Abstract:
To analyze the outcome of modified rhytidectomy approach through four flaps for the ORIF of displaced Subcondylar fractures of the mandible. 14 cadaveric specimens studied for facial nerve anatomy. 10 clinical cases with dislocated subcondylar fractures operated through four flap rhytidectomy approach. The morbidity of neuropraxic facial palsy is significantly less when compared to the benefit of open access and anatomical reduction of these fractures. This approach goes a long way in reducing morbidity in the form of TM joint arthritis and internal derangement of the joint. This surgical approach is useful for ORIF of fractures in the condyle, subcondyle and upper ramus regions of mandible through skin flap, SMAS flap, Glandular flap and pterygomasseteric sling flap.

Keyword: Subcondylar fracture, four flap Rhytidectomy approach, ORIF

Introduction:
Processus condylaris is one of the anatomically weak portions of mandible and its fractures are common. Condylar fractures had been treated conservatively previously and successful results had been documented radiologically in children and adolescents. The treatment for condylar neck and subcondylar fractures remains one of the most controversial topics of mandible surgery despite the high incidence of these fractures. For decades, closed reduction has been the preferred treatment, but closed treatment requires varying periods of maxillomandibular fixation (MMF, 0 to 4 weeks) and long term complications like pain, ankylosis, internal derangement of the temporomandibular joint (TMJ), as well as the inadequate restoration of the vertical height of the ramus, can possibly occur.

Material & Methods:
10 clinical cases of dislocated subcondylar fractures were operated in the Department of Plastic Reconstructive Surgery, Madras Medical College and Government General Hospital.
Plastic Surgery, Government General Hospital, Chennai between December 2010 and December 2012.

Of them 7 were males and 3 were females. All had dislocated subcondylar fractures.

8 Patients had ipsilateral parasymphysial fractures and 1 patient had associated ipsilateral body and the other patient had contralateral parasymphysial fracture of mandible. Age of these patients ranged from 22 to 60 with an average of . All injuries were sustained due to road traffic accidents.

All the patients had associated head injury. All these patients are conservatively managed by the Neurosurgical team, except one patient who had extradural hematoma and burr hole was performed for clot evacuation and a tracheotomy for airway.

The clinical application is based on the cadaveric dissections conducted in Nov 2010 in our department. 14 cadaveric specimens were dissected to study about the branching pattern of Facial nerve.

**Surgical Anatomy Revisited:**

According to our previous anatomical study we found that Facial nerve after emerging from the stylomastoid foramen it gives off branches to

1) the auricular muscles
2) the posterior belly of digastric muscle
3) the stylohyoid muscle

and then it pierces the parotid gland. Within the parotid gland the nerve constitutes a small trunk and splits into upper and lower divisions. Within the parotid gland, there is further branching upper division gives off temporal, zygomatic and buccal branches and the lower division gives off mandibular and cervical branches. These subsequently leave the parotid gland and enter the face and supply the target muscles. Of the 14 cadaveric dissections, distal branching pattern is seen i.e. divisions of facial nerve were over the neck of mandible whereas in the other 2 cadaveric specimens, the proximal branching pattern were seen and here the branches were over the neck of mandible.

**Surgical Approaches:**

Three standard approaches have been documented in the literature for open reduction and internal fixation of subcondylar fractures

1. Rhytidectomy preauricular or endaural approach
2. Retromandibular approach
3. Submandibular approach Each surgical approach has its own limitations, the retromandibular approach causes puckering, hypertrophic scar and cervical and marginal mandibular nerve injury. The submandibular approach does not give direct access to the fracture site, obvious scar with all attendant problems.

On the other hand four flap rhytidectomy approaches gives

1. Wide direct access through surgically created window between divisions/branches of facial nerve to fracture site for
   a. Effective manipulation of fracture fragments
   b. to pave way for anatomical reduction
   c. to facilitate rigid fixation with plates and screws with additional advantage of
d. fine scar because the SMAS flap is separated from the skin flap it paves the way
for imperceptible scar inconspicuous region in preauricular sulcus and retroauricular areas

2. Though technically demanding the four flap rhytidectomy approach the key to success is creation of working window through branches or divisions of facial nerve which is achieved by combination of anterograde and retrograde technique.

