc derangement aetiology must be addressed. Patients in this study presented with disc displacement without reduction, occlusal disharmonies, degenerative change, muscle spasm and abnormal condylar position.
By restoring normal joint anatomy with subsequent orthodontic stabilisation treatment which provided occlusal support, predictable long-term results can be achieved for this group of challenging patients.
Whilst not a cure-all procedure, splint assisted disc plication surgery can be recommended for refractory patients with chronic disc displacement without reduction.

References


