

TECHNICAL NOTE

Transparotid approach for mandibular condylar neck and subcondylar fractures

Approccio transparotideo per il trattamento chirurgico delle fratture del collo del condilo mandibolare e sottocondilari

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SUMMARY

Mandibular condylar neck fractures and subcondylar fractures represent, respectively, 19-29% and 62-70% of all mandibular fractures; treatment involves some problems, common to both, concerning the choice of an adequate approach. Herewith, personal experience is reported related to the surgical treatment of some cases of mandibular condylar neck and subcondylar fractures by transparotid approaches with partial parotidectomy, removing the salivary tissue overlying the condylar neck and/or the subcondylar region. Over the last 5 years, we observed 22 fractures of the condylar neck and 10 fractures of the subcondylar region. In 13 patients (11 male, 2 female, age range 10-68 years, mean 33 years), 10 of whom had other mandibular and/or other maxillo-facial and skeleton fractures – 50% of these with dislocated condylar heads – and the other 3 for their free choice, regarding the different treatments, 18 transparotid approaches with partial parotidectomy (bilateral in 5 cases), were performed reducing and fixing 12 condylar neck fractures and 5 subcondylar region fractures with appropriate plates (2.0 mm) and screws. After surgery, no intermaxillary fixation was performed. Complications included 4 salivary fistulae (bilateral in 1 patient), which closed spontaneously after 4 or 5 weeks with a dressing, 1 case of Frey's syndrome, which healed after 2 treatments with botulin and 6 cases of transient facial palsy lasting 4-8 weeks (1 case bilateral) affecting zygomatic, buccal and marginal mandibular nerves. During follow-up, functional parameters considered were: restoration of original pre-injury occlusion; vertical, lateral and protrusion mandibular movements. All patients re-acquired the original pre-injury occlusion; the maximal post-operative intrinsic distance was at least 40 mm after a variable period of rehabilitation and lateral and protrusion movements also led to satisfactory final results. All patients were free of pain and had no deflection or clicking upon opening or chewing. None suffered from haematoma, miniplate fractures, bone resorption or condylar necrosis. In our experience, the Transparotid approaches with partial parotidectomy permits very good anatomical repositioning of the displaced condylar or subcondylar osseous segments in all cases, since isolation of the facial nerve branches and removal of a limited part of the parotid gland tissue overlying the lesion allow perfect exposure of the fracture site. The wide operation field allows the facial nerve to be preserved and permits easy internal rigid fixation with plates, as the drill, screws and screwdriver can be positioned exactly perpendicular to the bone surface instead of obliquely, as occurs with many different approaches.

KEY WORDS: Mandible • Condylar neck fractures • Subcondylar fractures • Facial nerve

RIASSUNTO

Le fratture del collo del condilo mandibolare e quelle sottocondilari costituiscono rispettivamente il 19-29% e il 62-70% di tutte le fratture della mandibola. Il trattamento di queste fratture presenta alcuni problemi comuni concernenti la scelta dell'approccio più adeguato. Riportiamo la nostra esperienza personale nel trattamento chirurgico della fratture del "complesso collo del condilo-regione subcondilare" mediante un accesso transparotideo che prevede una parotidectomia parziale ("selettiva") per rimuovere e spostare lateralmente il tessuto ghiandolare e divaricare i rami del nervo facciale posti al di sopra delle rime di frattura. Abbiamo osservato negli ultimi 5 anni, 22 fratture del collo del condilo e 10 della regione subcondilare. In 13 pazienti (11 maschi, 2 femmine, età media 33 anni, range 10-68), 10 con altre fratture mandibolari e/o maxillo-facciali e scheletriche – 5 di questi con testa del condilo dislocata – e 3, in seguito ad una loro libera scelta dopo adeguata informazione, abbiamo effettuato 18 accessi transparotidei (bilaterali in 5 casi) riducendo e fissando con placche e viti di titanio da 2,0 mm, 12 fratture di collo di condilo e 5 fratture della regione sottocondilare (una frattura del collo condilare è stata esposta ma non si è ritenuto indispensabile fissarla con osteosintesi). Dopo l'intervento chirurgico non è stato mai applicato un bloccaggio intermassellare. Come complicanze abbiamo osservato 4 fistole salivari (bilaterali in una paziente) guarite spontaneamente in 4-5 settimane con medicazioni; un caso di sindrome di Frey risoltasi dopo 2 trattamenti con tossina botulinica e 6 paralisi temporanee delle branche inferiori del nervo facciale (bilaterali in un caso) risoltesi in 4-8 settimane. Durante il follow-up abbiamo preso in considerazione i seguenti parametri: il ripristino della occlusione originale pre-trauma, i movimenti mandibolari verticali, laterali e di protrusione. Tutti i pazienti hanno riacquisito l'occlusione originale pre-trauma; la distanza massima interincisiva nei movimenti verticali è risultata essere pari, o superiore, a 40 mm dopo vari periodi di riabilitazione; i movimenti di lateralità e di protrusione hanno dato risultati soddisfacenti. Nessun malato ha lamentato dolore, deviazione mandibolare, rumori articolari in apertura o durante la masticazione. Non abbiamo avuto ematomi, rottura delle placche, riassorbimento osseo o necrosi dei condili. Pertanto, nella nostra esperienza, l'accesso transparotideo con parotidectomia parziale ha consentito un riposizionamento ottimale dei segmenti ossei fratturati poiché l'isolamento dei rami del nervo facciale e la rimozione di una piccola parte di tessuto ghiandolare soprastante la lesione ossea hanno consentito una perfetta esposizione della rima di frattura. L'ampio campo operatorio ottenibile consente di non ledere i rami del nervo facciale e di effettuare con facilità le osteosintesi con placche perché è possibile lavorare posizionando trapano e cacciavite perfettamente perpendicolari alle superfici ossee e non con angolazioni oblique come spesso accade utilizzando altri tipi di approcci chirurgici.

