# Temporal hollowing after pterional craniotomy

The temporal muscle atrophy or temporal hollowing seems to be the patient's main complaint. Only 17 (44.73%) studies addressed patient satisfaction regarding the aesthetics, and only 10 (26.31%) of the studies reported the cosmetic outcome as a primary outcome. Nevertheless, minimally invasive approaches appear to overcome most cosmetic complaints and should be performed whenever possible <sup>1)</sup>

Several alternatives are available to fill the hollowing of the supratemporal fossa during cranial reconstruction, but each has a disadvantage, whether it is expensive or difficult to shape for bilateral symmetry. Park et al. solved the cosmetic problem by using a properly carved silicone block to fill the supratemporal fossa while conducting cranioplasty, and here reports it with a literature review <sup>2)</sup>.

### Prevention

A modified osteoplastic pterional craniotomy significantly reduced atrophy of temporal muscle and caused proportionally less frontal muscle nerve damage compared with pterional craniotomy, although this latter outcome was not significant. These findings suggest that osteoplastic craniotomy may be a more advantageous intervention in cosmetic and functional terms compared with classical pterional craniotomy <sup>3)</sup>.

The suprafascial dissection technique does not cause permanent injury of the FTFN, and this approach results in a significantly lower incidence of postoperative temporal hollowing than interfascial dissection, especially without leaving a temporalis muscle cuff. <sup>4)</sup>.

The osteomyoplastic flap showed a less severe hollowing in the temple although it demands more time in order to perform it. The frequency of complications seems to be the same <sup>5)</sup>.

## Treatment

Reconstruction of frontotemporal lesions using Medpor® implants after the pterional approach improved temporal hollowing without additional complications <sup>6)</sup>.

Kim et al. developed a method of temporal augmentation using a calvarial onlay graft as a singlestage neurosurgical reconstructive operation in patients requiring craniotomy. In this report, we describe the surgical details and review our institutional outcomes. The patients were divided into pterional craniotomy and onlay graft groups. Clinical temporal hollowing was assessed using a visual analog scale (VAS). Temporal soft tissue thickness was measured on preoperative and postoperative computed tomography (CT) studies. Both the VAS and CT-based assessments were compared between the groups. Our review indicated that the use of an onlay graft was associated with a lower VAS score and left-right discrepancy in the temporal contour than were observed in patients undergoing pterional craniotomy without an onlay graft <sup>7)</sup>.

### Silicone implant for temporal hollowing

Silicone implant for temporal hollowing.

#### **Case series**

CT data of patients who received craniectomy and conventional CAD cranioplasty in Mainz between 2012 and 2018 were analyzed. CT datasets prior to craniectomy and after cranioplasty were subtracted to quantify the volume and localization of the defect.

Out of 91 patients, 21 had suitable datasets. Five cases had good cosmetic results with no defect visible, 16 patients had an apparent hollowing defect. Their average defect volume was 5.0 cm3  $\pm$  4.5 cm3. The defect localizations were in the area behind the zygomatic process and just below the superior temporal line, covering an area of app. 3×3 cm2. Surgical attempts of temporal muscle restoration were more often found in reports of good results (p<0.01), but also in 50% of reports, whose surgeries resulted in hollowing of the temple. Mean time between the two surgeries was 112  $\pm$  43 days. No significant differences between patients with and without hollowing defect were detected regarding time between the two surgeries, age or performing surgeon.

This work supplies evidence for the indication of a surgical corrective during cranioplasty in the small but cosmetically relevant area of the "frontozygomatic shadow". Based on these 3D data analysis, future focused surgical strategies may obtain better aesthetical results here <sup>8</sup>.

Temporal hollowing after pterional craniotomy is an unavoidable result. Bone, temporalis muscle, and soft tissues are combined etiologies. No predictive factors including age, sex, causes, operative time, radiation, and surgical technique are demonstrated. Volume of temporal area reduction was 19.74 cm 3 . Immediate reconstruction is recommended and volume of reconstruction is calculated from preoperative imaging <sup>9)</sup>

Temporal hollowing occurs to varying degrees after pterional craniotomy. The most common cause of temporal hollowing is a bone defect of the pterional and temporal regions due to the resection of the sphenoid ridge and temporal squama for adequate exposure without overhang. The augmentation of such bony defects is important in preventing craniofacial deformities and postoperative hollowness. Temporal cranioplasty has been performed using a range of materials, such as acrylics, porous

polyethylene, bone cement, titanium, muscle flaps, and prosthetic dermis. These methods are limited by the risk of damage to adjacent tissue and infection, a prolonged preparation phase, the possibility of reabsorption, and cost inefficiency. Kim et al have developed a method of temporal augmentation using a calvarial onlay graft as a single-stage neurosurgical reconstructive operation in patients requiring craniotomy. In this report, they describe the surgical details and review our institutional outcomes. The patients were divided into pterional craniotomy and onlay graft groups. Clinical temporal hollowing was assessed using a visual analog scale (VAS). Temporal soft tissue thickness was measured on preoperative and postoperative computed tomography (CT) studies. Both the VAS and CT-based assessments were compared between the groups. The review indicated that the use of an onlay graft was associated with a lower VAS score and left-right discrepancy in the temporal contour than were observed in patients undergoing pterional craniotomy without an onlay graft <sup>10</sup>.

Ninety-eight consecutive patients underwent reconstruction of pterional and temporal defects after FT and OZ craniotomy using the Medpor Titan implant. The implant was shaped to recreate the pterion to provide coverage for the cranial defect and to bolster the temporalis muscle to prevent temporal hollowing. The implant was then secured to the bone flap with titanium screws. Cosmetic evaluation was performed from both surgeon's and patient's perspective.

Of 90 patients who underwent cosmetic assessment at the 3 month follow-up, temporalis asymmetry was noticed subjectively by three patients and noted in 7 patients by the surgeon. Orbital asymmetry was not noticed in any cases by either surgeon or patient. Overall patient satisfaction was found in 89 of 90 patients (98.9%). There were no cases of temporal hollowing. One patient had a delayed wound infection, and one had an inflammatory reaction that required removal of the implant.

The technique using the Medpor Titan implant is a fast and effective method for pterional reconstruction after FT and OZ craniotomy with excellent cosmetic results and patient satisfaction. The implant combines the advantages of both porous polyethylene and titanium mesh, including easy custom-shaping without sharp edges, structural support and relatively lower cost. <sup>11</sup>.

#### **Case reports**

A patient who had a skull defect restored using a precisely shaped implant engineered via a computer using the opposite temporalis muscle as a mirror image. Polyether-ether-ketone cranioplasty was performed for the 52-year-old man with temporal hollowing after DC with resection of the temporalis muscle and fascia, due to a ruptured cerebral arteriovenous fistula.

The shape of the patient's surgical side was restored and not asymmetrical. The patient was very satisfied.

In the case of cranioplasty (CP) in patients with DC with resection of the temporalis muscle, CP with implants that include the opposite muscle may increase patient satisfaction without the risk of additional complications <sup>12</sup>

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