A Comparison of the Accuracy of Cephalometric Analysis Using Conventional Hand Tracing vs. Computer Aided Analysis

M. A. Gutierrez, DDS, A. L. Shearer, DMD, R. Kleefield, DDS, J. Oppenheimer, DDS
St. Barnabas Hospital, Department of Dentistry, Division of Orthodontics, Bronx, NY

Abstract

The purpose of this study was to evaluate the accuracy and reproducibility of cephalometric analysis using the most current versions of Vistadent® and Dolphin® software, as compared to hand tracing. Due to the recent advances in the new versions of these programs, we expect these methods to be as accurate and predictable as the traditional manual tracings. Twenty lateral cephalometric radiographs were examined by two operators to evaluate the most current Vistadent® and Dolphin® software, as compared to hand tracing. For the 660 angular measurements made there were no statistical differences between conventional tracings and either Vistadent 3.16 or Dolphin 9.8. The most current Vistadent® and Dolphin® software as compared to conventional hand tracing do provide accurate and reproducible analysis.

Introduction

Broadbent introduced cephalometric radiology in 1931. In 1948 Downs introduced the Downs analysis which is often cited as the first true orthodontic analysis. Since then, orthodontic cephalometric analysis have been an integral part of orthodontic diagnosis and treatment planning. Manual tracing has been regarded as the standard for measuring cephalometric relationships. The manual tracings method is time intensive and results in pencil tracings which are not very presentable and difficult for the patient to understand during treatment planning sessions. (Fig 1 A).

Discussion

Dana and Goldstein et al found that Dolphin 8® was significantly different from Vistadent 99® and manual tracings in measuring the mandibular plane (GoGn), due to the automatic construction of Gnatlon point. We did not have this problem with the mandibular plane using Vistadent 3.1KAT® and Dolphin 98®, because in the updated versions the operators plot Gnatlon. Several authors did see significant differences in the Wits appraisal due to differences in occlusal plane construction. Old versions constructed this plane automatically(4). Our study showed no statistical differences for the Wits appraisal. In the current versions of Dolphin and Vistadent the operator is allowed to plot the occlusal points for construction of the occlusal plane.

Materials and Methods

Thirty lateral cephalometric radiographs were picked at random from an orthodontic private practice. The twenty best films were chosen for the study. A digital cephalometric orthodontic analysis was composed using the Vistadent 3.16 and Dolphin 98®. Eleven well known angular measurements and eight linear tracings from Downs, Ricketts, Steiner and Wits analyses were chosen. Hand-tracings of the cephalometric radiographs on acetate paper using a 5mm #2 pencil on a high quality light box in a reduced light room were constructed. To evaluate inter-examiner error, 5 radiographs not included in the study were traced by each operator at different times. No statistical differences were found between the two operators (p>0.05). For the computer software analysis, the radiographs were scanned and calibrated into the computer. The analysis included the following measurements: Linear: WITS, U1-NA(mm), L1NB(mm), L1-Apo, E-line, N-ANS, ANS-GN, GN Angular: SNA, SNB, Y-AXIS, SN-MP-U1, SN-U1-NL, L1-MP, L1-NB, U1-L1, NLA Data was then be analyzed statistically using a paired student t test.

Results

For the 660 angular measurements made there were no statistical differences between conventional tracings and either Vistadent or Dolphin programs (p>0.05). For the 480 linear measurements made there were no statistical differences between conventional tracings and either Vistadent or Dolphin programs (p>0.05).

Conclusion

The most current Vistadent, and Dolphin software as compared to Conventional Hand tracing do provide accurate and reproducible cephalometric analysis. Therefore, Orthodontists can rely on either computerized imaging software programs to be as accurate and reliable as manual methods, which leads to a better and more reliable diagnosis.

References