

Original Article

Analysis of neurologic complications after modified temporomandibular joint disc anchorage surgery

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Received October 10, 2016; Accepted December 8, 2016; Epub March 15, 2017; Published March 30, 2017

Abstract: Objective: The purpose of this study was to evaluate the incidence of Neurologic complications and time taken for its recovery following the surgery of modified temporomandibular joint (TMJ) disc anchorage. Methods: A total of 441 patients treated with the modified TMJ disc anchorage from July 2011 to December 2012 were included in this study. All patients were asked to fill in the questionnaires, which included facial paralysis (Cranial nerve VII injury), numbness (Cranial nerve V injury) and Frey Syndrome. The results were analyzed by using SPSS16.0 software package. Results: 402 patients (549 joints) had completed the follow-up questionnaire, with a follow-up rate of 91.16%. There were 72 male and 330 female patients with a mean (SD) age of (31.36 ± 15.18) years. There were 6 sides of difficulties in closing eye (1.09%), 37 sides of difficulties in raising eyebrow (6.74%), 7 sides of disappearing forehead wrinkles (1.28%), 79 sides of numbness (14.39%), 6 sides of symptoms of Frey's syndrome after surgery. Accordingly, there were 1 side of difficulty in raising eyebrow (0.18%), 14 sides of numbness (2.56%) and 5 sides of symptoms of Frey's syndrome (0.91%) persisted during the time of follow-up. Conclusions: Modified temporomandibular joint disc anchorage surgery is a safe and effective method to treat TMJ internal derangement. As long as proper care was taken during the surgery, permanent nerve injury was uncommon. The incidence of temporary nerve injury could be due to compression or stretching of nerve fiber resulting in neuropraxia.

Keywords: Temporomandibular joint disorder, modified temporomandibular joint disc anchorage, neurologic complications

Introduction

Anterior disc displacement is one of the most frequent temporomandibular joint (TMJ) disorders, which often results in clicking, joint pain, a limited range of motion and masticatory difficulties [1]. Disc repositioning is a common procedure for patients with disc displacement to eliminate mechanical interference, to relieve pain and to improve the range of motion. Two techniques of repositioning the anteriorly displaced disc have been reported [2-4]. The first is the arthroscopic technique, which has been proved to be effective in the management of early internal derangements [3, 4]. However, the arthroscopic procedures are often inadequate for patients with a long standing history or late stages of disc displacement, and the technical requirement is relatively high. There-

fore, an open joint procedure using the bone anchor was recommended. In 1887, Annandale [5] first described the surgical repositioning of the displaced TMJ disc. Later, McCarty et al [6] repositioned the TMJ disc by a posterior wedge resection (2 mm) of the bilaminar zone, and the success rate was 94%. This led to the evolution of many varieties of new or modified TMJ disc-repositioning procedures with different success rates [6]. Wolford et al [2] first inserted one mitek anchor into the condylar process and the disc was fixed with a special suture for the treatment of 105 patients (188 joints), and achieved a good therapeutic effect. In 2010, Zhang et al [1] reported a new method to reposition the displaced discs using two bone anchors in 81 joints, and the immediate postoperative MRIs confirmed that over 96.3% of the joints had a successful disc repositioning. Since 2011, to

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Table 1. Complications of modified temporomandibular joint disc anchorage surgery

| Symptom | Numbers (side) | Percentage (%) |
|---------------------------------|----------------|----------------|
| Facial paralysis | | |
| Difficulties in closing eyes | 6 | 1.09 |
| Difficulties in raising eyebrow | 37 | 6.74 |
| Disappearing Forehead wrinkles | 7 | 1.28 |
| Numbness | 79 | 14.39 |
| Frey Syndrome | 6 | 1.09 |

improve the success rate and decrease the potential for relapse, the authors have modified the technique for open disc repositioning with only one miniscrew anchor and grafted subcutaneous fat flap from the earlobe into the anterior release space, which is called modified TMJ disc anchorage [7]. The effective rate could reach 98.6% according to postoperative MRI study [7].

