Scientific Research Publishing

Open Journal of Modern Neurosurgery, 2020, 10, 318-324
https://www.scirp.org/journal/ojmn
ISSN Online: 2163-0585
ISSN Print: 2163-0569

Double J Fixation after Craniotomy: Technical Description of a Modification Method for Bone Flap Fixation (Hiederov Method)

Hieder Al-Shami[1*], Ahmed M. Salah[2], Mohamed Fathy Adel Ali[2]

[1]Al-Ahly Bank Hospital, Cairo, Egypt
[2]Department of Neurosurgery, Faculty of Medicine, Kasr-Alainy Medical School, Cairo, Egypt
Email: *adamhouse73@gmail.com

How to cite this paper: Al-Shami, H., Salah, A.M. and Ali, M.F.A. (2020) Double J Fixation after Craniotomy: Technical Description of a Modification Method for Bone Flap Fixation (Hiederov Method). *Open Journal of Modern Neurosurgery*, **10**, 318-324.
https://doi.org/10.4236/ojmn.2020.103034

Received: December 20, 2019
Accepted: May 5, 2020
Published: May 8, 2020

Abstract

Background: Fixation of bone flap following craniotomy is usually achieved by synthetic materials. In rural and poor funding areas, innovation for cheap, safe and applicable material is needed. **Purpose**: The aim is to assess our new innovative technique in bone flap fixation against traditional techniques. **Patients and Methods:** The study was a prospective randomized controlled study enrolled at Al-Amal Hospital and Al-Ahly Bank Hospital from 2014-2019. Forty-eight patients were randomized in the study. Group A (24 patients) underwent titanium miniplate fixation while group B (24 patients) underwent our new technique. The new technique is double J tunnels performed by craniotome on either side of the bone (flap and skull sides), then a Prolene suture is passed through the shared stem of J' holes and secured in the wrapped side of J's holes and tying it tightly. Both techniques were examined against fixation time, rigidity, offset and final judgment postoperatively. **Result:** There was no statistically significant difference in using both techniques as regard fixation time. Our new technique was not inferior to the traditional one in achieving rigidity ($p > 0.05$). The final postoperative assessment was as equal as that seen in miniplate fixation. **Conclusion:** This technique is a simple, easy, cheap and effective method of fixing craniotomy bone flap.

Keywords

Craniotomy, Bone Flap Fixation, Miniplate Fixation

1. Introduction

Many methods were introduced in the field of bone flap fixation after cranioto-

my. The golden criteria of any method chosen are highly dependent on the following factors; ease of use, inert materials or not, lowest error rates of fixation, long-lasting fixation, not expensive [1]. For a long time, stainless steel wiring or mini-plates were used in bone flap fixation [2].

Many surgeons became familiar with miniplates—fixation as well as their health insurance institutes. These two techniques have their drawbacks as well [3] [4]. Skin necrosis due to manipulation or stainless steel wiring may also happen [5]. Cost was another role-player in many centers.

By performing many cranial surgeries in low resource centers; one should seek an alternative pathway to do the same step either for achieving more safety, reducing the time of surgery enhancing the quality or bypassing expensive steps. In our article, a modification of fixation technique for bone flap fixation by using horizontal tunneling of opposite bony lips was tested against formal opposite holes technique or titanium miniplate fixation. The aim is to assess our new innovative technique in bone flap fixation against traditional techniques.

2. Patients and Methods

2.1. Patients' Population

The study was a prospective randomized controlled study enrolled at Al-Amal Hospital and Al-Ahly Bank Hospital from 2014-2019. Patients' demography, craniotomies, and the component of bone flap fixation are illustrated in Table 1. Forty-eight patients were randomized in our study, each group composed of 24 patients. Group A, received titanium mini-plates fixation, while Group B craniotomies were fixed by our modified technique. The mean age of each group was (58 ± 0.7 years for group A and 54 ± 2.5 years for group B) and they homogeneously distributed ($p > 0.05$).

2.2. Materials Used

For miniplate fixation, a 1.5-mm titanium plating system was used (Codman, MA). Our technique requires no more than a Vicryl-braided suture of 1 or 2 sizes.

