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Ankylosis of temporomandibular joint after the traumatic brain injury: a report of two cases CASE REPORT

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Sporadic cases of the severely limited mouth opening or mandibular pseudo-ankylosis occur after the neurosurgical procedures for the cerebral tumor or ruptured cerebral aneurysm in the previous literatures (1–6). The approaches of these craniotomies are often involved in the flap of the temporalis (7, 8), and limited mouth opening in these circumstances is regarded as the consequences of scarring and shortening of the temporalis.

Mandibular pseudo-ankylosis may be caused by a variety of extra-articular factors such as the conditions of the masticatory muscles and coronoid process. The incidence of limited mouth opening is comparatively higher within 48 h after craniotomy and gradually decreases with time. The occurrence was rare of this prolonged limitation beyond 3 months (4). However, if this limitation remains unresolved for a long time, an intra-articular ankylosis might develop eventually (5, 9) because of the myogenic, osteogenic, neurogenic, or psychogenic origins. The postoperative intra-articular ankylosis of temporomandibular joint (TMJ) is rare after the severe traumatic brain injury (TBI). In this article, we report two such cases and present a modified surgical treatment for TMJ ankylosis.

First case report

A 6-year-old Chinese boy was crashed into wall by others and fell down with unconsciousness before 1 year ago.

Abstract – Mouth opening limitation after the neurosurgical procedures is a common complication and usually resolves within 3 months. If limited mouth opening remains unresolved on the long term, an intra-articular ankylosis of temporomandibular joint may develop eventually. The possible mechanisms base on the myositis and atrophy of the masticatory muscles for these craniotomies are often involved in the temporalis. This article reports two unusual cases with the intra-articular ankylosis of temporomandibular joint after the traumatic brain injury, who received a modified surgical treatment for joint ankylosis. Therefore, the early diagnosis and intervention are important to minimize these complications.

He had been admitted to the neurosurgery department and received the transtemporal craniotomy for intracranial hemorrhage as well as the internal fixation of mandible mentum. The limited mouth opening got progressively worse without joint pain or noise since 4 months after craniotomy.

Clinical examinations revealed the maximal incisal opening was 3 mm without the deviation of mandibular midline. No joint tenderness or click was found on both TMJ. Activities of bilateral condyles were significantly decreased in palpation, and the right condyle was a little worse than the left. The partial bony defect existed in the right skull (Fig. 1).

Preoperative examinations on panoramic radiograph and lateral tomography of TMJ indicated that the bilateral joint spaces became vague, the joint structures could be still figured out and a mass of high density formed (Figs 2 and 3). The history of traumatic brain injury, clinical examinations, and radiographic findings were strongly suggestive of a diagnosis of the bilateral bony ankylosis.

TMJ arthroplasty was performed to alleviate the restrictive mouth opening under the general anesthesia with a fiberoptic intubation. In addition, a preauricular incision was made and deepened to the superficial temporal fascia and joint capsule by the blunt separation. Bilateral sides of joint capsules still existed. The lateral aspect of condyle was connected with glenoid fossa by the bony mass that was removed in arthroplasty



Fig. 1. The partial bony defect existed in the right skull.





Fig. 4. The lateral aspect of temporomandibular joint was exposed by the preauriclar approach, and condyle was connected with glenoid fossa by the bony mass.

(Fig. 4). A bone gap was chiseled between glenoid fossa and ankylosed condyle, and then the medial part of condyle and glenoid fossa was recontoured. The joint disk remnant was reduced to cover the condylar surface and sutured with joint capsule. Gentle manipulation of the jaws resulted in the mandibular motion of a full range 31 mm.

Photomicrographs of the decalcified specimen presented the mature high-density woven bone, which almost became indistinguishable from the surrounding bone. These connective tissues mixed with the sporadic cartilaginous tissues without inflammatory cell



Fig. 3. In lateral temporomandibular joint tomography before arthroplasty, the joint structures became vague, and the bilateral joint spaces (arrow indicated) could be still figured out.



Fig. 2. In panoramic radiograph before arthroplasty, the bilateral joint spaces became vague, the mass of high density formed and the joint structures could not be figured out.



Fig. 5. (a) Photomicrographs of the decalcified specimen presented that joint cavity filled with the mature woven bone, which almost became indistinguishable from the surrounding bone. These high-density connective tissues mixed with the sporadic cartilaginous tissue. (HE stain, original magnification $\times 100$). (b) The masseter muscle presented the hyaline degeneration and fibrosis. (HE stain, original magnification $\times 100$).

(Fig. 5a). The masseter muscle presented the hyaline degeneration and fibrosis (Fig. 5b).

Second case report

A 19-year-old man was trapped in a vehicle accident and suffered from the transient unconsciousness at that time. He was admitted to the local hospital where he underwent the transtemporal craniotomy, tracheotomy, and the mechanical ventilation in the neurosurgical procedure at September 2004. Mouth opening limitation occurred since 1 month after craniotomy. The patient received the bilateral TMJ arthroplasty for mouth opening limitation at 9 month after craniotomy, but mouth opening was not improved. In January 2006, the bilateral TMJ arthroplasty was performed again, and the tracheal intubation in tracheotomy had not drawn since June 2005.

Clinical manifestations indicated neck was soft and tracheal intubation in tracheotomy remained. This case presented the respiratory rudeness in bilateral lungs. The



Fig. 6. (a) Case 2 underwent the craniotomy of the left temporal region with a scar. (b) Case 2 before temporomandibular joint arthroplasty presented the right peripheral facial paralysis and the maximum mouth opening was 5 mm without deviation.

lower extremities were disabled, and the upper extremities were normal. This patient was lying in bed during previous 9 months. The mouth opening was 5 mm without deviation. The symptoms of facial paralysis appeared in the right face such as the right disappearing frontal stria, the right shallow nasolabial fold, and the closed dysfunction of eyes (Fig. 6a,b), and the pronunciation of this patient was not clear.

