J Oral Maxillofac Surg
77:1962-1964, 2019

Advanced Model of a 4-Step Chart for Percutaneous Approaches to Condylar Fractures: A Tool to Comprehend Trends in Classification Based on the Dissection Route

*Tomoaki Imai, DDS, PhD,**
Mitsuhiro Nakazawa, DDS, PhD,† and Narikazu Uzawa, DDS, PhD‡

In the application of percutaneous approaches for mandibular condyle fractures, facial nerve injury (FNI) has been the most troubling aspect associated with surgical repair.[1] The conventional classification of these approaches according to the incision site does not reflect the risk of FNI owing to diverse dissection routes via a similar incision,[2] which have confused surgeons and residents who intend to minimize the morbidity.[3] Equivocal examples in the treatment of condylar neck and subcondylar fractures include approaches via retromandibular incisions (transparotid, retroparotid, and transmasseteric anteroparotid [TMAP] approaches), as well as those via submandibular incisions (traditional submandibular [Risdon] and high perimandibular [high cervical TMAP] approaches).[3] From the viewpoint of the risk of FNI, the classification of percutaneous approaches based on dissection routes as well as the incision site would be more reasonable than a classification based on the incision site alone.[2]

Surgeons encounter various soft tissue structures in the course of percutaneous approaches to the condyle. We previously presented a 4-step chart for depicting the whole image, which includes 4 components: the skin incision, the parotid, the facial nerve branches, and the condyle.[3] However, these components are inadequate to enhance awareness of the possible anatomic structures to be surgically managed. We herein propose an advanced model of the self-learning system with additional elements: the platysma–superficial musculoaponeurotic system (SMAS), the masseter muscle, the parotid duct, and the apparatus of the temporoparietal area (Fig 1).

The SMAS, a fibrofatty superficial fascia in the face, links inferiorly with the platysma and superiorly with the temporoparietal fascia over the temple and the galea over the scalp. The point of recognizing percutaneous approaches is the extent to which surgeons proceed on the platysma-SMAS before entering deep dissection to the ramus and/or condyle. On the chart's component of the facial nerve, this critical point would be reflected as inter-branch spaces through which the surgical path is deepened.[3] Given the concept of the marginal mandibular branch (MMB) as a key branch, percutaneous approaches via retromandibular and submandibular incisions can be classified into 2 categories based on whether the subcutaneous dissection traverses the MMB deeply (the meshed area of the facial nerve component in Fig 1) or superficially (the non-meshed area). The application of the deeply traversing group (ie, traditional submandibular and retroparotid approaches) would increase the probability of FNI in comparison to superficially

Received from Department of Oral and Maxillofacial Surgery II, Osaka University Graduate School of Dentistry, Suita, Japan.

*Assistant Professor.

†Associate Professor.

‡Professor.

Conflict of Interest Disclosures: None of the authors have any relevant financial relationship(s) with a commercial interest.

Address correspondence and reprint requests to Dr Imai: Department of Oral and Maxillofacial Surgery II, Osaka University Graduate School of Dentistry, 1-8 Yamadaoka, Suita, Osaka 565-0862, Japan; e-mail: hsc12@hotmail.com