2.3. Randomization

After IRB approval, informed consent was taken from every participant after

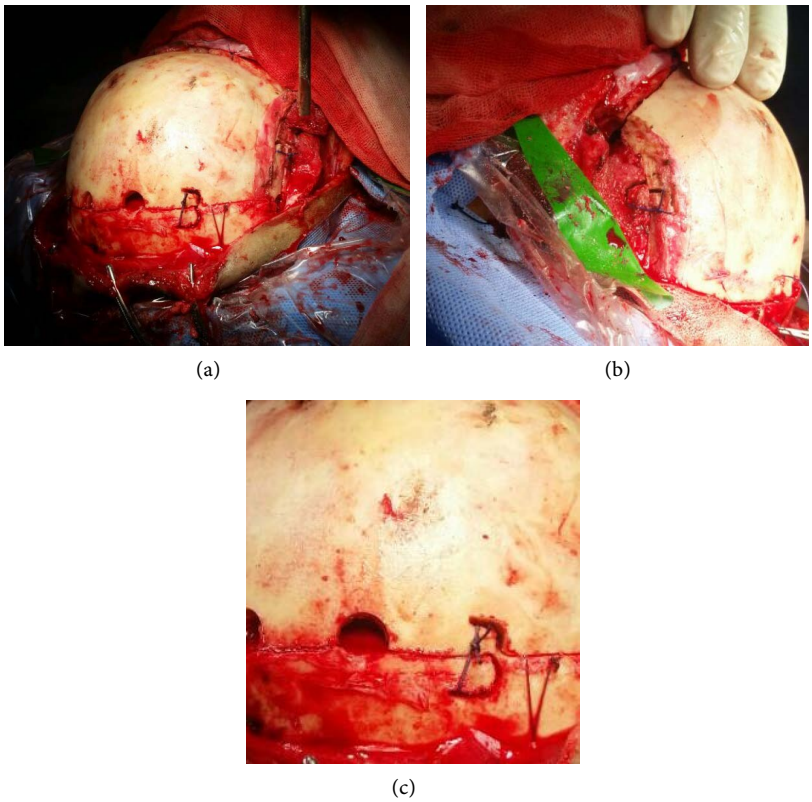
Table 1. Patient's criteria.

	Group A	Group B
• Age (yrs)	58 ± 0.7	56 ± 2.5
• Plate (%)	70.8%	62.5%
Reason of craniotomy		
- Trauma	6	18
- Vascular	5	1
- Tumor	13	5

quite a clear explanation of the technique and purpose of the study. Forty-eight patients were randomized into two groups. The operators were able to do both techniques effectively.

2.4. Description of Techniques

After completion of the surgical aim (removing the tumor or clipping an aneurysm), closure of dura should be done after achieving hemostasis. Using the craniotome (MIDAS REX®) to do J holes at each side of the bone flap and skull side. The stems of J holes are 90 degrees perpendicular to craniotomy and a long stem is a result of meeting the letters at the same point. The wrapped J segment should be the opposite as well. The wrapped segment of J is done by turning the craniotome gently three times to make a side indentation and then push it gently to form wrapped segment of J letter, try to make strong bone chip between stem and wrapped segment of J hole. It will be of no value if both J's are not the opposite. Use the craniotome with caution, the movement of craniotome is horizontal and not vertical drilling as usual. The dural surface needs no protection as the footplate is already present in the craniotomy device. Then, a Prolene suture (1) is inserted inside both J' stems by using a hook or non-toothed forceps and passed to be secured inside the wrapped segment of both J's alternatively. Finally tying it strongly five times or six times. This method can be done on three or four sides as possible. However, try to do it consecutively. Figures 1(a)-(c)



(a) (b) (c)

Figure 1. The final appearance of knot fixation by performing double J holes at either side of the flap.

showed the final appearance. Miniplate fixation involved predrilling screw holes on the flap margins, attaching the selected plates, then drilling additional matching holes in the skull and applying screws through the plate to complete the fixation. The choice of location for points of fixation and the number and types of miniplates and screws needed were left to the discretion of the surgeons. In either technique used, bone gaps and burr holes were filled with bone cement after accomplishing of the fixation process.

