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# STUDY OF THE EFFECTIVENESS OF VARIOUS METHODS OF PLASTIC POST-TRAUMATIC CRANIAL DEFECTS.

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## Abstract
*The purpose of this work is to study the significance of clinical and neurological symptoms and evaluate the effectiveness of using various methods of plastic surgery of post-traumatic defects of the cranial vault*

**Keywords:** **analysis of the incidence of brain meningiomas depending on gender**

## Introduction
Craniocerebral injury (CCT) is a pressing problem, accounting for 35-40% of all injuries in peacetime. In case of combined injuries, the specific gravity of CCT reaches 70-72%. Clinical and neurological symptoms with CCT in general and post-traumatic defects of the skull in particular can be varied. These patients experience general cerebral , focal, vegetative-somatic symptoms, and some patients have epileptic seizures [3,4,6].
Doctors have been dealing with the problem of closing post-traumatic defects and restoring the integrity of the cranial vault since ancient times, and to this day, researchers are developing various methods for plastic surgery of skull defects and searching for the best method of graft fixation. has made all neurosurgeons think since the advent of neurosurgery [1,2,5].
When carrying out restorative treatment, it is optimal to eliminate or completely compensate for the damage, and in the presence of a trepanation defect in patients with the consequences of severe traumatic brain injury, pathogenetic therapy should begin with its plastic closure [4,8,9].
The optimal characteristics for any fixation system are the biological inertness of the material, reliability of fixation, absence of displacement between the graft and the cranial vault, ease of use, moderate cost of the design, absence of artifacts when conducting neuroimaging , neurophysiological or any other research methods. None of the known methods of graft fixation today meets all these requirements sufficiently [7,10,11].
The presence of a skull defect, especially an extensive one, leads to the development of organic and functional disorders of brain structures, disruption of hemo- and liquor dynamics in the brain. At the same time, the risk of external trauma to the unprotected brain increases significantly [1,3,4,9].

## Materials and Methods
This work is based on an analysis of the results of surgical ¬treatment of 60 patients with post-traumatic defects of the cranial vault bones (PTDCs) of various locations, who were treated as inpatients at the multidisciplinary clinic of the Samarkand State Medical University, Department of Neurosurgery, in the period from 2017 to 2023. Among the analyzed patients, men predominated - 45 (75.0%) and 15 (25.0%) women. All patients had a history of ¬TBI. In 48.5% of patients, the skull defect was localized in the fronto-parietal region, in 42.9% in the frontotemporal region, in

56.4% in the temporo-parietal region and in 8.6% of patients in the fronto-parietal-temporal region ( Diagram No. 1) . Based on the size of the skull defects, patients are divided into 3 groups: small - up to 30 cm 2 - in 24 (40%) patients, medium - up to 30-60 cm 2 in 32 (53.3%) patients and large - > 60 cm 2 in 4 (6.7%) patients (Table 1).

