

**COMPUTER AIDED GEOMETRIC DESIGN (CAGD):
A COMPARATIVE STUDY OF CUBIC B-SPLINE, RATIONAL
CUBIC BEZIER AND RATIONAL CUBIC TIMMER CURVES
WITH AN APPLICATION OF CRANIOFACIAL
FRACTURES RECONSTRUCTION**

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ABSTRACT

Curve plays a significance role in Computer Aided Geometric Design (CAGD) because it is easy to model any figure. Bezier curve, Timmer curve and B-Spline curve are method that can be used to design any objects or images. In this research, three methods are proposed to reconstruct the craniofacial fracture. The methods are called Rational Cubic Bezier, Rational Cubic Timmer and Cubic B-Spline. Rational Cubic Bezier, and Rational Cubic Timmer are easier in designing since it contain an additional parameter which is weight that used to manipulate the images. Timmer curve also is an advanced method to Bezier curve. The purpose of this study is to apply the cubic B-spline, rational cubic Bezier, and rational cubic Timmer methods while comparing the smoothness and CPU time of the three curves proposed, and finally identify the optimum way in craniofacial fracture reconstruction. The research is carried out to confirm the importance of the precision and smoothness of the curves in resolving the stated problem. The comparative analysis of three methods reveals that the best approach is selected by taking two factors into consideration: the smoothness of the curve and the shortest time consumed for developing the curve, and the most efficient method is chosen by the end of this research project. Result shows for the smoothness of the curve goes to rational cubic Bezier, $w = 4$ because it give a symmetrical shape of overall parietal bone and close to control polygon and make it more suitable to fit the area of fracture while for the shortest time consumption goes to cubic B-Spline as it had the shortest CPU time among the three methods to generate the curves.

Keywords: cubic B-Spline, rational cubic Bezier, rational cubic Timmer, curvature, craniofacial fracture reconstruction

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