PAROLE CHIAVE: Mandibola • Fratture del collo del condilo • Fratture sottocondilari • Nervo facciale

Introduction

Mandibular fractures are the third most frequent maxillo-facial fractures after those of the nasal and zygomatic bones. Mandibular condylar neck fractures and subcondylar fractures constitute, 19-29% and 62-70% of all mandibular fractures, respectively^{1,2}.

Management of these lesions remains controversial and a consensus about the best approach is difficult to reach, particularly regarding the choice of open versus closed techniques, especially for condylar fractures. The displacement of the proximal and distal bone fragments in the case of condylar fractures depends on the direction, degree, magnitude and precise point of application of the force, as well as the state of dentition and the occlusal position¹. In fact, with adequate molar support and the teeth in occlusion, little or no displacement can occur. Most condylar fractures are caused by indirect traumas, the forces being transmitted to the condyle from a blow elsewhere.

Various classifications of condylar fractures are reported in the literature. Spiess and Schroll³ propose six classes of fractures of the condylar head and neck with various types of displacement of the bone fragments. For practical purposes Lindahl⁴ classified condylar fractures as those of the condyle head, condyle neck and subcondylar. Zachariades et al.¹ classified condylar fractures as intracapsular, condylar neck and subcondylar. MacLennan⁵, Lindahl⁴, Zhang and Obeid⁶ and others⁷⁻⁹ classify these fractures also as undisplaced, deviated and displaced when the condyle is inside the glenoid fossa, and as dislocated when outside.

Treatment of fractures of the condylar neck and the subcondylar region presents some of the same problems regarding the choice of an adequate approach, since both lie under the parotid gland and facial nerve.

Concerning the sites of condylar and subcondylar fractures, according to Lindahl's⁴ and Zachariades et al.¹ classifications, we can consider "intracapsular" the lesions with the fracture line in the condylar head and "extracapsular" the lesions consisting of condylar neck fractures with the fracture line extending over the sigmoid notch, and of subcondylar fractures that have the fracture line extending under the sigmoid notch in the upper part of the vertical ramus (Fig. 1).

The debate regarding the optimal treatment of these fractures is still open and for every fractured condyle the decision concerning appropriate intervention has to be made individually, although Haug et al.¹⁰, in agreement with Zide and Kent¹¹, Zide¹² and Kent et al.¹³, have published the latest indications for open treatment of the

