Modified Risdon approach using periangular incision in surgical treatment of subcondylar mandibular fractures

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SUMMARY
Introduction
No consensus has been reached yet on the surgical approach for treatment of condylar fractures.

Objective
The aim of this study was to present modified Risdon approach (without facial nerve identification) in the treatment of subcondylar mandibular fractures.

Method
This is a retrospective study of a period 2005–2012. During this seven-year period, 25 condylar mandibular fractures in 22 men and three women (19–68 years old) were treated by modified Risdon approach without identifying the facial nerve. The main inclusion criterion was subcondylar fracture according to Lindahl classification.

Results
No additional morbidity related to postoperative complications, such as infection or salivary fistula, was observed in this series. Only two (8%) patients developed temporary weakness of the marginal branch of the facial nerve, which resolved six weeks postoperatively. Each patient achieved good mouth opening postoperatively. Scar was camouflaged in the first cervical wrinkle. Two patients developed temporomandibular joint dysfunction. No patient had postoperative occlusal disturbance. In all of the patients good aesthetic result was achieved in a two-year follow-up.

Conclusion
In comparison with techniques described in the literature, the main advantages of the modified Risdon approach are the following: no need for facial vessels identification; direct, fast, and safe approach to mandibular angle and subcondylar region; relatively simple surgical technique and good cosmetic result – due to aesthetically placed incision. This approach could be recommended for subcondylar fracture as a simplified and safe procedure.

Keywords: subcondylar fracture; extraoral approach; open reduction

INTRODUCTION
Open approaches for treating patients with mandibular fractures have been used in the modern era of maxillofacial traumatology since the implementation of internal fixation [1]. No consensus has been reached yet over the surgical approach for treatment of condylar fractures. However, many authors support an opinion that open reduction and internal fixation provide good functional outcome [2, 3].

Beside intraoral endoscopic-assisted surgical procedures, the conventional extraoral treatment approaches, such as the submandibular, retromandibular (transparotid and retroparotid), preauricular and modified Risdon approach are still in use. Some of these approaches, like transparotid, are very complex, and require identification and preservation of certain anatomical structures like buccal and marginal branches of the facial nerve, which is time consuming surgery [4]. On the other side, postoperative neuropaesthesia of the mandibular branch of the facial nerve (MBFEN) has been reported as the main complication of the classic Risdon’s procedure and care should be taken to minimize this risk [5]. In order to avoid this complication conventional approaches have been modified [6, 7, 8].

In order to reduce this risk, some authors recommend direct access to the mandible through submandibular gland without identification of the MBFEN. This procedure involves elevating the superior flap and can be used for mandibular fractures as well [1, 5]. The routine exploratory identification of the MBFEN nerve is still a matter of debate.

OBJECTIVE
The aim of this study is to describe modified Risdon approach (without facial nerve identification) in surgical treatment of subcondylar mandibular fractures and to examine the effectiveness of this method in open reduction and internal fixation.

METHODS
Surgical technique
Modified Risdon approach to the subcondylar region was performed under general anesthesia. To control bleeding, the surgical site was infiltrated with a solution of lidocaine and epinephrine (1:80,000).
There are several important anatomical landmarks for this procedure: 1. platysma layer; 2. superficial layer of deep cervical fascia (SLDCF) – investing fascia; 3. anterior superior border of sternocleidomastoid muscle (SCMM), and 4. posterior border of submandibular gland (SG).

The periangular incision was placed into the first cervical crease 1.5–2 cm from the gonion, being about 5 cm long (Figure 1). After skin and subcutaneous tissue incision, platysma was dissected carefully in order to preserve SLDCF because the MBFN is just above or adherent to the mentioned fascia (Figure 2). SLDCF was incised meticulously at the precise determined localization, 2 cm below the mandibular angle and above the anterior border of the SCMM (Figure 3). The subfascial space (under SLDCF) was entered using blunt scissors between the anterior border of the SCMM (landmark #3) and posterior border of the SG (landmark #4). This space is avascular and safe – it represents a keyhole for this approach. Dissection, which could be carried out either by scissors or fingertip, was continued further towards the angle of the mandible. It is very easy to identify lower border of the mandibular angle by palpation and elevation of SLDCF with overlying tissue. This manoeuvre provided exposure of pterygo-masseteric sling. It has to be highlighted that this approach does not require visualization and identification of the MBFN. Mild retraction of submandibular gland anteriorly and sternocleidomastoid muscle posteriorly provides enough space for safe incision of periosteum along the lower border of the mandibular angle (Figure 4). Masseter muscle was then stripped from the angle and along the posterior border of the ramus to identify fracture line and bony fragments. Adequate subperiosteal dissection over the mandibular

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**Figure 1. Placement of periangular incision**

**Figure 2. Platysma layer**

**Figure 3. Cutting of the superficial layer of deep cervical fascia – point of entry into subfascial space**

**Figure 4. Safe incision of periosteum along the lower border of the mandibular angle**

**Figure 5. Bony fragments after reduction**
Ramus provided good exposure of the fracture site in order to reduce the fracture fragments and to place internal fixation (Figure 5). Retromandibular vein could be visualized posteriorly and should be preserved.

