

Retrospective Analysis of Morphological and Functional Alterations of the Maxillo-Facial Area in Patients Treated for Neurosurgical Pathologies with a Different Pterional Approach

Sansalone Salvatore and Apicella Davide*

Department of Orthodontics and Dentofacial Orthopaedics, Calabrodental Hospital, Marrelli Health, Italy

*Corresponding author: Apicella Davide, Department of Orthodontics and Dentofacial Orthopaedics, Calabrodental Hospital, Marrelli Health, Crotona, Italy



ARTICLE INFO

Received: 📅 February 16, 2021

Published: 📅 February 25, 2021

Citation: Sansalone S, Apicella D. Retrospective Analysis of Morphological and Functional Alterations of the Maxillo-Facial Area in Patients Treated for Neurosurgical Pathologies with a Different Pterional Approach. Biomed J Sci & Tech Res 34(2)-2021. BJSTR. MS.ID.005520.

ABSTRACT

An alternative approach to temporomandibular disorders is presented. TMJ disorders are usually studied starting from the field of oral sciences, in this case the TMJ disorders are studied as a side effect or consequence of surgical interventions involving a muscle involved in mandibular movements. TMJ disorders were observed in all patients who underwent skeletal disconnection of the temporal muscle. However the patients where the re-attachment of the muscle was favored by a surgical technique that preserved the structural arrangement of the muscular tissue have largely recovered the functionality of the temporomandibular joints and of the mandibular movements.

Introduction

Pterional craniotomy is a method which provides wide access to the skull base. This method is considered crucial in neurosurgery, however this approach has a drawback, which is the need to perform a complete dissection of the temporal muscle. This leads to a risk of blemishes and functional alterations concerning chewing: this functional deficit is generally due to damage of the frontal branch of the Facial nerve and to the atrophy of the temporalis muscle [1-3].

The advantages of this method are:

1. Reduced surgery time
2. Less trauma of tissues around the lesion
3. More favorable postoperative course
4. Less hospitalization time
5. Lower costs and
6. Better aesthetic and functional results [4-6].

A variation to the classic pterional approach was proposed by J. Hernesniemi with the technique of the „lateral supraorbital approach”: it represents an alternative to the classic pterional approach with different indications and different operative advantages [5]. The greatest challenge of modern neurosurgery is to find new strategies that reduce invasiveness without compromising visibility and accessibility to the operating field: the pterional approach, in light of these considerations, represents the gold standard for surgeon-friendly neurosurgery and patient-friendly.

Surgical Procedure

Head Position

The patient is in supine position. The head is directed about 20 degrees downwards, elevated and rotated according to the position of the aneurysm or of the lesion to be approached: in positioning the head it is necessary to avoid that the contraction of the cervical

muscles create an obstacle to the regular cerebral blood flow along the main pathways venous.

Skin Incision and Dissection of Temporalis Muscle

After the incision of the skin, fascia temporalis and temporalis muscle must be incised too using a scalpel, muscles have to be spaced apart together with the skin to avoid injuries to the Frontal and Facial nerve. It is important to save the Temporalis Superficialis artery because it can be used for a intracranial or extracranial vascular bypass.