2.5. Intraoperative Assessment

The intraoperative assessment depends on two factors; offset dimensions (average and maximum) and flap rigidity. The definition of offset is the distance between flap surfaces concerning the adjacent bone surface. Offset was measured on average and maximum (in mm). The yielding ability of flap in response to maximum pressure applied is defined as rigidity and measured in mm.

2.6. Post-Operative Assessment

A separate investigator, blinded from either technique used assessed the flap by two grading system as shown in Table 2. The follow-up process was taking place from 3 - 6 months (median follow up time was 4.2 months). The classification system for the final bone flap position was suggested by our team.

2.7. Statistical Analysis

Data retrieved were processed using the Statistical Package for Social Sciences SPSS® program version 25. Data of offset average and rigidity were compared using chi-square t-tests while the classification of the flap according to the final assessment between both techniques was tested by Fisher exact test. A P-value below 0.05 was regarded as significant.

3. Results

3.1. Intraoperative Results

The means and standard deviations for time spent on accomplishing techniques in groups A, B were 10.1 ± 3 and 12 ± 0.2 minutes respectively.

Table 3 illustrates the intra reparative results (offset and rigidity). There was no statistically significant difference in using both techniques ($p > 0.05$).

Table 2. Grading systems used in postoperative assessment.

A. Position of flap
1) No offset
2) <2 mm offset
3) >2 mm offset
B. Appearance of craniotomy flap
1) Excellent = no offset visible or palpable
2) Marginal = not visible but palpable
3) Failed but palpable = visible and palpable

3.2. Post-Operative Results

The results of follow up analysis are plotted in Table 4. As regards our bone flap position final judgment, as in Figure 2 illustrates the classification for both groups.

It has been shown that our repair method is not inferior to commonly used titanium mini plates ($p > 0.5$).

4. Discussion

In this study, we attempted to compare the pros and cons of using sutures through a sided gap against the traditional method of titanium mesh. There was a clear similarity between both techniques as regard offset and rigidity. Our technique is not inferior to the traditional one as regard final assessment.

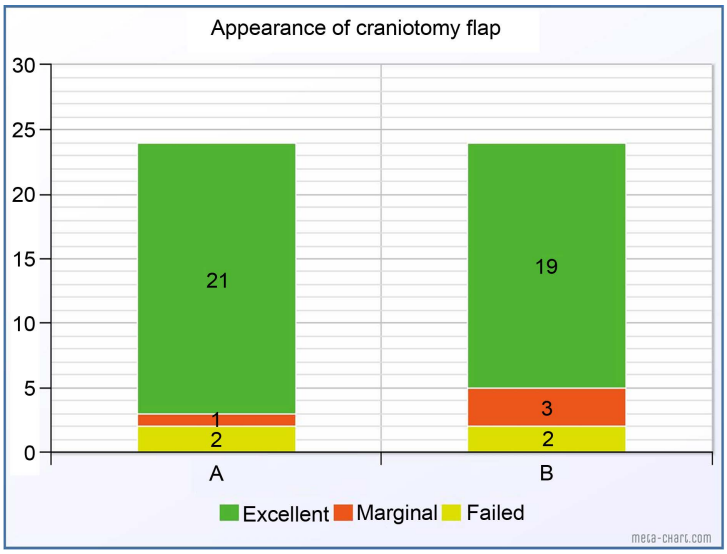


Figure 2. Final assessment of craniotomy flap.

Table 3. Intraoperative results.

Factor	Group A	Group B	P*
Fixation time (mins)	10.7 ± 3	12 ± 0.5	0.117
Average offset (mm)	0.7 ± 0.4	0.5 ± 0.3	0.056
Maximum offset (mm)	1.5 ± 0.9	1.2 ± 0.09	0.2
Craniotomy flap movement (mm)	1.1 ± 0.8	1.0 ± 0.7	0.6

*According to student t-test.