Diagram1

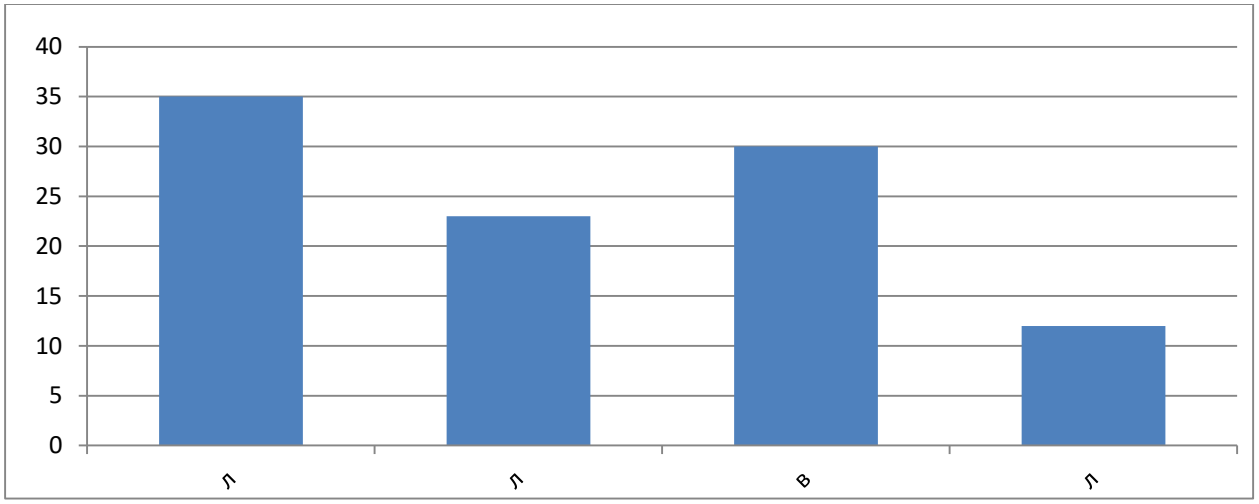


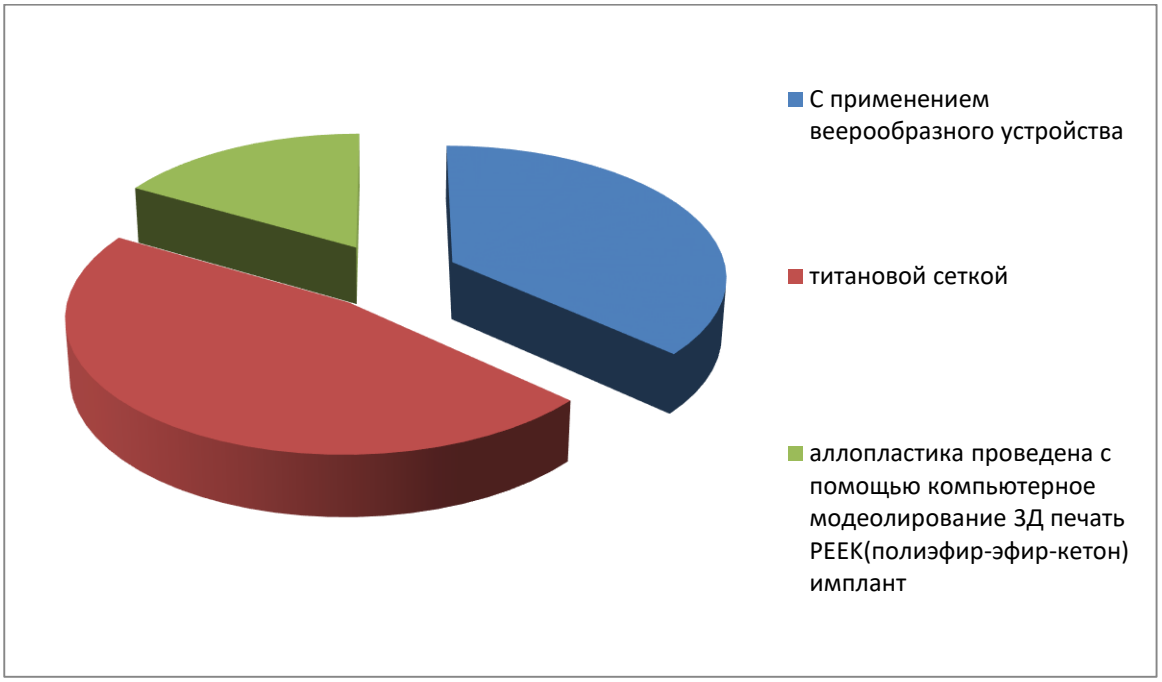

Table1

| Size of bone defects | Number of patients | % |
|---|---|---|
| small ( < 30 $^{cm2}$ ) | 24 | 40 |
| medium (30-60 cm $^{2}$ ) | 32 | 53.3 |
| large ( > 60 cm $^{2}$ ) | 4 | 6.7 |
| Total | 60 | 100 |

Of the 60 patients with PDSCH, 22 (36.7%) underwent autoplasty of defects in the bones of the calvaria using a fan-shaped titanium device, in 28 ( 46.7%) patients alloplasty was performed using a titanium mesh, in 10 (16.7%) patients alloplasty was performed using computer modeling 3D printing PEEK (polyether-ether-ketone) implant (Diagram No. 2).

All patients underwent a comprehensive examination, including clinical neurological and radiological examination using modern research methods (EEG, multislice computed tomography with 3D reconstruction of the skull and magnetic resonance imaging).