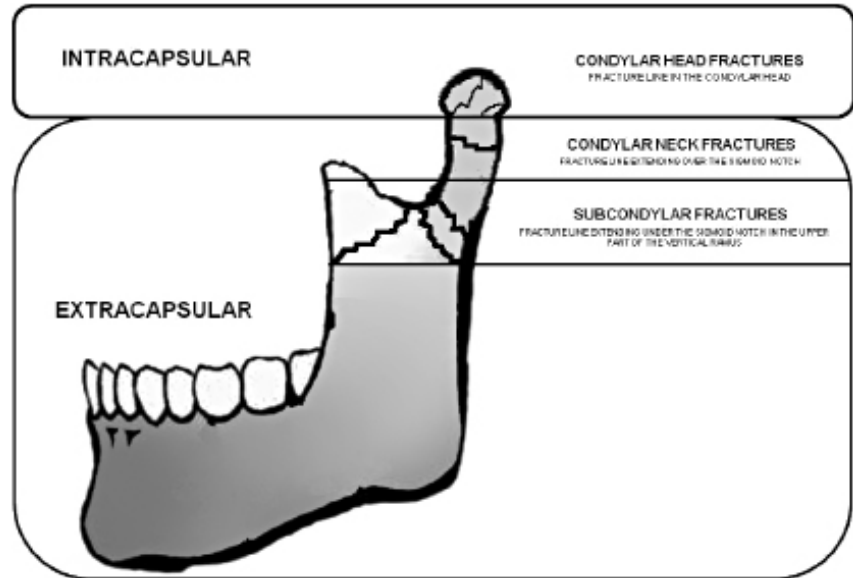


Fig. 1. Sites of condylar (intra-capsular and extra-capsular) fractures and of subcondylar fractures (according to Lindahl's and Zachariades' classification).

condyle process, which include "malocclusion, mandibular dysfunction and abnormal relationship of the jaws". Conservative treatment, with closed reduction and intermaxillary fixation, provides good results; many Authors also consider the risks and morbidity of surgery too great to justify the procedure^{11-14,17}. Nevertheless, with the advent of osteosynthesis, allowing fixation, stabilization and fracture healing in an anatomically correct position, over the last few years a continuously increasing number of reports in the literature have advocated surgical treatment for condylar and subcondylar fractures, employing a wide variety of approaches^{1,3,18-30} (Table I).

Table I. Some of the surgical approaches for condylar and subcondylar fractures.

- Preauricular
- Extended preauricular
- Retroauricular
- Submandibular
- Retromandibular
- Coronal
- Bicoronal
- Ramus osteotomy
- Intraoral
- "Combined"
- Facial rhytidectomy
- Face-lifting
- Transparotid
- Transparotid - transcutaneous
- Transmasseteric antero - parotid
-
- Endoscopic

Table II. Study population (C.N.: condylar neck; S.R.: subcondylar region; R.: right; L.: left).

Patient	Age (yrs)	Sex	Mandibular fracture site	Other mandibular fractures	Other maxillo-facial fractures	Skeleton associated fractures
AA	30	M	C.N. R.+L.	Mandibular horizontal arch	Maxillary sinus Nasal bone Dental alveolus	
DFM	45	F	C.N. R.+L.		Nasal bone Zygomatic arch Orbital floor	Femur 4 Ribs Patellas
OG	68	M	C.N. L.	Mandibular horizontal arch		
ME	32	M	C.N. R.		Maxillary sinus Orbital floor	
DCN	10	M	C.N. R.+L.	Mandibular horizontal arch		
PP	29	M	S.R. R.	Mandibular horizontal arch		
TV	35	M	S.R. L.		Nasal bone Zygomatic arch Frontal bone	Acetabulum
IC	43	M	S.R. L.			
MM	32	M	S.R. L.			
LPM	35	M	C.N. L.	Angle of mandibula	Nasal bone	
VU	52	M	S.R. R.			
ID	27	M	C.N. R.+L.	Mandibular horizontal arch		Femur
PS	34	F	C.N. R.+L.	Mandibular horizontal arch	Nasal bone	Tibia Fibula Pelvis

When surgery is indicated, open reduction with internal rigid fixation is preferable; however, the risk of injury to both the facial nerve and its branches has to be taken into consideration, together with the difficulty in obtaining adequate access and correct placement of plates and screws, because the parotid gland, masseter muscle and soft tissues need to be strongly retracted to permit surgical manoeuvres.

The present report refers to personal experience over the last five years, in the surgical treatment of 13 patients with condylar neck and subcondylar fractures by a Transparotid Approach with Partial Parotidectomy (T.A.w.P.P.), removing the salivary tissue overlying the fracture sites.

Patients and methods

In the last five years, we have observed 254 patients with maxillo-facial fractures, limited to a single facial bone in 171 cases and associated with multiple fractures in 83 cases.

Overall, 73 fractures were mandibular (28%), 22 of which regarding the condylar neck (31%) and 10 the subcondylar region (16%).

Radiological examinations consisted of Orthopantomography (OPT) and Three- Dimensional Computed Tomography (3D CT-scan).