Table 4. Post-operative results.

A. Offset	Group A	Group B
1) No offset palpable	19	18
2) <2 mm offset	2	4
3) >2 mm offset	3	2

Neurosurgery is practiced in high low resources centers, even in high-income countries; centers are different in their funds. Our technique found a good anchor to achieve an acceptable outcome in rural or low-income areas where they cannot offer titanium meshes for their patients.

The technique is easy and applicable. In contrast to the formal fixation technique, this method is safe. In the latter technique, a vertical application of drill is protected by Cushing brain spoon retractors [6] [7]. Unprofessional protection or non-accurate drilling may produce serious brain injury [8]. In our technique, the power needed to do holes for putting sutures later is mainly horizontal as same as craniotomy itself. These holes are liable to be closed later with little bone dust. Indeed, these sutures exert the same fixation principles as conventional technique [2].

This technique provides no intervening foreign bodies that may affect healing. Time taken to achieve four or three-sided fixation is not beyond that in the formal technique [4]. In conclusion, this technique is a simple, easy, cheap and effective method of fixing craniotomy bone flap.

The main limitation of the study was in neglecting designing an arm or group with stainless steel fixation.

Acknowledgements

The authors suggest a synonym for the technique described. Hiederov method is the name given to using double J tunnels with a tying suture through them.

Conflicts of Interest

There is no conflict of interest.

References

[1] Brophy, T., Srodon, P., Briggs, C., Barry, P., Steatham, J. and Birch, M. (2006) Quality of Surgical Instruments. *Annals of the Royal College of Surgeons of England*, **88**, 390-393. https://doi.org/10.1308/003588406X98621

[2] Broaddus, W.C., Holloway, K.L., Winters, C.J., Bullock, M.R., Graham, R.S., Mathern, B.E., Ward, J.D. and Young, H.F. (2002) Titanium Miniplates or Stainless Steel Wire for Cranial Fixation: A Prospective Randomized Comparison. *Journal of Neurosurgery*, **96**, 244–247. https://doi.org/10.3171/jns.2002.96.2.0244

[3] Matsukawa, H., Miyama, M., Miyazaki, T., Uemori, G., Kinoshita, Y., Sakakibara, F., Saito, N., Tsuboi, T., Noda, K., Ota, N., Tokuda, S., Kamiyama, H. and Tanikawa, R. (2017) Impacts of Pressure Bonding Fixation on a Bone Flap Depression and Resorption in Patients with Craniotomy. *Journal of Clinical Neuroscience*, **41**, 162-167. https://doi.org/10.1016/j.jocn.2017.02.026

[4] Adaaquah, D., Gates, M., Van Gompel, J.J. (2018) Rate of Craniotomy Fusion after Free Bone Flap. *World Neurosurgery*, **118**, e283-e287. https://doi.org/10.1016/j.wneu.2018.06.172

[5] Bukhari, S. and Junaid, M. (2015) Mini Titanium Plates and Screws for Cranial Bone Flap Fixation; An Experience from Pakistan. *Surgical Neurology International*, **6**, 75. https://doi.org/10.4103/2152-7806.156774

[6] Goodrich, J.T., Sandler, A.L. and Tepper, O. (2012) A Review of Reconstructive Materials for Use in Craniofacial Surgery Bone Fixation Materials, Bone Substitutes, and Distractors. *Child's Nervous System*, **28**, 1577-1588. https://doi.org/10.1007/s00381-012-1776-y

[7] Winston, K.R. and Wang, M.C. (2003) Cranial Bone Fixation: Review of the Literature and Description of a New Procedure. *Journal of Neurosurgery*, **99**, 484-488. https://doi.org/10.3171/jns.2003.99.3.0484

[8] Gutiérrez-González, R., Boto, G.R., Rivero-Garvía, M., Pérez-Zamarrón, A. and Gómez, G. (2008) Penetrating Brain Injury by Drill Bit. *Clinical Neurology and Neurosurgery*, **110**, 207-210. https://doi.org/10.1016/j.clineuro.2007.09.014