The access to the fracture site with this approach usually takes between five and 10 minutes and there is no significant bleeding. In all cases a plating system was used for rigid internal fixation. The wound was irrigated, checked for hemostasis, and closed in the following four layers: the periosteum, superficial cervical fascia with platysma, subcutaneous layer, and skin. Skin was closed with intradermal suture. A suction drain was usually removed after two days. X-rays showed preoperative findings and appropriate anatomic reduction (Figures 6 and 7).

**Patients**

Twenty-five patients with mandibular fractures at 34 sites including subcondylar enrolled in this study. There were 22 male and three female patients, ranging from 19 to 68 years of age. They were surgically treated at the Department of Maxillofacial Surgery between 2005 and 2012 using a modified Risdon approach without identifying the facial nerve (Table 1). The other fracture sites were treated using open reduction with an intraoral approach, or combined approaches in some complex cases. The routine preoperative investigation comprised clinical examination and digital orthopanoramic and posterior–anterior radiograms of the mandible. All the patients selected for open reduction and internal fixation had posttraumatic malocclusion and showed radiological signs of the displaced fracture. The main inclusion criteria in this study group were displaced subcondylar fractures according to Lindahl classification with occlusal disturbance and deflection [9]. In all patients postoperative review of above mentioned radiograms were compared with the preoperative ones and the following clinical signs were noted: mouth opening, occlusion, temporomandibular joint (TMJ) dysfunction and facial nerve damage.

**RESULTS**

In all patients good anatomical position of bone fragments were achieved. No postoperative complications, such as infection or salivary fistula, were observed in this series. Only two (8%) patients developed temporary weakness of the MBFN, which resolved six weeks postoperatively. Each patient achieved good mouth opening with no deflection. Two patients developed TMJ dysfunction, clicking that was treated conservatively (Table 1). No patient had postoperative occlusal disturbance. In all the patients good aesthetic results were achieved.

**DISCUSSION**

Risdon has described submandibular approach for TMJ ankylosis in 1934, which has been traditionally used for many years [10]. In 1963, Ginestet et al. [11] illustrated a curve-shaped incision at the mandibular angle for extraoral ectopic wisdom teeth extraction, without detailed description of the procedure. Using Risdon approach, Nam et al. [12] described treatment of subcondylar fracture trough submandibular incision placed 3 cm or more below the inferior border of the mandible because of the close vicinity of the MBFN. This is a classic submandibular approach that is technically demanding because of longer route to fracture site and more difficulties in fragment reducing and plating. The use of periangular incision provides direct access to the angle of the mandible and is closer to the subcondylar area. Furthermore, surgical anatomy of the MBFN presents great variability in the literature [13, 14, 15]. Ziarah and Atkinson [16] pointed out that the
MBFN could be traced 0.2–1.4 cm below the mandibular angle. Hayes Martin manoeuvre, described within submandibular approach, may not always be considered safe [17]. Because of that, other authors suggest identifying and dissecting the MBFN for more safety [12, 15]. It has been even reported that MBFN can occasionally cross under the facial artery and vein [15]. Some surgeons have pointed out the utility of the surgical approach underneath the submandibular gland fascia without the routine identification of the mandibular nerve, which actually minimizes the risk of nerve damage [10, 18, 19]. Nevertheless, using submandibular approach, surgeons usually face long tunnel to the subcondylar area and stronger tissue traction is always necessary to reach fracture site, which can cause neuropraxia of mandibular branch of facial nerve. However, using a simplified technique described in this study, the tunnel is significantly shorter. Furthermore, the surgical layer of the subfascial flap, which is elevated in order to access the mandibular border, can be identified precisely using various anatomic landmarks mentioned where surgical technique is described. There is no need for facial blood vessels identification and ligation. Comparing to other approaches, this method does not require identification and visualization of the MBFN [12]. It is crucial to avoid dissection or tissue traction directly over the masseter muscle due to variability of the route of the MBFN [16]. It is absolutely necessary to respect each layer and to dissect “one by one,” as described (Figure 3). The crucial step is to perforate SLDCF near anterior border of the SCMM and 2 cm below the mandibular angle and dissect it from the posterior border of the SG. This distance of 2 cm should be reached due to variability of the route of the MBFN [16]. It provides the safe zone, which is best to enter by blunt finger dissection. It is a very important manoeuvre, needed in order to avoid blood vessels and nerves, and is a very quick way in approaching mandibular angle and visualizing pterygo-masseteric sling. This also provides less tissue traction and manipulation during reduction and fixation of bone fragments.

In this series, only two (8%) patients developed temporary facial nerve weakness. The frequency of temporary facial palsy after extraoral approaches to the subcondylar region varies in the range 0–30% [20–24]. Hou et al. [25] found that after modified transparotid approach, 22% of patients suffered from temporary facial palsy. Using retro-mandibular approach, two authors described two cases of permanent facial palsy after five years of follow-up, although damage to the facial nerve frequently produces weakness of the depressors of the mandible [25]. In all cases, the neuropraxia is transient, and the cause might be compression of the nerve by retractors or nerve manipulation.