Preoperative computed tomography (CT) of skull in this case showed that the bony anatomy structures of bilateral condyles and eminences were obscured, and the joint space narrowed. Some high-density mass exhibited the ectopic osteogenesis in the lateral pterygoid muscle before TMJ arthroplasty (Fig. 7). The patient was diagnosed as the bilateral fibrous ankylosis of TMJ and the right peripheral facial paralysis.

TMJ arthroplasty was performed under the general anesthesia with the nasotracheal intubations. A preauricular incision was made to expose the lateral aspect of joint. The lateral side of condyle connected with glenoid fossa and eminence by the bony mass in joint gap, and the bony mass was removed in arthroplasty. TMJ disk remnant was surgically reduced to cover the condylar



Fig. 7. Preoperative computed tomography (CT) of skull in Case 2 showed that the bony anatomy structures of bilateral condyles and eminences were obscured, and the joint space narrowed (arrow indicated). Some high-density mass (arrowhead indicated) exhibited the ectopic osteogenesis in the lateral pterygoid muscle.

surface. The bilateral coronoid processes were resected by the intraoral coronoidotomy to release the temporalis. Tracheal intubation in tracheotomy remained after operation. Maximal mouth opening was obtained by 40 mm. Physical training of mouth opening was commenced at 3 days after TMJ arthroplasty.

The pathology of biopsy unexpectedly revealed that joint cavity filled with the mature high-density woven bone and dense connective tissues (Fig. 8a). The dissected muscle pathology also showed fibrous degeneration, and the temporalis myositis was diagnosed (Fig. 8b).

Discussion

Intracranial hematoma and intracranial hypertension are the common complications after the severe traumatic brain injury, and then transtemporal craniotomies have to perform to release these complications. The frontotemporal approach among the neurosurgical craniotomies is usually chosen for its advantage to expose the skull base and saddle area completely. However, the inappropriate dissection of the temporalis often induces the postoperative myotitis and atrophy, which may lead to mouth opening limitation (1-7). Based on the anatomy of the temporal muscles, some steps are recommended to preserve the temporalis (10-12).

An intracapsular ankylosis might develop eventually if the extra-articular ankylosis remained unresolved.

Miyamoto et al. (5) also found that limitation of jaw motion hastened the progress of intracapsular ankylosis in the animal experiment, in which the joint microtrauma, the destruction of articular cartilage, and the limited mandibular movement were the predispositions for intracapsular ankylosis. In the first case of present study, the right TMJ was the bony ankylosis, which the lateral aspect of joint covered with bony tissue, a flattened condyle was in close approximation to glenoid fossa, and joint cavity filled with the hyaline and chondroid tissues. The left TMJ was the fibrotic ankylosis, in which the condyle was flattened and adhered to glenoid fossa, and the joint space reduced. Bilateral TMJs of the second case were the bony ankylosis, in which there were still some bony fusions medially between condyle and fossa. The medial structures of articular surface and disk were undamaged in both two cases. The joint disks were reduced to the normal position to cover the stump of condvle.

Besides the myogenic, osteogenic, neurogenic, and psychogenic origins, changes of the systemic environment in TBI patients could enhance the excessive osteogenesis (13, 14). These osteogenesis stimuli may be immobilization, microtrauma, and hypoxia. And the excessive osteogenesis is a rapid process of transforming the immature osteoid tissue to the mineralized woven bone within several weeks. Some proposed hypotheses are to explain these findings (13–15): First, TBI patients are hyperventilated in an attempt to decrease the



Fig. 8. (a) The pathology of biopsy revealed that joint cavity filled with the mature woven bone and high-density connective tissues. (HE stain, original magnification $\times 200$). (b) The dissected muscle pathology also showed the fibrous degeneration, and the temporal myositis was diagnosed. (HE stain, original magnification $\times 200$).

intracranial pressure by reducing pCO_2 . Second, their blood pH becomes more alkalotic in the mildly alkaline systemic environment that may predispose to calcium deposition. Third, a potential humoral mechanism such as the basic fibroblast growth factors enhances this excessive osteogenesis. In second case of this study, the ectopic osteogenesis exhibited some high-density mass in the lateral pterygoid muscle. The new bones formed between condyle and eminence, and then the joint space narrowed significantly (Fig. 7).

Nitzan et al. (6) demonstrated that in the recent aggressive skull base surgery, emphasis was rightfully on the low zygomatic and ortibal exposure to minimize the brain retraction. Skull base surgery was a risk factor for the postoperative pseudoankylosis. Coonan et al. (8) noted that this postoperative pseudoankylosis after the transtemporal craniotomy often persisted in the patients who were reluctant to use their temporalis, but the aggressive physiotherapy was potentially beneficial to relieve this limited opening if started early. If the diagnosis and intervention delayed, the declined efficacy of this physiotherapy indicated the surgical treatments such as the temporalis detachment or coronoidectomy.

In present study, after the bony ankylosis developed, TMJ arthroplasty with coronoidectomy was inevitable to recover the normal mouth opening. The intraoral approach with a vertical incision along the ascending ramus provided a good access to coronoidectomy. The affected temporalis was dissected until a maximal mouth opening achieved from 3 to 4 cm. The coronoid process should be rescted to avoid postoperative mechanical obstruction or refibrosis of the temporalis. The mandibular physiotherapy after TMJ arthroplasty is designed to gradually increase mouth opening to an acceptable degree by the passive mouth opening with a mouth gag.

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Conflict of interests

None declared.

Ethical approval

Not required.

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