Received May 21 2019

Accepted May 24 2019

0278-2391/19/30560-9

https://doi.org/10.1016/j.joms.2019.05.029

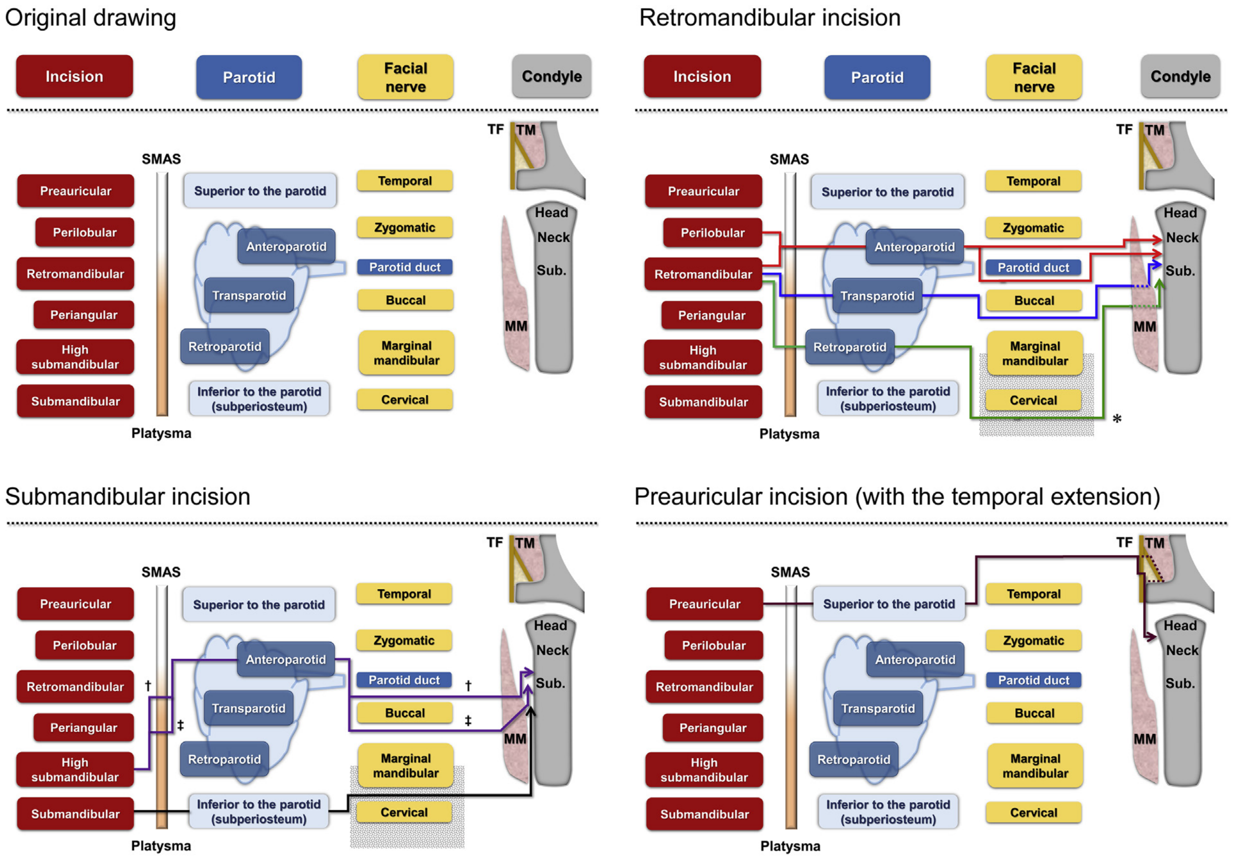

FIGURE 1. Advanced model of 4-step chart for percutaneous approaches. The original drawing for self-learning is shown in the *upper left*. This visual system consists of 4 major components (the skin incision, the condyle, and the relationships with the parotid and facial nerve branches)[3] and additional elements (platysma–superficial musculoaponeurotic system [SMAS], parotid duct, masseter muscle, and apparatus of the temporoparietal region). Other incision items, such as rhytectomy or temporal, can be introduced as users' prefer. The 3 main approaches with a retromandibular incision are shown in the *upper right*. The *red*, *blue*, and *green arrows* indicate the transmasseteric anteroparotid, transparotid, and retroparotid approaches, respectively. The *asterisk* indicates the inferoposterior to cervicofacial division of the facial nerve, which contains nerve fibers of the marginal mandibular branch and cervical branch. The *dotted lines* through the masseter muscle indicate that the pterygomasseteric sling is incised on the posterior border of the ramus, whereas the *solid lines* represent a transmasseteric manner. Approaches with a submandibular incision are shown in the *lower left*. The *black arrow* indicates the traditional submandibular (Risdon) approach. On the *purple arrows*, the *dagger* and *double dagger* indicate high cervical transmasseteric anteroparotid and high perimandibular approaches, respectively. The main points of difference are the superoinferior levels of the supraplatysmal dissection and subsequent deepening to the condyle. The *meshed rectangles* correspond to areas inferoposterior to the marginal mandibular branch. The approaches through the area (ie, the retroparotid and traditional submandibular approaches) travel in a subplatysmal dissection and traverse under the facial nerve branches. The superiorly retracted bulky flap includes the whole parotid and masseter muscles and thus often involves cumbersome manipulation to reduce the fractured condyle, leading to an increased risk of facial nerve injury.[4] Approaches with a preauricular incision are shown in the *lower right*. The *brown arrow* indicates subfascial dissection, and the *dotted line* indicates modification by deep subfascial (supratemporalis) dissection, which includes the superficial temporal fat pad. MM, masseter muscle; Sub, subcondylar; TF, temporal fascia; TM, temporal muscle.

Imai, Nakazawa, and Uzawa. Percutaneous Approaches to Condyle. J Oral Maxillofac Surg 2019.

traversing the MMB (ie, transparotid, TMAP, and high perimandibular approaches).[4] In the course of dissection in the TMAP and high perimandibular approaches, the nerve branches with frequent interconnection (the buccal branch) are anatomically sheltered by the platysma-SMAS, and the retraction load is unlikely to affect the nerve function.

The masseter muscle and the parotid are soft tissues with large volumes, which can be surgically managed. The smaller the volume of the retracted flap for access to the condyle, the more feasible the surgical field to manipulate reduction and fixation of condylar neck and subcondylar fractures. Both the masseter muscle and the parotid are entirely included in the flap in the retroparotid and traditional submandibular approaches. On the other hand, in the TMAP and high perimandibular approaches, the transmasseteric access contributes to reducing the flap volume, enhancing the efficacy of the procedures and reducing the risk of FNI. Although a minor structure, the parotid duct would be a superoinferiorly anatomic index along the anterior edge of the parotid when deepening from the level of the SMAS to the condyle, especially in the TMAP approach.

In the management of the condylar head, a preauricular approach with or without the temporal extension is generally achieved. The superficial layer of the temporal fascia is incised superior to the zygomatic arch, followed by subfascial dissection. Deep subfascial dissection on the temporal muscle (deep subfascial approach or supratemporalis approach) also is applied to protect the temporal branch more carefully because thick soft tissue, including double layers of the temporal fascia and an intermediate tissue (ie, the superficial temporal fat pad), covers the nerve branch.

A lack of familiarity with percutaneous approaches other than the traditional submandibular access might make surgeons select closed treatment for condylar fractures that are otherwise candidates for surgery.[5] Estimating the risk of FNI in each surgical procedure is therefore important for decision making regarding the performance of open treatment and for selection of an appropriate approach. Our chart provides a pliable and multifaceted perspective about subcutaneous routes in percutaneous approaches, regardless of the incision site, and also helps to comprehend the trends in classification and to differentiate an increased number of approaches to minimize the risk of morbidity.

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