However, due to the specific anatomic structures of TMJ, Cranial nerve V and VII are usually the most vulnerable anatomic structures that should be given utmost importance while performing modified TMJ disc anchorage surgery [8-10]. Therefore, identification and follow-up of these kind of surgical complications are very important. In this paper, through following up the patients underwent modified anchorage surgery in our hospital, the postoperative Neurologic complications of modified anchorage surgery were summarized and their causes were analyzed to provide guidance for future surgery.

Materials and methods

Subjects

The modified TMJ disc anchorage were performed on 441 patients of TMJ internal derangement (ID) between July 2011 and December 2012. The patients having TMJ ID were classified into 1 to 5 stages based on Wilkes and Bronstein's classification criteria [11], and patients in stages III to V were included in this study. Out of 441 patients, 402 patients (549 joints) were actually followed up, consisted of 72 males and 330 females with a mean age of (31.36±15.18) years and an average ID duration of (21.69±11.26) months. The mean follow-up interval was (31.89±5.55) months. All the operations were carried out in our depart-

ment by the team of authors. This study was approved by the Ethics Committee of Shanghai Jiao Tong University School of Medicine.

Surgical procedure

Based on the conventional methods, modified disc anchorage surgical methods use only one miniscrew anchor and additionally excise subcutaneous fat flap in front of the earlobe and grafted it in the gap left after the release of the anterior joint attachment to prevent scar contracture, thereby reducing the recurrence. We have explained the detailed procedures in our previous article by He D et al [7].

Questionnaire in details

Informed consent was obtained from all the patients after explaining the purpose of questionnaire. The patients were volunteered to complete the questionnaire (one questionnaire for one side of joint), with items including ① facial paralysis (Cranial nerve VII injury), ② numbness (Cranial nerve V injury), ③ Frey Syndrome. The resulting data were input into SPSS software package (version 16.0, Chicago, IL) for statistical analysis.

Results

The postoperative Neurologic complications of the modified anchorage were shown in **Table 1**.

Cranial nerve VII injury

The major symptoms of Cranial nerve VII injury included difficulties in closing eye (6 sides) and raising eyebrows (37 sides), disappearing forehead wrinkles (7 sides) (**Table 2**). Among them, 1 side of difficulty in raising eyebrow was persisted during the time of follow-up.

Cranial nerve V injury

79 sides of joints showed symptom of numbness, accounting for 14.39%, immediately after surgery. The range of numbness included the preauricular, zygomatic, temporal, masseteric, buccal, and infraorbital regions (**Table 3**). Some patients had numbness covering multiple regions. The recovery time of numbness were shown in **Table 4**.

Frey's syndrome

After surgery, 6 sides showed flushing and sweating in the joint region while eating, i.e.,

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Table 2. Healing period of facial nerve injury

| Symptom | Numbers of healed (sides) | | | | | Not healed | Average time of healing (month) |
|---------------------------------|---------------------------|-------|-------|--------|---------|------------|---------------------------------|
| | <2 M | 3-4 M | 5-6 M | 7-12 M | >1 Year | | |
| Difficulties in closing eyes | 1 | 0 | 3 | 2 | 0 | 0 | 7.17 |
| Difficulties in raising eyebrow | 14 | 5 | 7 | 9 | 1 | 1 | 5.11 |
| Disappearing Forehead wrinkles | 1 | 1 | 4 | 1 | 0 | 0 | 5.71 |

Table 3. Numbness range of distribution

| Numbness range of distribution | n | % |
|--------------------------------|----|-------|
| Preauricular region | 64 | 11.66 |
| Zygomatic region | 17 | 3.10 |
| Temporal region | 8 | 1.46 |
| Masseteric region | 8 | 1.46 |
| Buccal region | 7 | 1.28 |
| Infraorbital region | 2 | 0.36 |

Table 4. Numbness recovery period

| Numbness recovery period | n | % |
|--------------------------|----|-------|
| <2 months | 18 | 22.78 |
| 3~4 months | 8 | 10.13 |
| 5~6 months | 20 | 25.32 |
| 7~8 months | 0 | 0 |
| 9~10 months | 0 | 0 |
| 11~12 months | 14 | 17.72 |
| >1 year | 5 | 6.33 |
| Not recovered | 14 | 17.72 |
| Total | 79 | 100 |

Frey's syndrome. 1 side has significantly improved the symptoms in two years, while the remaining 5 still persisted during the time of follow-up.