Anatomical crux of our technique the four flap rhytidectomy approach to the treatment of dislocated Subcondylar fracture is creation of working window through branches or divisions of facial nerve trunk.

**Data**

12 cadaveric specimens and 9 clinical cases showed distal branching pattern i.e., divisions overlies the neck of mandible where as 2 cadaveric specimens and 1 clinical case showed the proximal branching pattern where the branches overlies the neck of mandible. Variation is not only person to person also intrapersonal. Totally 10 cases were operated 7 males and 3 females between December 2010 and December 2012. The results were analyzed prospectively. All had dislocated subcondylar fractures with one (8 ipsilateral parasymphysial #) or two (1 associated with ipsilateral body and contra lateral parasymphysial #) associated other mandibular fractures.
Technique:
All were operated through GA with sub mental or nasotracheal endotracheal tube. Average operating time is 2hrs and 15 minutes. Informed consent with all possible complications is obtained from all patients. Punctate and small bleeders are managed through bipolar diathermy and bleeding from retro mandibular veins is managed by phleborrhaphy with fine absorbable sutures. All are operated under 2.5 loupe magnification. Nerve locators were used in the study. After skin incision which is Rhytidectomy approach the four flaps are raised namely

1. Skin flap,
2. SMAS flap,(superficial musculo aponeurotic system)
3. Glandular flap and
4. Pterygomasseteric sling flap.

Figure 4 SMAS flap being raised
Figure 5 SMAS flap being raised
Care is taken to avoid injury to any of the divisions / lower branches of facial nerve. Fracture site is exposed and the fracture fragments are aligned. Two 1mm thickness four holed plates with gap with 6mm x 1.5 mm screws were used for rigid fixation in all cases except one case where we used one plate in a female as the area is small. Anatomical perfect reduction was obtained in all cases under direct vision by direct manipulation of fracture fragments working through the window created between divisions in 90% cases and between the upper and lower buccal branches in 10% cases. Water tight SMAS layer closure given in all cases after glandular flap reapproximation to prevent the parenchymal fistula of parotid gland. Suction drain placed in the subcutaneous plane in all cases. Fine imperceptible scar in the preauricular sulcus and retro auricular region is obtained in all cases. We never used MMF in postoperative period, but we used MMF intraoperatively in all cases before internal fixation.

Results:
Only one case developed neuropraxia in the buccal nerve distribution and recovered completely with splinting and systemic steroid therapy in 12 days and this occurred in the proximal branching pattern i.e., operating at branches level. No malocclusions, TMJ internal derangements, infection, hematoma superficial necrosis, hypertrophic or puckered scar noted in all our clinical cases with mean follow up period of 3.5 months. Incidence of neuropraxia of facial nerve for four flap rhytidectomy approach in the proximal branching is one case and that recovered within 2 weeks because of pes anserinus crossover compensation and extent of nerve injury. But neuropraxia of facial nerve for four flap rhytidectomy approach in distal branching pattern is nil.

Case 3:
27 year old male admitted with Head injury and Subcondylar and parasymphysial fracture of mandible. He was conservatively managed by the Neurosurgical team and taken over by us for ORIF of mandible fractures. After complete evaluation he was operated. Intraoperatively he was found to have proximal branching pattern of the divisions of facial nerve. Careful dissection was done and fracture site exposed. ORIF done using two 4 hole miniplates with gap and 6mmX1.5mm screws used. Post operatively patient showed Neuropraxia along the buccal branch distribution and that settled within 14 days with conservative management.

Figure 6 This patient had proximal branching pattern and had neuropraxia along the buccal nerve distribution
Figure 7 This patient had proximal branching pattern and had neuropraxia along the buccal nerve distribution.

**Case 9:** 41 year old male admitted with Head injury and Left Subcondylar and parasymphysial fracture of mandible. He was conservatively managed by the Neurosurgical team and taken over by us for ORIF of mandible fractures. After complete evaluation he was operated. Intraoperatively he was found to have distal branching pattern of the divisions of facial nerve. Careful dissection was done and fracture site exposed. ORIF done using two 4 hole miniplates with gap and 6mmX1.5mm screws used.