Diagram.No2




***Distribution of patients according to methods of plastic surgery of cranial defects.***

## Results and discussion

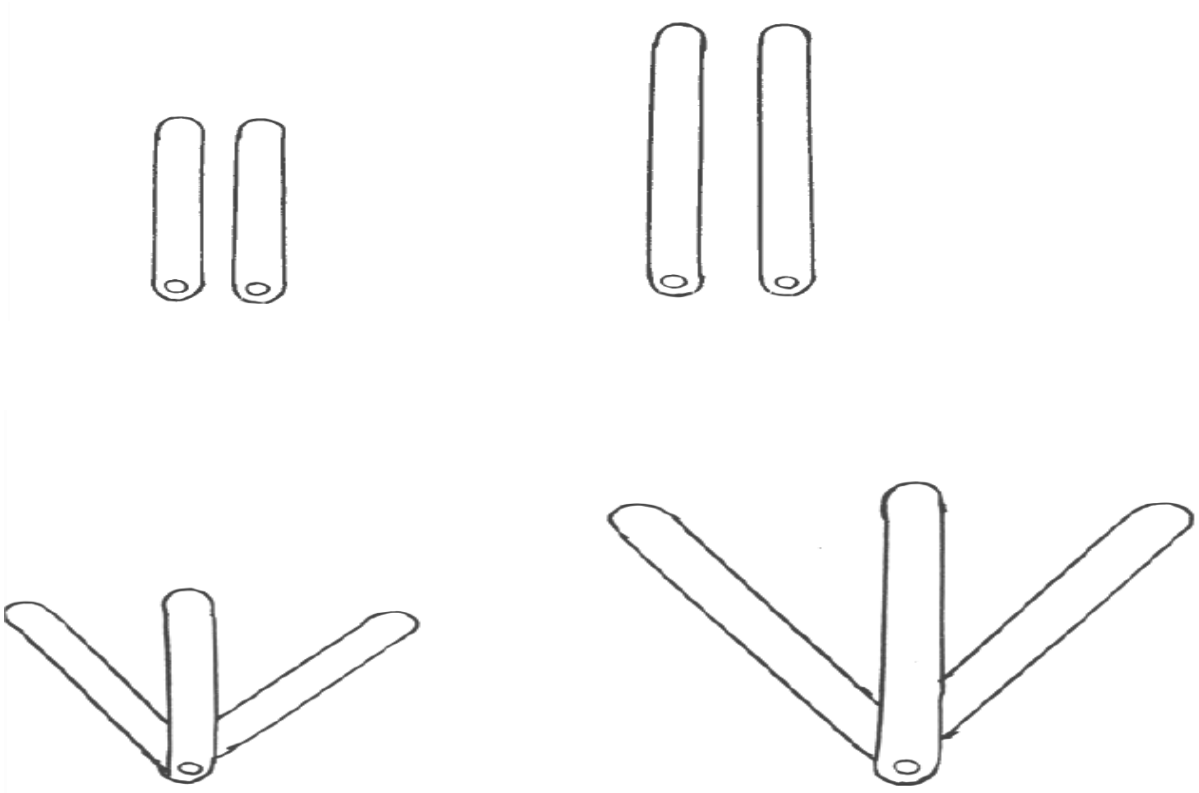
In 25% of patients, cranioplasty was performed within 1 year after injury and resection trepanation of the skull, and in the remaining 75% of patients, plastic surgery of skull defects was performed after 1 year. The neurological picture of trepanned skull syndrome (TSS) included cephalgia (98.4%), weather lability (88.4%), decreased ability to work (47%), decreased memory (72%), impaired intellectual function (38%), bulging underlying brain tissue into the trepanation window (72%), mental changes associated with cosmetic issues and constant fear of brain injury (88%), epileptic seizures (36.8%). Focal symptoms were observed in the form of hemiparesis, central paresis of the facial nerve, amorosis, hyposmia, anosmia and myopia. Hemiparesis was observed in 17.5%, central paresis of the facial nerve on the right in 15.4%, on the left in 12.4%, amaurosis in 5%, hyposmia in 5.6%, anosmia in 8.6% and amblyopia in 12.4 %.

For post-trepanation defects of the skull, especially for defects after surgery for depressed fractures of the calvarium and intracranial hematomas, various methods of plastic surgery are widely used: autoplasty, xenoplasty , alloplasty, etc. The best method , of course, is autoplasty of skull defects. Professor Mamadaliev A.M. et al . methods of primary and secondary autoplasty of calvarial defects using a fan-shaped titanium device have been developed and put into practice (patents for inventions have been received).

In the first and second groups, surgical intervention began with excision of the skin ¬scar and release of the edges of the bone defect.

The fixing fan-shaped device consists of several identical titanium plates, hingedly connected to each other. The ends of the plates have a rounded shape and at one end of each of the plates there is a hole for mutual fixation. A stainless steel rivet, used in medicine, is used to secure the plates. Alternatively, the hinge connection can also be achieved using stainless steel wire or thick silk. The plates have different sizes. Their length can be up to 150, width - up to 20 mm and thickness up to 2 mm. The size and number of plates depend on the size of the bone defect of the calvarium. In working condition, the device has a “Fan” shape.

The free ends of the plates were installed in “grooves” made between the outer and inner plates of the skull bone along the edge of the defect. The number of grooves depended on the number of plates. The hinged end of the device was placed on the opposite side of the bone defect on the made recess on the outer plates bones. The bone fragments removed during trephination were placed evenly and closely over the fan-shaped device. These fragments were treated prophylactically with an antiseptic solution. The postoperative wound was sutured tightly.



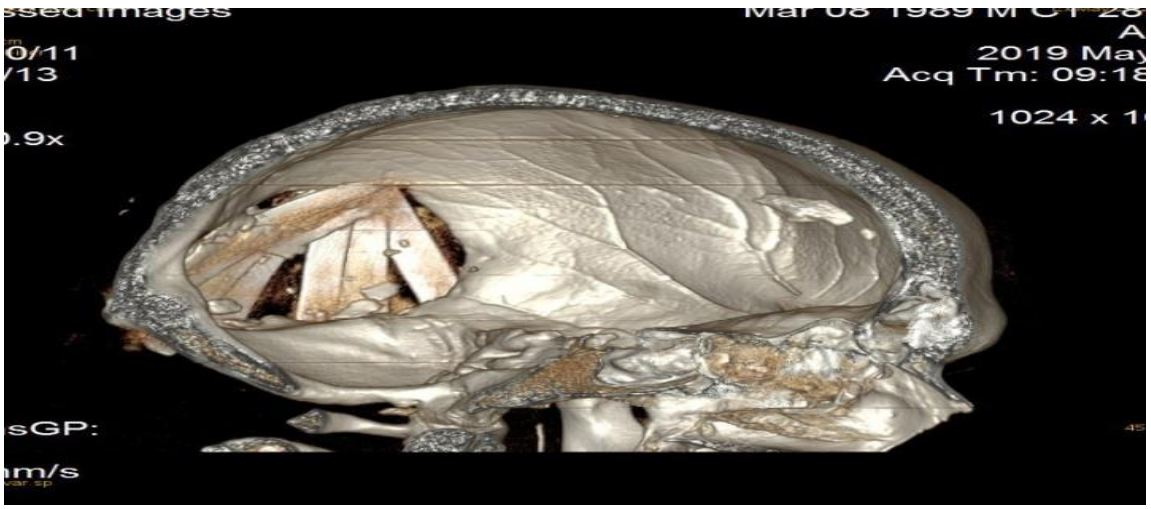



**Fig 3** 3D MSCT condition after installation of FAN-shaped titanium plates

The best results were observed with autoplasty of bone defects of the cranial vault. No purulent complications were observed in these groups of patients. However, 1 out of 22 patients experienced various complications such as graft rejection after surgery.

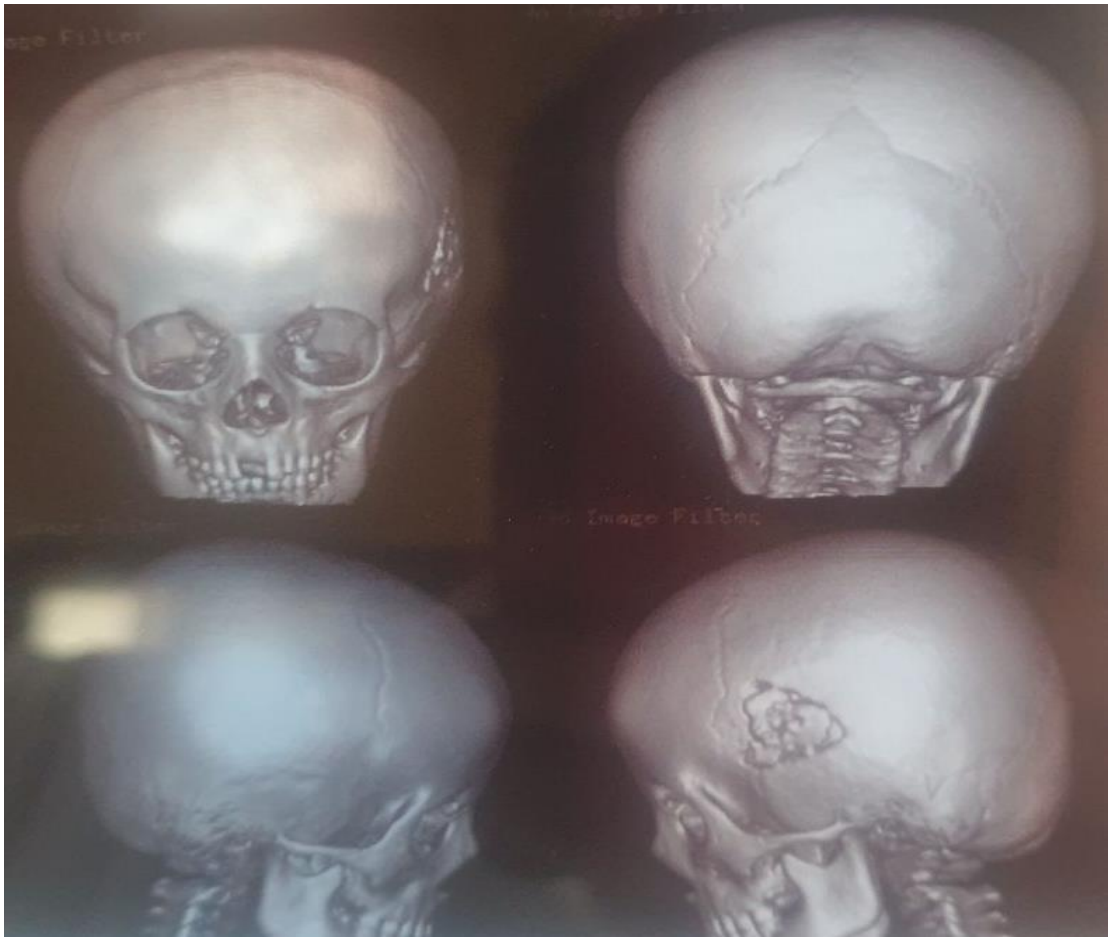
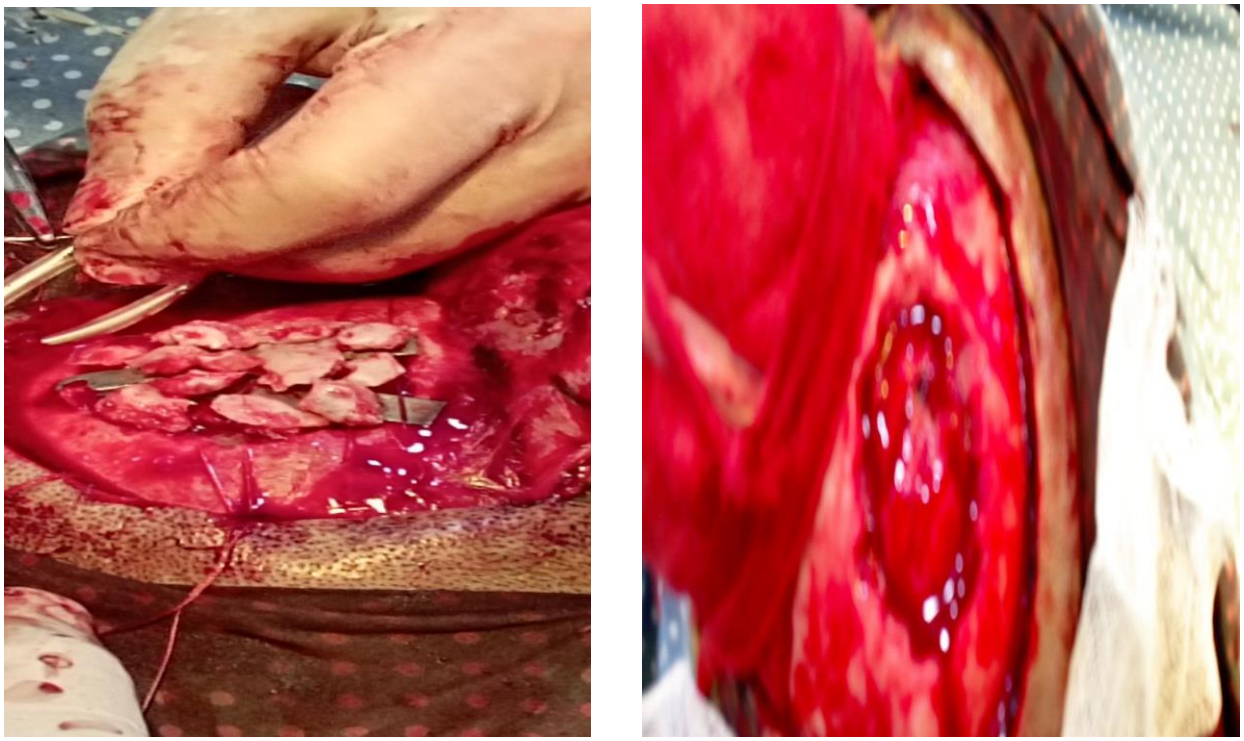