Discussion

After decades of advancement, the modified TMJ disc anchorage surgery has the highest success rate so far [7] and most of internal derangements can be managed by this technique. However, for the beginner, complications are likely, due to the lack of special skills while performing operations. Gokkulakrishnan [10] reported the preauricular incision and its modifications adopted in TMJ open surgery have a main drawback that the courses of neurologic structures primarily derived from cranial nerves V and VII pass through the entire length of the incision. Hoffman [8] reported the potential complication of TMJ surgery. As for the open surgery, he listed some events of potential Neurologic complications, such as cranial

nerves V and VII injuries and Frey Syndrome. The questionnaire of this study mainly referred to the above events.

Cranial nerve VII injury

The Cranial nerve VII may get affected. Most frequently involved are the temporal and zygomatic branches leading to weakness of frontal and orbicularis oculi muscle. In this study, the symptoms included difficulties in closing eye (6 sides) and raising eyebrow (37 sides), and disappearing forehead wrinkles (7 sides). The most common cases were difficulty in raising eyebrow, with an occurrence rate of 6.74%, while the difficulty in closing eye was the least frequently observed symptom (1.09%). Facial nerve injury is a common complication in the open surgery for the TMJ. The branch of the facial nerve runs a superficial course through the articular capsule of the TMJ via the upper part of the parotid gland, therefore, it lies directly over the surgical field of entry [7]. Facial nerve injury might be resulted from various conditions, such as improperly positioned surgical approach, oversized preauricular incision and inadvertent suture ligation of the facial nerve branches. In addition, Excessive swelling, hematoma formation and heavy retraction may also cause compression or stretching of nerve fiber resulting in neuropraxia. For this reason, during the surgery, attention should be paid to the following aspects: (1) The incision must be performed closely to the temporomandibular ligament and articular capsule under the periosteum of the zygomatic arch, in order to wrap the temporal and zygomatic branches of the facial nerve in the tissue flap. (2) The preauricular incision should not be extended downward beyond the earlobe, so as not to damage the facial nerve. (3) A very careful intraoperative placement and force application of the retractors were essential for the protection of the nerves. (4) Corticosteroids should be used to reduce the swelling and nerve sheath edema. (5) Pressure dressing with an elastic bandage and suction drain before layered closure are

also recommended for minimizing hematoma formation.

Numbness

In this study, 79 sides of joints showed postoperative symptom of numbness, which was usually caused by Cranial nerve VII injury, and was the most common Neurologic complication persisted after modified TMJ disc anchorage surgery, accounting for 14.39%. The range of numbness persisted mainly over the preauricular and zygomatic regions, but some patients were found with numbness in the temporal, masseteric, buccal, and infraorbital regions, as well as numbness in multiple regions. 46 sides were recovered within 6 months, 19 were recovered after 6 months, and 14 were still complaining numbness during the follow-up time. Numbness may be caused by the oversized preauricular incision and injuring the overlying skin sensory nerves. On the other hand, since the adopted preauricular incision was very close to the auriculotemporal neurovascular bundle, an improperly positioned incision might damage the auriculotemporal nerve, thereby leading to numbness. Therefore, the surgery via the temporal and preauricular approaches should be strictly carried out along the auriculotemporal neurovascular bundle to avoid damages to the auriculotemporal nerve. Meanwhile, the preauricular incision [12] should be rigorously restricted from exceeding the earlobe and the temporal hairline, so as to minimize the flap range.