Figure 8 This patient had left subcondylar fracture with anterior open bite

Figure 9 This patient had left subcondylar fracture with anterior open bite

Figure 12 Distal branching pattern

Figure 13 ORIF with two 4 hole miniplates
Discussion

Treatment of Subcondylar fractures can follow two different routes: conservative or surgical. Previously, conservative management of condylar fractures was favoured. However, an open reduction was first applied to a low Subcondylar fracture in 1925 \(^{12}\), and recently it has become more common, probably because of the introduction of plate and screw fixation devices that allow for the stabilization of such injuries\(^1\), \(^3\). Today, many surgeons prefer open reduction of displaced fractures, because such reduction and rigid fixation enables good anatomic repositioning and immediate function. Although there is still debate concerning therapy for Subcondylar fractures, a number of reports have now suggested that, compared with non-operative treatment, the treatment of condylar fractures by open reduction and rigid fixation creates more favourable results. The predominant surgical indication for adults is a dislocated or displaced condylar fracture outside the mandibular fossa, as it is generally impossible to attain anatomic reduction via conservative treatment \(^3\). According to the Zide and Kent criteria\(^3\), the indications for open reduction were limited, because the techniques and materials available at that time were limited. New considerations regarding the indications and advantages of open
reduction have evolved. Today, for dislocated Subcondylar fractures, open approaches are considered the treatment of choice in many surgical units. Some new kind of incisions were recommended as rhytidectomy and retromandibular incision, because of inadequacy of classic incisions, and new methods of rigid fixation such as lag screw fixation have been used.

The surgical treatment needs experience and concentration. The facial nerve and its branches must be saved from any injury. The reduction and fixation of fracture ends with plate, screw or wire is difficult. For this difficulty, many surgeons are not desirous for surgical repair and they prefer conservative methods. But, surgical repair should have applied in appropriate conditions after evaluation of clinical and radiological status of patients and fractures. Surgical indications have been explained by Zide and Kent and have been accepted widely by authors.

**Absolute indications for open reduction:**

1. Caput of condyle displaces to middle cranial fossa

2. Insufficient occlusion after a week from closed reduction (as open bite), or being fragmentshowed radiological preventing movement of condylar neck and inadequate opening of mouth,

3. Extra capsular dysplastic fractures of condyle

4. Foreign body in joint capsule

**Relative indications:**

1. Any splint cannot applied for the reason of alveolar wedge atrophy in edentulous or partial edentulous mandible with dysplastic caput condyle, or absence of any splint

(2) The patients cannot tolerate the intermaxillary fixation period (epileptics, alcoholics),

(3) Being concomitant fractures as unilateral or bilateral condyle fractures, comminuted fractures of symphysis or unstable maxilla fractures.

In addition; age, level of the fracture, degree of the deformity, teeth status of the patient, concomitant injuries and medical condition of the patients must be considered and the appropriate treatment should applied.

The correlation between the anatomy of facial nerve and surgical procedures deserve more detailed descriptions. Some authors describe surface landmarks to identify the facial nerve branches (Furnas, 1965; Dingman & Grabb; Bernstein & Nelson, 1984; Niccoli-Filho & Varandas, 1988). It is important to notice that, because of the anterolateral course of the facial nerve, the peripheral branches are located more superficially.

The buccal branches of the facial nerve in relation to the parotid duct associated with surgical procedures such as rhytidectomy and parotid gland surgery are relevant. There are two branches of buccal branch: one superior and one inferior to the duct at the point of emergence from the parotid gland.

We create working window between divisions of facial nerve which is the most common pattern seen in subcondylar area and this provides unparalleled wider access for anatomical reduction and fracture fixation. In proximally dividing facial nerve, which is seen in only 10% of cases where the branches overlie the
Conclusion:
This Four flap Rhytidectomy approach not only gives a wide access to the fracture site for effective reduction and fracture fixation but facial nerve injury is avoided and a imperceptible scar in the inconspicuous region in preauricular sulcus and retro auricular areas is obtained as elucidated in this article. Common myth of fear of injuring facial nerve need not be there because in 90% of cases it is only the distal branching pattern is seen. In order to compare this procedure with any other approach, we need more patients and long follow up time to perform randomized and controlled prospective analysis.

References:


