

Why Best Fit Circles are not Always Best

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INTRODUCTION: The surgical treatment for anterior shoulder instability is influenced by the degree of glenoid bone loss when measuring glenoid track. The agreed quantity of glenoid bone loss that warrants a bony stabilization procedure remains debatable, as does the method of measuring glenoid bone loss. Systematic reviews have identified best-fit circles as a reliable method of calculating glenoid bone loss for calculation of glenoid track, however the literature fails to comment on how reliable this method of calculating glenoid bone loss is when applied to various types of glenoid morphology e.g., elliptical shaped glenoids, inverted comma shaped glenoids, and ovoid shaped glenoids.

METHODS: A mathematical model was implemented programmatically to calculate the best fit method in a reproducible non-subjective manner. The degree of error was calculated using the dice coefficient for the anteroinferior quadrant of the glenoid. This provided a non-subjective completely reproducible method of assessing differences in anteroinferior bone estimation via the best fit method.

RESULTS: We found statistically significant differences (p-value 0.006) in the dice coefficient on using the best-fit method to predict anteroinferior glenoid morphology on ellipsoid glenoids vs. ovoid or inverted comma type glenoids. Comparison of the actual glenoid width and the diameter of the best-fit circle demonstrate systematic over prediction of the glenoid width with the best-fit method.

DISCUSSION AND CONCLUSION:

We demonstrate a novel mathematical model that suggests glenoid anatomy is critical when applying the best-fit circle model to assessing glenoid bone loss and must be interpreted with a high degree of caution and applied to the individual patient in question. Best-fit models are **only** ideal for application to glenoid morphology where the inferior glenoid is very circular. More robust methods of measuring glenoid bone loss are required to make accurate surgical plans for our patients.