Craniotomy

On the Temporalis bone two holes have to be done to gain the access: the first hole is posterior, it is done above the zygomatic arch, the second one, also called the "key hole", it is brought forward up to one and a half cm on the frontal bone then with a curvilinear course we cross the superior temporal line and following the cutaneous edge we reach the posterior limit of the bone flap. The following phase of the osteotomy is done with a surgical drill, it creates a bloodless access to the skull base, this method also breaks part of the lesser wing of the Sphenoid bone. The incision of the Dura Mater is done with a semicircular incision around the Lateral Sulcus; then the first meninge can be spaced apart to gain the access to the Arachnoid [1,3,7]. In the pterional approach the risk of injuring the temporal branch of the Facialis nerve is high, this leads to the possibility of causing iatrogenic aesthetic-functional type damage, such as alteration of the tone of the Frontalis muscle and of the Orbicularis muscle: these two branches are particularly evident following the subgaleal pterional approach, but the risk is reduced if the temporal muscle is preserved together with the galeal fascia. The temporal branch of the facial nerve crosses the zygomatic process, reaching the frontal muscle: if the pterional access incision follows the reference of the temporal fascia, preserving the body of the temporal muscle, injuries to the branches of the facial nerve, that carry the innervation to the Frontal muscles, are avoided [8-12]. The aim of the work is to verify the clinical, morphological and functional implications of the pterional approach in pathologies with neurosurgical indication; specifically, we want to investigate whether the surgical umlaut envisaged by this approach should have a full-thickness linear course, or multiple thicknesses following the planes of each fascia; finally you want to evaluate if the umlaut is safer with the cold blade scalpel or with the monopolar? [13-17].

Materials and Methods

Between 2008 and 2015, the authors retrospectively selected

876 patients, treated with the pterional access technique: the pathologies that required neurosurgery were intracranial aneurysms, meningiomas of the anterior and middle cranial fossa, and some types of glioma arising in the temporo-frontal area. The inclusion criteria excluded patients with pain, inflammation or infections in the region of the surgical site, patients who had re-operations in the same area, patients who had craniofacial trauma, and patients who required surgical access so broad that affect the temporal muscle, since this muscle could have an abnormal scarring outcome, predisposing the region to abnormal and deforming musculoskeletal stresses. At the end of the sample selection phase, 656 patients were included in the retrospective study.

Patients have been evaluated by the maxillofacial surgeon and by the baseline neurosurgeon (T0) before the surgery and during the post- surgery check ups. (T1-2-3-4).

The authors performed functional tests to evaluate the following parameters:

1. Functionality of the V and VII Cranial nerve,
2. Postoperative pain assessed by the VAS (visual analog scale),
3. Width of the mouth opening with reference to the inter-incisal distance,
4. Amplitude of lateral movements of the mandible,
5. Tone and symmetry of the masticatory muscles [14].

Data have been recorded at baseline (T0), one week after surgery (T1), after one month (T2), after three months (T3) after 12 months (T4). The surgical technique used was different for the different types of pathology treated, however, only those patients who had surgical access with the pteral access method were selected. Patients have been divided in 4 groups. We obtained the following results:(Tables 1-4).

Table 1.

	Surgical Access Techniques	n. of Patients
Group 1	Single layer and monopolar coagulation	152
Group 2	Single layer and scalpel (preserving deep temporalis fascia)	164
Group 3	Double layer and monopolar coagulation	172
Group 4	Double layer and scalpel (preserving deep temporalis fascia)	168

Table 2.

Single Layer and Monopolar Coagulation 152 Patients		After One Week	After One Month	After Three Months	After One Year
	1 functionality of the V and VII Cranial nerve	No deficit	No deficit	No deficit	No deficit
	2 postoperative pain assessed by the VAS (visual analog scale)	72%	45%	20%	13%
	3 width of the mouth opening with reference to the inter-incisal distance	63%	42%	22%	9%
	4 amplitude of lateral movements of the mandible	Possible in 78% of cases	Possible in 97% of cases	Possible in 99% of cases	Possible in all the patients
	5 muscle atrophy	Not observed	52% of patients	68% of patients	68% of patients

Table 3.

