

Evaluation of accuracy and reproducibility in manual point picking during 3D cephalometry on CBCT data

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Three-dimensional cephalometry is currently emerging as an innovative diagnostic tool, due to accessibility and radiation low dose of Cone Beam CT (CBCT) scanners (1). Despite annotation made by specialists is now considered the gold standard in clinical practice and research, reliability of manual point picking can be biased by intra and inter-operator differences (2). In order to estimate the variability of the manual procedure, in this study an evaluation of accuracy, precision and reproducibility was performed. Three experienced operators analyzed ten CBCT images, retrospectively selected from the SST Dentofacial Clinic database. They annotated 9 chosen landmarks on all the images for three times, under the same conditions and at least one week of distance. Accuracy and precision were calculated as the median and the interquartile range of the distances from each landmark to the corresponding barycenter, calculated as the mean of all operator annotations. Kruskal-Wallis test was performed to evaluate reproducibility, and post-hoc tests were carried out to assess whether the significance depended from operators. A remarkable difference was found in accuracy between anatomic and geometrical landmarks, in both the intra and inter-operator repetitions. The intra-operator analysis showed higher accuracy and precision values than the inter-operator one. Statistical analyses revealed significant differences in reproducibility ($p < 0.05$) for all landmarks except for Sella turcica, but the post-hoc tests did not show a clear pattern between operators. Results demonstrate that both accuracy and reproducibility may vary, depending on the operators, suggesting the need for automatic or semiautomatic tools that will help the operator during annotation.

References

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Keywords

3D cephalometry; CBCT; accuracy; reproducibility.