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Review Article

Temporalis Flap in Lateral Skull Base Reconstruction: A Case Report and Literature Review

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Abstract: The resolution of small to intermediate-sized anomalies affecting the craniofacial region can pose a formidable problem for surgical practitioners in instances where indigenous soft tissue flaps fail to provide sufficient tissue volume or suitable tissue characteristics to fulfill the desired reconstructive requisites. In the present scenarios, the preferred reconstructive modalities involve the utilization of regional pedicled flaps or free tissue transfers. The utilization of flaps originating from the temporalis muscle, fascia, or a combination of them, was initially documented by Yolovine in the year 1898. Subsequently, Murphy employed these flaps in 1914 for surgical interventions targeting the temporomandibular joints (TMJ). Subsequent to their initial utilization, axial flaps predicated upon the middle and deep temporal vessels have been subject to extensive and comprehensive deployment. This study seeks to provide a comprehensive understanding of the temporalis flap procedure, its indications, outcomes, and potential complications by analyzing a single case and conducting an exhaustive literature review.

Keywords: Scalp Trauma, Head Trauma, Scalp Reconstruction, Temporal Flap, Face Flaps, Fare Reconstruction.

INTRODUCTION

The temporalis muscle, an anatomical structure located in the temporal region of the cranium, has been identified as a valuable flap for various surgical procedures. It can be employed either as a muscle flap or as a fascial flap, depending on the specific requirements of the surgical intervention. In cases where thin and pliable tissue is deemed necessary, the temporalis muscle flap has demonstrated its utility in meeting these demands. The utilization of this therapeutic intervention can be traced back to the latter part of the 19th century, wherein it was initially employed for the management of ankylosis affecting the temporomandibular joint, as well as for the restoration of orbital exenteration defects. Since its initial implementation, the temporalis muscle has been extensively documented in the literature for its utility in the reconstruction of various anatomical defects, including but not limited to orbital defects and skull base defects. Additionally, it has been recognized as a valuable resource for providing coverage in mastoidectomy and temporal bone defects, as well as addressing palatal and oropharyngeal defects. Furthermore, the temporalis muscle has demonstrated promising outcomes in the realm of facial reanimation. The muscular tissue exhibits a remarkable capacity to serve as a volumetric augmentation strategy for parotidectomy defects, thereby mitigating the occurrence of contour deformities. Additionally, its inherent properties enable it to function as a formidable impediment against the untoward phenomenon of aberrant reinnervation of parasymphathetic nerves, thereby effectively averting the onset of Frey's syndrome. The utilization of flaps composed of the temporalis muscle, fascia, or a combination thereof, was initially documented by Yolovine in the year 1898, and subsequently employed by Murphy in 1914. The comprehensive elucidation of the intricate interplay between the temporalis muscle and fascial flaps, along with an exhaustive exposition of the surgical modality employed for the acquisition of said flap, can be readily accessed within the existing body of literature. The

anatomic considerations within this particular region frequently present challenges due to the absence of standardized nomenclature, leading to confusion among researchers and medical professionals alike. The ability to accurately identify and distinguish fascial layers is a crucial skill for surgeons, as it plays a pivotal role in ensuring the adequate protection of the intricate distributions of the facial nerve.

ANATOMY

The temporalis muscle is a component of the masticatory muscles that receives innervation from the trigeminal nerve. The muscle in question originates from the temporal fossa, attaches to the coronoid process of the mandible, and is enveloped by two layers of fascia. The superficial temporal fascia, also referred to as the temporoparietal fascia, is located in close proximity to the scalp skin and is connected to the subcutaneous musculoaponeurotic system (SMAS) and galea aponeurotica. The deep temporal fascia, alternatively referred to as the temporalis fascia, is situated in close proximity to the superficial fascia, with an avascular plane of loose areolar tissue serving as a demarcation between the two layers. Its primary function is to enclose and provide structural support to the temporalis muscle as it extends towards the zygomatic arch. The deep temporal fascia exhibits a high degree of adherence to the periosteum of the zygomatic bone at the arch level. The primary source of blood supply to the deep temporal fascia is primarily the middle temporal artery. On the other hand, the anterior and posterior deep temporal arteries, which are derived from the second segment of the internal maxillary artery, provide the blood supply to the temporalis muscle.