Single Layer and Scalpel 164 Pazienti		After One Week	After One Month	After Three Months	After One Year
	1 functionality of the V and VII Cranial nerve	Deficit in 11% of the patients	Deficit of VII in 7% of the patients	Deficit of VII in 7% of the patients	Deficit of t VII in 6% of the patients
	2 postoperative pain assessed by the VAS (visual analog scale)	75%	47%	25%	12%
	3 width of the mouth opening with reference to the inter-incisal distance	66%	44%	22%	10%
	4 amplitude of lateral movements of the mandible	80%	94%	98%	Possible in all the patients
	5 muscle atrophy	Not observed	56%	70%	70%
Unico strato e uso del bisturi a freddo(preservazione fascia profonda del temporale) 172 pazienti		After one week	After one month	After three months	After one year
	1 functionality of the V and VII Cranial nerve	No deficit	No deficit	No deficit	No deficit
	2 postoperative pain assessed by the VAS (visual analog scale)	43%	23%	11%	No pain
	3width of the mouth opening with reference to the inter-incisal distance	33%	11%	No limitations	No limitations
	4 amplitude of lateral movements of the mandible	Possible in 92% of the patients	Possible in all the patients	Possible in all the patients	Possible in all the patients
	5 muscle atrophy	Not observed	Not observed	2%	3%

Table 4.

Double Layer and Scalpel 168 Pazienti		After One Week	After One Month	After Three Months	After One Year
	1 functionality of the V and VII Cranial nerve	Deficit of VII in 10 % of the patients	Deficit in 7% of tha patients	Deficit in 7% of the patients	Deficit in 7% of the patients
	2 postoperative pain assessed by the VAS (visual analog scale)	44%	25%	13%	4%
	3width of the mouth opening with reference to the inter-incisal distance	30%	12%	No limitations	No limitations
	4 amplitude of lateral movements of the mandible	Possibile nel 89%	Possibile in tutti i pazienti	Possibile in tutti i pazienti	Possibile in tutti i pazienti
	5 muscle atrophy	Non visibile	Non atrofia	Non atrofia	Non atrofia

Results

From the analysis of our case series we found that there are different clinical implications depending on the group analyzed and the parameters evaluated. Early postoperative complications were evident in the chewing function with painful-dysfunctional symptoms in the temporal and preauricular region, with evident difficulty in chewing: this dysfunction decreased in surgical protocols which required less dissection of the planes around the temporal muscle; this more conservative approach led to a reduction in the incidence of contractures of the temporal muscle, decreased postoperative edema and improved the post-surgical course in general. A further criticality highlighted was the presence, following pterional surgery, of sites with reduced mechanical resistance to the Frontalis muscle, caused by the opening of the muscle on two planes, this exposed the branches of the Facial nerve to injuries and dysfunctions. These branches on these planes run towards the frontal muscle. Late complications affecting the masticatory function are manifested mainly in cases in which hypotrophy of the temporal muscle is highlighted: this occurrence was mainly associated with the use of surgery with monopolar scalpel and the failure to preserve the deep fascia of the temporal muscle, limiting thus the ability to open the mouth and placing the anatomical conditions to result in dimorphisms of high aesthetic value [13,14,16-19].

Conclusion

From the literature examined, and from a careful analysis of our cases, we can deduce that the best way to dissect the temporal muscle, in the pterional approach, is to incise it together with the skin with a full thickness flap, without detaching the superficial muscle fascia from the subcutaneous plane in order to preserve the peripheral nerve branches that innervate the Frontal muscles. This approach will reduce the risk of alterations in the facial expression, function and sensitivity of the maxillofacial area in treated patients. Finally, an important indication is to preserve the internal fascia of the temporal muscle, detaching it with a blade: in fact, the cases treated with monopolar coagulation have reported in the long term important hypotrophies associated with aesthetic-functional deficits, with serious repercussions on the chewing capacity.

