

THE EFFICACY OF CUSTOM-MADE COMPUTER ASSISTED POLYETHER ETHER KETONE (PEEK) OSTEOSYNTHESIS PLATES IN PEDIATRIC MANDIBULAR FRACTURE TREATMENT (A RANDOMIZED CONTROLLED CLINICAL TRIAL)

Nourhan M. Abdelmoneim^{1*} *PhD*, Ahmed S. El-mahalawy² *Phd*, Mahitab M.

Soliman³ *Phd*, Marwa G. Noureldin⁴ *Phd*, and Omneya A. Gamaleldin⁵ *Phd*

1. Lecturer of Oral and Maxillofacial Surgery, Faculty of Dentistry, Fayoum University, Fayoum, Egypt 1

2.,3. Professor of Oral and Maxillofacial Surgery, Faculty of Dentistry, Alexandria University, Alexandria, Egypt 2,3

4. Assistant professor of Oral and Maxillofacial Surgery, Faculty of Dentistry, Alexandria University, Alexandria, Egypt 4

5. Assistant professor of Diagnostic and Interventional Radiology, Faculty of Medicine, Alexandria University, Alexandria, Egypt 5

*Corresponding author

INTRODUCTION

Pediatric mandibular fracture is particularly challenging and its management during the deciduous and mixed dentition stages is still controversial. (1) The disadvantages of conventional titanium plates elicited the search for better options for fracture fixation biomaterials that avoid the drawbacks of titanium and can be customized to protect the developing tooth buds. (2) Therefore, polyether ether ketone (PEEK) has emerged as a promising alternative in the development of new osteosynthesis plates.

METHODOLOGY

A randomized controlled clinical trial was conducted on fourteen pediatric patients with recent displaced mandibular fractures indicated for open reduction and internal fixation (ORIF). The patients were randomly allocated into study and control groups, seven for each group. After a thorough case history, clinical examination, and radiographic evaluation, management was performed. Preoperative virtual surgical planning and computer assisted PEEK plate fabrication were done for study group patients. (Figure 1). The study group received custom-made computer assisted PEEK plate fixation. the control group received titanium miniplate fixation. (Figure 2,3) The operative time was assessed in both groups. The patients were then followed up for three months postoperatively. Each patient's clinical, and radiographic fracture healing parameters were assessed.

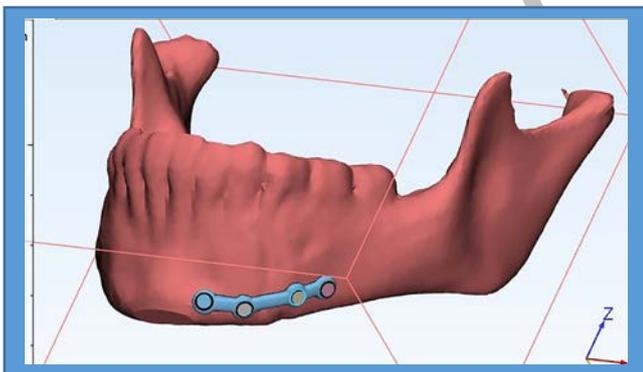


Figure (1): Intimate adaption of the final virtual customized PEEK plate on mandibular surface topography.

RESULTS AND DISCUSSION

The mean operative time was significantly less in the study group than that of the control group. In the study group the overall postoperative complications were less than in the control group but the difference was insignificant. After three months, postoperative CTs scans revealed proper bony union in all directions and the mean bone density was statistically higher within the study group than the control group.



Figure (2): Fixation of custom-made peek plate into its accurate positions.

These results attributed to excellent PEEK biocompatibility because of its bio-inert and hydrophobic characteristics and adequate mechanical properties. In agreement with the results reported by Lv et al., in 2022. (3)



Figure (3): Fixation of titanium miniplate into its accurate positions.

CONCLUSION

With the aid of virtual surgical planning and CAD/CAM technology, custom-made computer-assisted PEEK plates offer superior efficacy to the titanium mini-plates in the fixation of pediatric mandibular fractures in terms of shorter operative time, greater accuracy, safer screw placement regarding the developing tooth buds in mixed dentition stages, and higher bone density, in addition to its transparency that doesn't interfere with the x-ray follow up.

ACKNOWLEDGMENT

I really would like to sincerely thank everyone who helped me finish this research.

REFERENCES

1. Rostyslav Y, Yakovenko L, Irina P. Fractures of the lower jaw in children (causes, types, diagnosis and treatment). Retrospective 5-year analysis. *J Oral Biol Craniofac Res* 2020;10:1-5.
2. Riviş M, Roi C, Roi A, Nica D, Văleanu A, Rusu L-C. The implications of titanium alloys applied in maxillofacial osteosynthesis. *Appl Sci* 2020;10:3203.
3. Lv M, Yang X, Gvetadze SR, Gupta A, Li J, Sun J. Accurate reconstruction of bone defects in orbital-maxillary-zygomatic (OMZ) complex with polyetheretherketone (PEEK). *J Plast Reconstr Aesthet Surg* 2022;75:1750-7.