In 13 patients, surgical treatment was performed to re-assemble the fractured segments, as there were:

- associated mandibular fractures in 7 cases;
- associated maxillo-facial fractures in 6 cases, 3 of which

with mandibular fractures of the horizontal arches and also of the angle;

- condylar head dislocation in 6 cases;
- bilateral condylar neck fractures in 5 cases (one of these patients, a 10-year-old boy had the operation because his parents wanted to avoid immobilization and accepted the risk of submitting the boy to another operation at a later date to remove the plates).
- loss of vertical ramus height in 2 cases;
- impossibility to restore the pretraumatic or, at least, adequate occlusion for an anterior open bite in 2 cases.

These indications for open surgery are the same as those reported, in the literature, by several Authors^{1-3 10-13 19 25-27 31}.

The patients comprised 11 males and 2 females, age range 10-68 years (mean age: 33 years). Causes of the fractures were: car accidents (7 cases), personal violence (3 cases), falls from a bicycle (2 cases), and an accident at work (1 case).

Four patients also had other skeletal fractures: one female - four ribs, both patellas and a femur, the other female - the pelvis, tibia and fibula; one man had a fracture of the acetabular fossa and the other a fractured femur (Table II).

A total of 18 T.A.w.P.P.s (bilateral in 5 cases), were performed reducing and fixing 12 condylar neck fractures and 5 fractures of the subcondylar region with appropriate plates and screws. In one case of bilateral fracture, "incomplete" on one side, the condylar neck fracture site was exposed but rigid fixation of the fragments was not deemed necessary.

Under general anaesthesia, after treating any associated extra-mandibular fractures and/or mandibular fractures, surgery began with a preauricular incision, as is usually performed in common parotid surgery (often with part of the skin incision in the external auditory conduct and preserving the great auricular nerve).

The facial nerve, with its main branches, was localized and isolated, limiting the dissection to the fracture site and isolating the facial fibres above from the surrounding parotid tissue so that it was possible to mobilize them for a long tract; a partial parotidectomy was then performed, removing only the salivary tissue overlying the fracture site.

The fracture was exposed with the facial fibres mobilized, where necessary (Fig. 2); it was then reduced and fixed with appropriate plates (2.0 mm) and screws, avoiding injury to the facial nerve. In the 6 cases with condylar head dislocation outside the glenoid fossa, a long screw was used in order to find, move and reposition the osseous fragments vertically during osteosynthesis.

We employed only one plate to fix the condylar neck fractures and two plates for sub-condylar region fractures, except in one case.

The wound was closed in layers, particular care being taken with the parotid tissue, and closure of the parotid fascia. Thereafter, a suction drain was left in situ.

After surgery, no intermaxillary fixation was performed. Analgesics and a soft diet were given in the post-operative period. An OPT was performed, in all cases, to check the state of the repositioned fragments.

Patients were usually discharged 5-6 days post-operatively; they were advised to eat soft food, for 4-6 weeks, and encouraged to practice opening and closing the mouth.

These 13 patients were observed at follow-up for at least 6 months, to check for any possible complications or changes in functional parameters.



Fig. 2. T.A.w.P.P., exposure of fracture site.

Results

During follow-up, functional parameters considered were:

- restoration of the original pre-injury occlusion;
- vertical, lateral and protrusion mandibular movements.

All patients re-acquired their original pre-injury occlusion; the maximal post-operative interincisal distance was at least 40 mm after a variable period of rehabilitation and final lateral and protrusion movements also showed satisfactory results. The patient who underwent surgery 3 years ago, aged 10 years, is closely checked by an odontologist; his facial bones are growing normally and, therefore, it does not appear to be necessary, so far, to remove the plate (Figs. 3, 4).

All patients were free from pain and presented no deflection or clicking upon opening or chewing. None of the patients suffered from haematoma, sialocele, plate fractures, bone resorption or condylar necrosis.

The patients moved their jaws starting from the first day after the operation, speaking and eating a soft diet.