Frey's syndrome

It was noteworthy that, in this follow-up survey, 6 sides showed characteristic manifestations of Frey's syndrome. Only 1 side was obviously improved 2 years after the surgery, while the other 5 sides still showed the symptom. The reason was that the auriculotemporal nerve was damaged, causing a mix up of the sympathetic and parasympathetic nerves, which formed a "short out". Treatment includes placement of a graft material under the skin in the affected area, and or the use of botulin toxin [8].

In summary, Neurologic complications are common manifestations after modified TMJ disc anchorage surgery. But most of the nerve injury symptoms are temporary due to swelling, hematoma and heavy retraction causing compression and or stretching of nerve fibers. Permanent nerve injury is uncommon and can be

minimized through rigorous standardized training. After years of advancement and numerous clinical practices, modified TMJ disc anchorage surgery has been proven reliable and worthy of further promotion.

Acknowledgements

This study was supported by the National Natural Science Foundation of China in 2013 (81371168), the Medical-Engineering Cross Fund of Shanghai Jiao Tong University (YG-2013MS63), Shanghai Municipal Education Commission-Gao Feng Clinical Medicine Grant Support (20152226) and the Innovation Fund of Translational Medicine, Shanghai Jiao Tong University School of Medicine (15ZH2007), Science and technology commission of Shanghai biological medicine support project in 2016 (16441908800), Key project of Shanghai municipal health and family planning commission in 2016 (201640001), Ministry of science and technology research and development of the national key projects in 2016 (2016YFC1100-600).

Disclosure of conflict of interest

None.

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References

- [1] Zhang SY, Liu XM and Yang XJ. Temporomandibular joint disc repositioning using bone anchors: an immediate post-surgical evaluation by magnetic resonance imaging. *BMC Musculoskelet Disord* 2010; 11: 262.
- [2] Mehra P and Wolford LM. The mitek mini anchor for TMJ disc repositioning: surgical technique and results. *Int J Oral Maxillofac Surg* 2001; 30: 497-503.
- [3] Cai XY, Jin JM and Yang C. Changes in disc position, disc length, and condylar height in the temporomandibular joint with anterior disc displacement: a longitudinal retrospective magnetic resonance imaging study. *J Oral Maxillofac Surg* 2011; 69: e340-e346.
- [4] Yang C, Cai XY and Chen MJ. New arthroscopic disc repositioning and suturing technique for

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- treating an anteriorly displaced disc of the temporomandibular joint: part I-technique introduction. *Int J Oral Maxillofac Surg* 2012; 41: 1058-1063.
- [5] Annandale T. An address on internal derangements of the knee-joint and their treatment by operation. *Br Med J* 1887; 1: 319.
- [6] McCarty WL and Farrar WB. Surgery for internal derangements of the temporomandibular joint. *J Prosthet Dent* 1979; 42: 191-196.
- [7] He D, Yang C and Zhang S. Modified temporomandibular joint disc repositioning with miniscrew anchor: part I-surgical technique. *J Oral Maxillofac Surg* 2015; 73: 47, e1-e9.
- [8] Hoffman D and Puig L. Complications of TMJ surgery. *Oral Maxillofac Surg Clin North Am* 2015; 27: 109-124.
- [9] Keith DA. Complications of temporomandibular joint surgery. *Oral Maxillofac Surg Clin North Am* 2003; 15: 187-194.
- [10] Gokkulakrishnan S, Singh S and Sharma A. Facial nerve injury following surgery for temporomandibular joint ankylosis: a prospective clinical study. *Indian J Dent Res* 2013; 24: 521.
- [11] Wilkes CH. Internal derangements of the temporomandibular joint: Pathological variations. *Arch Otolaryngol Head Neck Surg* 1989; 115: 469-477.
- [12] He D, Yang C and Chen M. Modified preauricular approach and rigid internal fixation for intracapsular condyle fracture of the mandible. *J Oral Maxillofac Surg* 2010; 68: 1578-1584.