**Fig 4;** MSCT examination of a patient with a depressed fracture of the temporal bone on the left



Intraoperative photos 1,2. Installation of a FAN-shaped titanium plate

Of the 28 patients who underwent secondary allocranioplasty , 4 (14.3%) patients experienced various complications in the form of graft rejection, suppuration of the postoperative wound and osteomyelitis of the edges of the bone defect, which eventually required removal of the grafts.

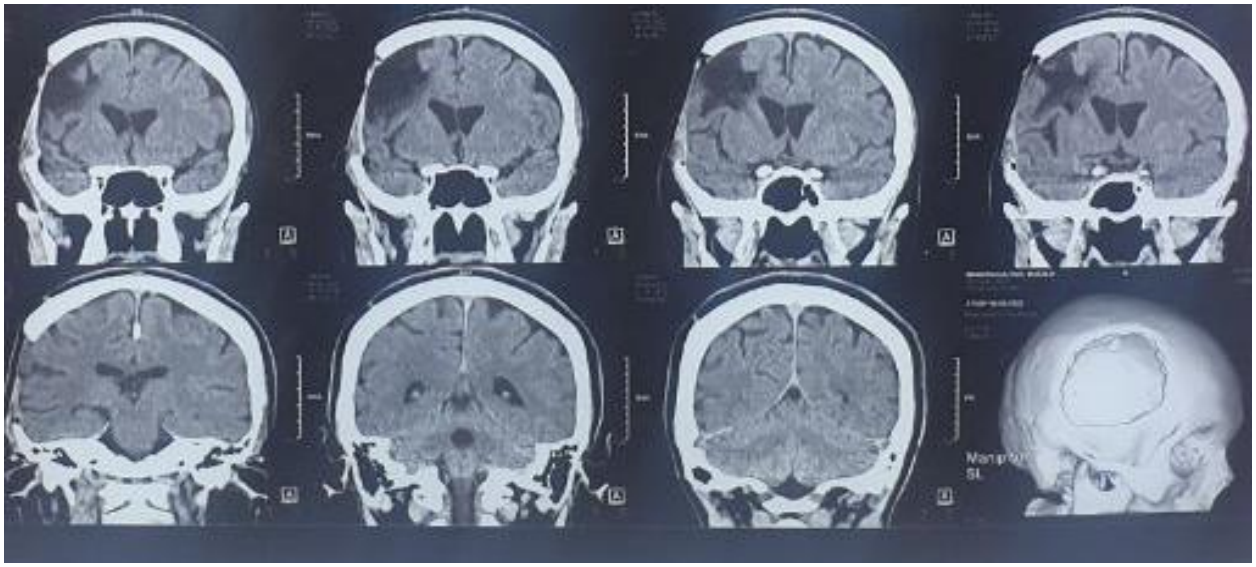
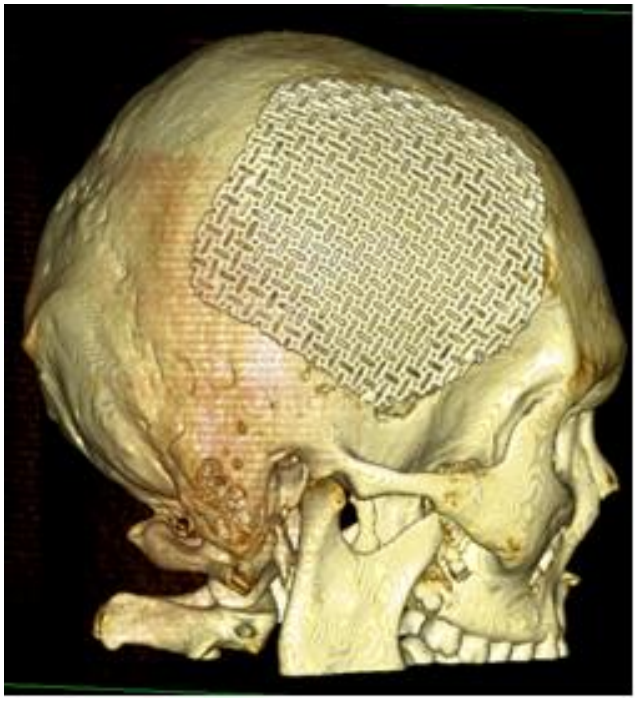
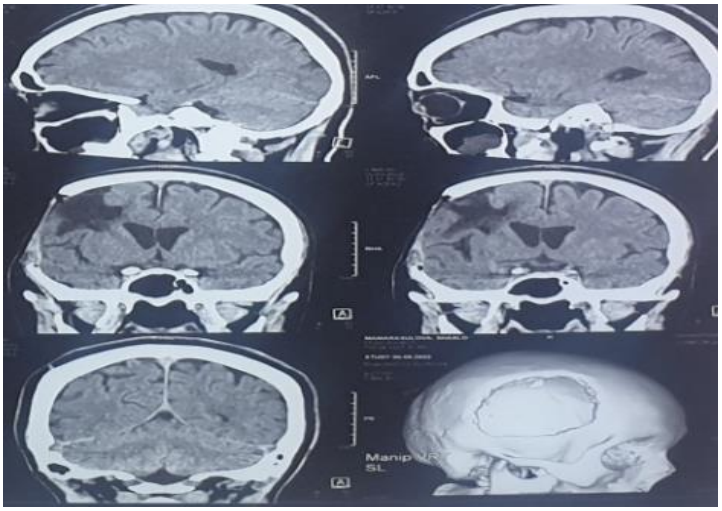
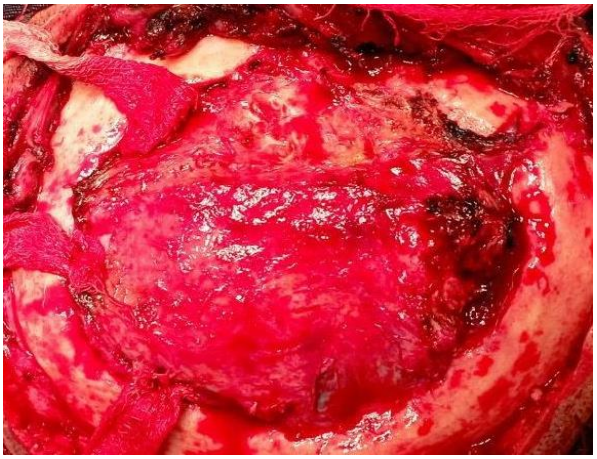