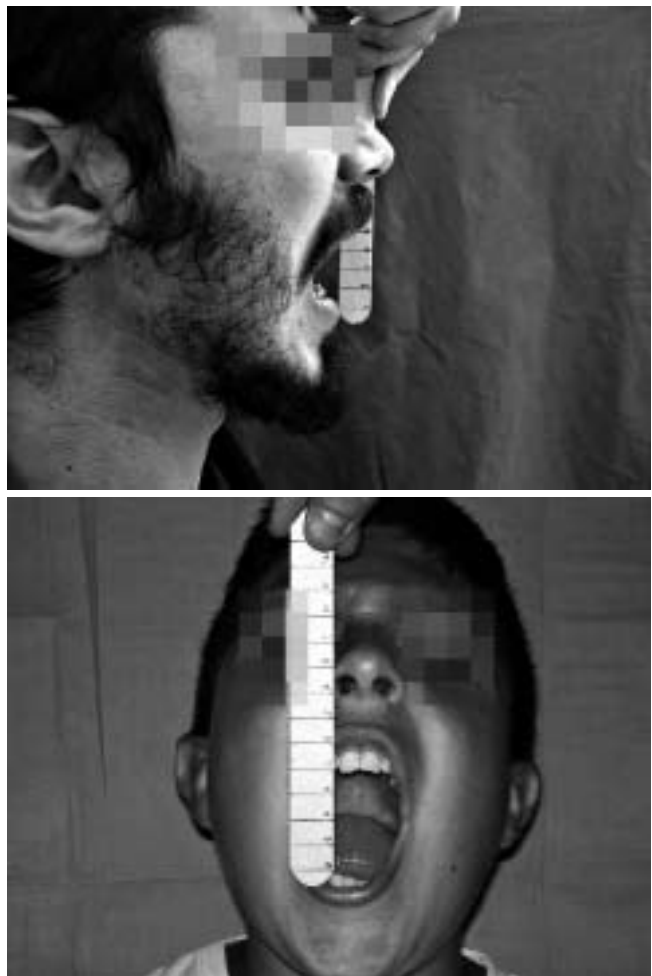


Fig. 3. A) Patient ID, male, mouth-opening 4 months after surgical treatment. B) Patient DCN, male, mouth-opening 3 years after surgical treatment.

From an aesthetic point of view, the scar healed very well with no complaints, in this respect, from the patients.

As far as concerns complications, 4 salivary fistulae (bilateral in 1 patient) were observed which closed spontaneously after 4 or 5 weeks with a dressing, 1 case of Frey's syndrome, which healed after two treatments with botulin, and 6 cases of transient facial palsy lasting 4-8 weeks (1 case bilateral) affecting zygomatic, buccal and marginal mandibular nerves. These complications are related to the greater "aggressiveness" of this approach compared with the conservative techniques; however, it should be pointed out that, all patients overcame these problems in < 2 months, moving their jaws from the first day after the operation and obtaining the very good final functional results described, simply because they were not subjected to immobilization of the joints and muscles.

Discussion

Mandibular fractures are very common as a result of maxillo-facial traumas; 19-29% are condylar neck fractures and 62-70% are subcondylar fractures^{1,2,32}.



Fig. 4. Patient DCN, male, lateral movements of the jaw on right and left sides.

Condylar neck and subcondylar fractures have some clinical problems in common regarding diagnosis and treatment. Both kinds of fracture can be treated via a conservative or a surgical approach, on the basis of several factors: degree and direction of displacement, level of fracture, position of the condylar head in relation to the glenoid fossa, position of the fractured bone segments of the subcondylar region with possible loss of vertical ramus height, patient age, dental status, accompanying fractures of the facial skeleton and of the body, potential for good occlusion and the patient's general condition.

There are many reasons for the debate concerning open versus closed treatment, but the most important is probably the complicated surgical procedure involved, which is the same, or very similar, for the treatment of both condylar neck and subcondylar region fractures²⁷.

Surgical problems in common consist of: limited access, risk of damage to the facial nerve and its branches, post-operative auricular anaesthesia – paraesthesia due to injury of the greater auricular nerve, damage to parotid gland function (sialoceles, fistula, etc.).

In our opinion, these clinical considerations justify the same treatment for these two different kinds of fracture characterized by the different level of the fracture line, extending over and under the sigmoid notch, both types being "extracapsular"^{4,6-8,33} and underlying the parotid gland and the facial nerve.

Not all mandibular fractures require surgery; in fact, a large number can be treated non-surgically, with pain-killers, physiotherapy or intermaxillary fixation under local anaesthesia in the outpatient department. It is unanimously agreed that open reduction is absolutely contraindicated for intracapsular fractures, being considered still experimental^{34,35}.