SURGICAL TECHNIQUE

The optimal visualization is achieved by extending a coronal scalp incision towards the preauricular region. The scalp can be easily lifted from the superficial temporal fascia, revealing the presence of the superficial temporal artery and vein, and sometimes the frontal branch of the facial nerve. The incision is made along the superior and posterior borders of the superficial temporal fascia, after which it is carefully reflected in an anterior and inferior direction. The elevation of the superficial temporal fat pad occurs through the process of incising a layer of the deep temporal fascia, which raises it along with the superficial temporal fascia. The frontal branch of the facial nerve is situated in close proximity to, or within, the adipose tissue layer known as the fat pad. By maintaining its position within the superficial temporal fascia layer, we can preserve the nerve and, to a certain degree, mitigate the occurrence of temporal hollowing that may arise from the extraction of the temporalis muscle flap. The temporalis muscle, a key structure in the human anatomy, can be successfully obtained in its entirety through the meticulous process of releasing its attachments to the temporal crest. Frequently, it is advantageous to incorporate a 1–2 cm margin of periosteum along with the flap. This serves two purposes: first, it allows for an increased functional length of the flap, and second, it provides a secure anchoring point for sutures due to its excellent suturing capabilities. The periosteal elevator serves as a valuable tool for the purpose of raising the muscle from the temporal fossa. This action is undertaken in order to prevent any potential harm caused by cautery to the deep temporal vessels, which are situated along the profound plane of the muscle. When the entirety of the muscle is not required, the preservation of an anterior strip of the muscle serves to minimize the resulting deformity, which can be observed when viewing from the front. The dissection process then continues in a caudal direction, aiming to separate the temporalis muscle until it reaches the point where it passes beneath the zygomatic arch. The flap is subsequently pivoted or turned inward to occupy the area of tissue loss. If additional range of motion is required, one may opt to eliminate the arch, thereby enabling a more posterior dissection of the muscle. The restoration of the arch can be achieved through the utilization of titanium mini-plates. When the flap is employed for intraoral reconstruction, excision of the coronoid process of the mandible facilitates the establishment of a sufficiently broad pathway for the muscle, while avoiding any additional morbidity. Once the temporalis muscle flap has been carefully rotated into the defect and appropriately fixed in position, the superficial temporal fascia may be either substituted or utilized to assist in filling the anterior donor-site temporal space. Subsequently, the scalp is meticulously closed in layers while drains are employed. Certain surgeons employ the use of acellular dermal matrix, porous polyethylene implants, or autologous fat grafting to enhance the hollowing at the donor site, either as a primary or secondary approach, as deemed suitable.

FIGURES

Indication for Temporalis muscle flap
Obliteration of oral defects
Temporomandibular joint reconstruction by gap asthriplasty
Craniak base reconstruction
Obliteration of orbital defect after enucleation
Facial reanimation surgery
Orbital repair with coronoid process after maxillectomy