According to literature, submandibular approach showed the worst outcome regarding permanent palsy of the facial nerve and hypertrophic/visible scarring. Additionally, the

| Table 1. Open reduction group |  |
|---|---|---|---|---|---|---|---|---|---|
| ID | Sex | Age | Lindahl | Location | Biology | Occlusion | Opening | TMJ dysfunction | VII damage | Follow-up (months) |
| 1 | M | 33 | L/D | Left | IPV | Normal | Good | No | no | 16 |
| 2 | M | 44 | L/D | Left | IPV | Normal | Good | No | no | 17 |
| 3 | M | 20 | L/D | Left | IPV | Normal | Good | No | no | 20 |
| 4 | M | 52 | L/D | Left | IPV | Normal | Good | No | no | 18 |
| 5 | M | 27 | L/D | Left | IPV | Normal | Good | NO | yes | 18 |
| 6 | M | 41 | L/D | Left | IPV | Normal | Good | Right TMJ click | yes | 72 |
| 7 | M | 21 | L/D | Left | IPV | Normal | Good | No | no | 60 |
| 8 | M | 19 | L/D | Left | IPV | Normal | Good | No | no | 65 |
| 9 | F | 41 | L/D | Left | FFH | Normal | Good | No | no | 60 |
| 10 | M | 19 | L/D | Left | IPV | Normal | Good | No | no | 60 |
| 11 | M | 68 | L/D | Bilateral | IPV | Normal | Good | Deviation | no | 57 |
| 12 | M | 54 | L/D | Left | IPV | Normal | Good | No | no | 56 |
| 13 | M | 41 | L/D | Left | FFH | Normal | Good | No | no | 62 |
| 14 | M | 32 | L/D | Right | IPV | Normal | Good | No | no | 15 |
| 15 | M | 28 | L/D | Right | FFH | Normal | Good | No | no | 18 |
| 16 | M | 29 | L/D | Right | IPV | Normal | Good | No | no | 32 |
| 17 | F | 48 | L/D | Right | TA | Normal | Good | No | no | 24 |
| 18 | M | 31 | L/D | Right | IPV | Normal | Good | No | yes | 30 |
| 19 | M | 21 | L/D | Right | IPV | Normal | Good | No | no | 66 |
| 20 | M | 24 | L/D | Right | IPV | Normal | Good | No | no | 48 |
| 21 | M | 39 | L/D | Right | IPV | Normal | Good | No | no | 36 |
| 22 | M | 27 | L/D | Right | IPV | Normal | Good | No | no | 48 |
| 23 | M | 28 | L/D | Left | FFH | Normal | Good | No | no | 60 |
| 24 | F | 29 | L/D | Left | TA | Normal | Good | No | no | 48 |
| 25 | M | 56 | L/D | Left | WRI | Normal | Good | No | no | 48 |

extraoral scars of the submandibular and preauricular approaches were significantly longer than those of the retromandibular approach [26]. Using the modified Risdon approach, the scars were barely noticeable and always hidden. There were no signs of hypertrophic scarring in this study.

**CONCLUSION**

The main advantages of the modified Risdon approach described in this study were the following: low risk for the mandibular branch of facial nerve damage; no identification and visualization of the mandibular branch facial nerve; no need for blood vessel identification (facial artery and vein); direct, fast, and safe approach to the mandibular angle and subcondylar region; relatively simple surgical technique and good cosmetic result – due to aesthetically pleasing incision.

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**REFERENCES**

Модификовани Риздонов приступ кроз периангуларну инцизију у хируршком лечењу субкондиларних прелома доње вилице

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Увод У литератури не постоји консензус у погледу хируршког приступа за лечење прелома кондиларног наставка доње вилице.

Циљ рада Циљ рада је био да прикаже модификовани Рисдонов приступ (без идентификације фацијалног живца) у лечењу субкондиларног прелома доње вилице.


Резултати У постоперативном току нису биле присутне саливарне фистуле и инфекција. Код два пацијената (8%) била је присутна времена пареза маргиналне гране фацијалног живца, која се повукла у року од шест недеља. Код свих пацијената је успостављено нормално отварање уста постооперативно. Ожиљак је добро скривен у првој вратној бори. Два пацијента су испољила симптоме дисфункција темпомандибуларног зglobа. Код свих пацијената постигнут је добар естетски резултат у двогодишњем периоду праћења.

Закључак У поређењу са техникама описаним у литератури, основне предности модификованог Риздоновог приступа су следеће: одсуство потребе за идентификацијом фацијалних крвних судова; директност, што омогућава брз и безбедан приступ углу доње вилице и субкондиларној регији; релативна једноставност хируршке технике, као и естетски позиционирана инцизија. Овај приступ може бити препоручен за лечење субкондиларног прелома доње вилице, као једноставан и безбедан.

Кључне речи: субкондиларни прелом; екстраорални приступ; отворена редукција

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