Fig 5; MSCT examination of a patient with a bone defect of the frontal-temporo-parietal region of the cranial vault on the right



**Intraoperative photos 3 (condition after titanium mesh installation); and Fig. 6 MSCT ( after surgery) of patient B. Condition after alloplasty with a titanium implant in the right fronto-parietal-temporal region**





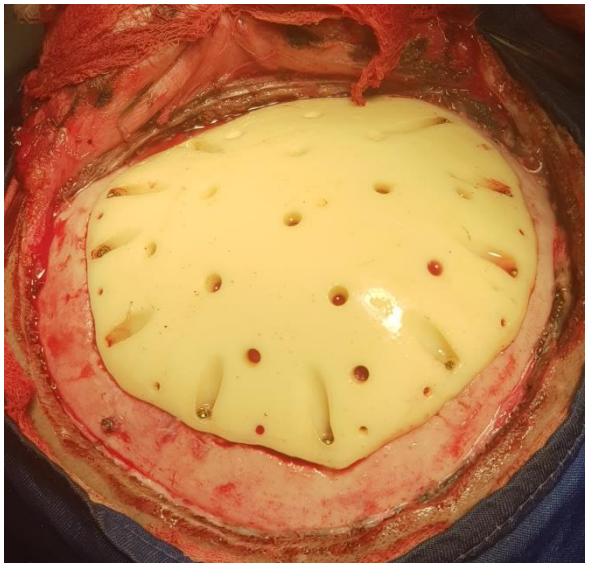


Fig 7; MSCT examination of a patient with a bone defect in the fronto-parieto-temporal region of the cranial vault on the right. Intraoperative photos 4 ( skeletonization of the bone defect and implant installation