1: Indication for Temporalis flap

2: Lateral view / Right lateral skull trauma defect

3: Temporal Muscle Flap

4: Defect cover after temporalis flap

5: Final result after surgery

DISCUSSION

The temporalis muscle, a thin and elastic musculature, exhibits a rotational radius measuring approximately 8 cm and a remarkable arc of rotation spreading up to 135°. This exceptional anatomical characteristic makes it a valuable resource for addressing various deficiencies that involve the temporal bone, anterior skull base, orbit, maxilla, palate, oral cavity, and oropharynx. The utilization of the flap is a viable option for the purpose of addressing gaps subsequent to oncologic resections, fixing instances of cerebrospinal fluid leakage, or providing coverage for mesh or plates employed in diverse forms of craniofacial reconstruction. In the area of facial reanimation procedures, an alternative approach involves the rotation of the temporalis tendon towards the oral commissure. This technique holds promise for addressing facial paralysis, a condition characterized by the loss of voluntary muscle control in the face. By strategically manipulating the temporalis tendon, which is responsible for the movement of the jaw, the goal is to restore functionality to the affected facial region. This innovative procedure warrants further investigation and evaluation to ascertain its efficacy and potential benefits in the the field of facial reanimation. In light of the raising utilization of free tissue transfer in contemporary reconstructive surgery, owing to its raised versatility and adaptability, it is imperative to acknowledge the longstanding merits associated with the application of regional flaps. Through the implementation of rotational manipulation of a present muscular structure within the surgical domain, a reduction in adverse effects at the donor site is achieved, thereby obviating the necessity for an additional surgical team possessing specialized knowledge in microvascular procedures. The temporalis muscle flap, a surgical technique commonly employed in reconstructive procedures, is not without its share of notable complications. Among these, two complications of particular significance are facial nerve injury and flap loss. Fortunately, the incidence rates for both conditions are relatively low. In the most extensive collection of 182 temporalis muscle flaps, an incidence of 19.2% was observed in terms of transient paresis affecting the forehead branch. Furthermore, a permanent paralysis rate of 2.7% and a total flap necrosis rate of 1.6% were documented. The cohort of individuals who exhibited complete flap necrosis had previously undergone therapeutic interventions involving chemotherapeutic agents. The potential adverse outcomes that may arise as a result of the medical intervention under consideration encompass a range of minor complications. These complications include, but are not limited to, infection, seroma formation, hematoma formation, alopecia, and the possibility of cosmetic deformity arising from a defect at the donor site. Patients who are subjected to the surgical procedure involving the temporalis muscle flap should to get comprehensive counseling with respect to the potential occurrence of a noticeable contour deformity that arises as a consequence of the extraction of the temporalis muscle. The implementation of a strategic approach aimed at preserving a portion of the anterior muscle holds the potential to mitigate the extent of deformity occurring in the anterior region situated behind the lateral orbital rim. This particular area, without of hair coverage, is susceptible to heightened visibility, thereby necessitating the adoption of measures to minimize its conspicuousness. In order to achieve enhanced flap mobility for the purpose of addressing defects in the lower third of the face or mastoid region, a potential approach involves the removal of the zygomatic arch. This surgical intervention has the potential to extend the available flap length by an estimated 2 to 3 centimeters. Following the rotational manipulation of the flap, the arch can be effectively restored and mended through the utilization of titanium miniplates. The frontal branch of the facial nerve is known to commonly traverse along Pitanguy's line, which is a designated trajectory extending from a point approximately 0.5 cm inferior to the tragus to a point approximately 1.5 cm superior to the lateral eyebrow. It is of utmost importance to exercise caution and ensure meticulous preservation of

this nerve during the dissection process of the temporalis flap.

CONCLUSION

The application of the temporalis muscle flap is a highly favorable alternative for the restoration of various craniofacial anomalies, especially in geriatric individuals who exhibit a number of concomitant medical conditions. There are several advantages associated with the use of free tissue transfer. These include a reduction in operative time, simplicity of tissue harvest, a dependable vascular supply that does not require microvascular anastomosis, little morbidity at the donor site, and shorter hospitalization periods. When performed by a skilled surgeon, the incidence of facial nerve damage and flap loss is significantly reduced. In order to enhance aesthetic results, the donor site can be repaired using many techniques, such as utilizing a portion of the temporalis muscle, temporoparietal fascia, various implants, or autologous fat. The choice of method is contingent upon the preferences of both the surgeon and the patient.

CONFLICTS OF INTERESTS

The authors have consistently showed the absence of any conflicts of interest, therefore guaranteeing the integrity and impartiality of their research findings.

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