However, when surgery is indicated ("malocclusion, mandibular dysfunction, abnormal relationship of the jaws", according to Haug et al.¹⁰, Zide and Kent¹¹, Zide¹² and Kent et al.¹³), there is no doubt regarding the advantage of treatment with osteosynthesis of the displaced fragments. In the last few years, many studies have shown that anatomical reduction and internal fixation improve the functional outcome^{1,3,19,26,27,31,36-38}, and it should be pointed out that our patients, if properly informed about the option of open and closed procedures and their risks, and thus actively involved in making the relevant decisions, the majority choose to undergo surgery, because of the possibility of using the jaw immediately.

Of mandibular fractures, lesions of the mandibular arch and angle can be treated via trans-oral, sub-mandibular and retro-mandibular approaches using internal rigid fixation, with an acceptable rate of complications. In contrast, surgical treatment of fractures of the condylar neck and of the subcondylar region involves the risk of damage to the facial nerve. For this reason, the surgical approach, for these fractures, requires great experience in order to avoid injury to the facial nerve and its branches, limit the

traumatic surgical manoeuvres by internal rigid fixation and obtain a wide surgical field with good illumination and undisturbed vision.

Clinicians are still faced with the dilemma regarding the optimal approach to the condylar neck and subcondylar region; various approaches described in the literature testify to the shortcomings of most techniques.

In the last few decades, many different approaches have been proposed, particularly for condylar neck fractures (Table I), to treat cases in which closed treatments (e.g., intermaxillary fixation, mandi-fix, anchor screws, etc.) appear unsuitable. Among these surgical approaches, we cannot identify an "ideal" technique. In fact, according to Choi and Yoo²⁵, pre-auricular, sub-mandibular and retro-mandibular approaches are not useful when operating on high condylar neck fractures because the access for accurate placement of the plates and screws is limited. The extended pre-auricular incision reported by Hammer et al.¹⁸ provided sufficient exposure of the condylar neck and the entire ascending ramus, but detaching the masseter muscle from the zygomatic arch entails considerable damage.

Another method of exposing condylar fractures is reported by Dunaway and Trott²¹, involving the use of an extended bicoronal approach with myotomy of the masseter muscle, which seems too traumatic.

A technique for removal and replantation of the condylar segment through the use of ramus osteotomy has also been proposed^{22,23}, but there is a high risk of resorption of the replanted condyles^{39,40}.

The facelift-transparotid approach¹⁹, the trans-masseteric antero-parotid approach²⁷ and the transparotid transcuteaneous approach²⁶ are valid if performed by experienced surgeons, but, in our opinion, these methods do not prove much safer than a transparotid approach with little parotid tissue removal, which provides excellent exposure of the facial nerve and fracture site in all cases.

An endoscopically-assisted trans-oral approach has also been described to treat selected cases of only low subcondylar fractures²⁸⁻³⁰, but it requires special instruments and additional training, with a considerable learning curve.

For these reasons, in our opinion, T.A.w.P.P permits easier

good anatomical repositioning of the displaced condylar or subcondylar osseous segments in all cases, since isolation of the facial nerve branches and removal of a limited part of the parotid gland tissue overlying the lesion allow perfect exposure of the fracture site. Care must be taken to avoid injury to the facial nerve, to perform a perfect haemostasis (posterior facial vein) and to close the salivary ducts. The wide surgical field allows the facial nerve to be preserved and permits easy internal rigid fixation with plates, because perfectly perpendicular placement of screws (at 90° to the bone surface) can be achieved using a drill and screwdriver, not obliquely to the bone surface as occurs with the many different above-mentioned approaches. In fact, if screws are not placed vertically, but at very low angles to the plates, immobilization of the condylar-subcondylar fragments may be insufficient or unsuccessful.

The greater "aggressiveness" of the T.A.w.P.P. compared with the conservative treatments and other more limited approaches used for condylar neck and subcondylar fractures is compensated, in our opinion, by the high degree of safety and the easy technical approach of this procedure, the excellent final functional results and the rapid recovery. The only relatively serious complications, we observed, were salivary fistulae, due to the opening of the parotid capsula and removal of a part of the gland (with opening of the salivary ducts), but these healed spontaneously in a short time.

Conclusions

Open reduction with internal rigid fixation of condylar neck and subcondylar fractures can be performed employing different surgical approaches. Among these, the T.A.w.P.P. can be recommended for its reliability and low rate of complications, since it provides the most direct access possible to the fragments and the possibility to avoid excessive traction of the retractors on facial nerve branches.

This procedure is relatively simple and allows good functional and aesthetic final results but should be performed by experienced surgeons familiar with parotid surgery.

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