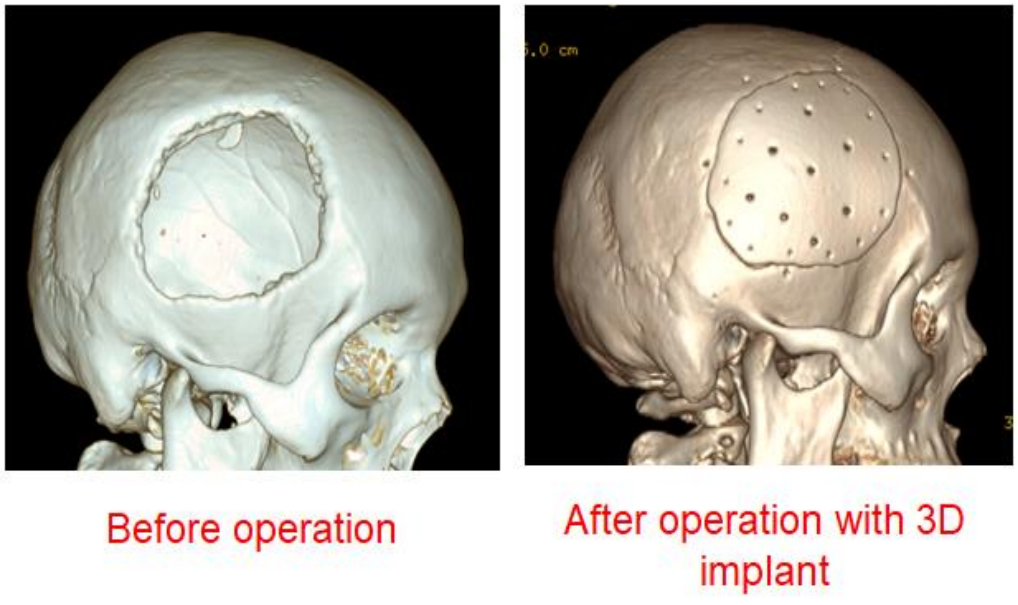


**Fig. 8.** 3D MSCT b-th Sh. Condition before and after surgery; Postoperative defect cranial vault on the right. Using 3D implants for plastic surgery of a bone defect of the calvarium on the right

In all cases, a satisfactory ¬cosmetic effect was obtained. At the time of discharge, the patients had no complaints - there was no pain in the transplant area ¬, the scar was soft, painless, the skin color was not changed, there was no swelling, the symmetry of the skull was preserved.
A control examination did not reveal any abnormalities in the neurological ¬status of patients in both groups. In 58 (96.7%) patients, the pain syndrome regressed ¬. In all cases, a good cosmetic result was achieved . Upon palpation, the ¬grafts did not differ from the surrounding bones of the patients; symmetry was preserved in all cases. Repeated craniography in patients of the first group did not reveal changes in the bone structure at the site of fixation and abutment of the plates to the bones,of,,th,skull

## Conclusion

Studies have shown that the use of implants made from titanium mesh optimizes the task of eliminating complex defects of the skull, reduces the trauma and duration of the operation, and provides a predictable good functional and cosmetic result.
The use of 3D computer modeling makes it possible to close skull bone defects of any size and configuration, and in the postoperative period, the best cosmetic and functional results are achieved, since the designed 3D implant is as identical as possible to the contours of the bone defect. The manufacturing of the implant occurs before the start of the operation, thus significantly reducing the duration of the surgical intervention and reducing the risk of infectious complications.
The use of autocranioplasty using a fan-shaped fixation device in patients in the acute period of TBI and in the late period of traumatic disease with existing defects in the bones of the arch has shown its high effectiveness. The advantage of this type of plastic surgery over others is that the patient's own bone tissue is used as a plastic material. The simplicity of the metal device, its fixation in the area of the bone defect, the ease of further removal and the possibility of performing autocranioplasty in any neurosurgical hospital - all these positive qualities also showed the advantages of this method over other types of plastic surgery.

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