References

- Chaddad-Neto F, Filho JMC, Dória-Netto HL, Faria MH, Ribas GC, et al. (2012) The pterional craniotomy: tips and tricks. *Arq Neuro-Psiquiatr* 70(9): 727-732.
- McLaughlin N, Cutler A, Martin NA (2013) Technical nuances of temporal muscle dissection and reconstruction for the pterional keyhole craniotomy. *J Neurosurg* 118(2): 309-314.
- Wen HT, de Oliveira E, Tedeshi H, Antrade FC Jr, Rhoton AL Jr (2001) The Pterional Approach: Surgical Anatomy, Operative Technique, and Rationale. *Operative Techniques in Neurosurgery* 4(2): 60-72.
- Evans T Johns Hopkins (2012) The frontotemporal ("pterional") approach: an historical perspective. *Neurosurgery* 71(2): 481-491.
- Hernesniemi J, Ishii K, Niemela M, Smrcka M, Kivipelto L, et al. (2005) Lateral supraorbital approach as an alternative to the classical pterional approach *Acta Neurochir* 94: 17-21.
- Altay T, Couldwell WT (2012) The frontotemporal (pterional) approach: an historical perspective. *Neurosurgery* 71(2): 481-491.
- Yaşargil MG (1984) *Microneurosurgery*. Thieme Stratton New York pp. 215-234.
- Pekar L, Bláha M, Schwab J, Melechovský D (2004) Craniotomy and the temporal branch of the facial nerve. *Rozhl Chir* 83(5): 205-208.
- Yaşargil MG, Reichman MV, Kubik S (1987) Preservation of the frontotemporal branch of the facial nerve using the interfascial temporalis flap for pterional craniotomy. Technical article. *J Neurosurg* 67(3): 463-466.
- Poblete T, Jiang X, Komune N, Matsushima K, Rhoton AL Jr (2015) Preservation of the nerves to the frontalis muscle during pterional craniotomy. *J Neurosurg* 122(3-6): 1-9.
- Coscarella E, Vishteh AG, Spetzler RF, Seoane E, Zabramski JM (2000) Subfascial and submuscular methods of temporal muscle dissection and their relationship to the frontal branch of the facial nerve. Technical note. *J Neurosurg* 92(5): 877-880.
- Gosain AK (1995) Surgical anatomy of the facial nerve. *Clin Plast Surg* 22(2): 241-251.
- Matsumoto K, Akagi K, Abekura M, Ohkawa M, Tasaki O, et al. (2001) Cosmetic and functional reconstruction achieved using a split myofascial bone flap for pterional craniotomy. Technical note. *J Neurosurg* 94(4): 667-670.
- De Andrade Júnior FC, De Andrade FC, De Araujo Filho CM, Carcagnolo Filho J (1998) Dysfunction of the temporalis muscle after pterional craniotomy for intracranial aneurysms. Comparative, prospective and randomized study of one flap versus two flaps dieresis. *Arq Neuropsiquiatr* 56(2): 200-205.
- Bowles AP Jr (1999) Reconstruction of the temporalis muscle for pterional and cranio-orbital craniotomies. *Surg Neurol* 52(5): 524-529.
- Spetzler RF, Lee KS (1990) Reconstruction of the temporalis muscle for the pterional craniotomy. Technical note. *J Neurosurg* 73(4): 636-637.
- Zager EL, Del Vecchio DA, Bartlett SP (1993) Temporal muscle microfixation in pterional craniotomies. Technical note. *J Neurosurg* 79(6): 946-947.
- Miyazawa T (1998) Less invasive reconstruction of the temporalis muscle for pterional craniotomy: modified procedures. *Surg Neurol* 50(4): 347-351.
- Welling LC, Figueiredo EG, Wen HT, Gomes MQ, Bor-Seng-Shu E, et al. (2015) Prospective randomized study comparing clinical, functional, and aesthetic results of minipterional and classic pterional craniotomies. *J Neurosurg* 122(5): 1012-1019.

ISSN: 2574-1241

DOI: 10.26717/BJSTR.2021.34.005520

Apicella Davide. Biomed J Sci & Tech Res



This work is licensed under Creative Commons Attribution 4.0 License

Submission Link: <https://biomedres.us/submit-manuscript.php>



Assets of Publishing with us

- Global archiving of articles
- Immediate, unrestricted online access
- Rigorous Peer Review Process
- Authors Retain Copyrights
- Unique DOI for all articles

<https://biomedres.us/>