AAO Foundation Final Report Form
(a/o 5/30/2021)

Please prepare a report that addresses the following:

Type of Award, e.g., Orthodontic Faculty Development Fellowship Award

Name(s) of Principal Investigator(s): Mohamed Bazina

Institution: University of Kentucky

Title of Project: Three-dimensional Voxel-based Maxillary Superimposition for Everyday Practice

Period of AAOF Support: (07-01-2019 to 06-30-2021):

Amount of Funding: 20,000$

Summary/Abstract:

Introduction: Cephalometric superimpositions have many uses in orthodontics, including growth evaluation and outcome assessment. However, two dimensional cephalograms can be distorted and yield incomplete two-dimensional data. CBCT imaging provide a three-dimensional, undistorted and more complete patient analysis. CBCT imaging provides many unique advantages to the orthodontic practice and influences how treatment outcomes are assessed. The aim of this study was to investigate the validity of 3D maxillary voxel-based superimpositions compared to the 2D method recommended by the American Board of Orthodontics (ABO). **Methods**: This retrospective study included pre- and post-treatment

CBCT images of 30 adolescent patients. The images were superimposed using the 3D voxel-based tools in Dolphin software. Two different 3D anatomic registration areas (3DA-3DB) were tested for the precision and reproducibility of the 3D maxillary superimpositions as compared to the 2D method using linear and angular measurements looking at the dental changes of the upper right central incisor (U1) and first molar (U6). **Results**: The U1 vertical difference was statistically significant (p=8e-7) for the superimposition method, though the mean differences were clinically insignificant (0.52 mm, 0.76 mm). The U1 angular and U6 vertical difference were not significant for the superimposition method (p=0.3636 & 0.1242, respectively). **Conclusions**: The 3D voxel-based maxillary superimpositions using Dolphin software program showed similar results to conventional 2D superimposition recommended by the American Board of Orthodontics.

Detailed results and inferences:

1. If the work has been published, please attach a pdf of manuscript OR
   We are in the process of submitting this paper to the AJODO for publication.

2. Describe in detail the results of your study. The intent is to share the knowledge you have generated with the AAOF and orthodontic community specifically and other who may benefit from your study. Table, Figures, Statistical Analysis, and interpretation of results should be included.

   Statistical Analysis: The mean differences between the two methods of three-dimensional voxel-based registration was evaluated. The data for each variable (change in maxillary right central incisor angulation, change in the vertical position of the maxillary right central incisor, and the change in the vertical position of the maxillary right first molar) for each of the three superimposition methods was assessed for normality using the Shapiro-Wilk W test (p<0.05) for the data for each variable. (Shapiro and Wilk, 1965) The intraclass correlation coefficient (ICC) was determined by independently remeasuring ten subjects for all variables using the two-way mixed-effects model for a single rater (SPSS 27, IBM). All were equal or greater than 0.9, indicating excellent reliability. [8,9] The data was normally distributed for each of the three superimposition types by Shapiro-Wilk test (p≥0.08).[10] A Mixed Model ANOVA was done to compare the three superimposition types within each subject. (JMP Pro 14.3.0)

   RESULTS
   The U1 vertical difference with all 30 subjects was significant for superimposition type (p=8e-7). The U1 angular difference and the U6 vertical difference were not significant for superimposition type (p=0.3636, p=0.1242 respectively). These results and the mean differences can be found in **Tables I, II, and III,** respectively.
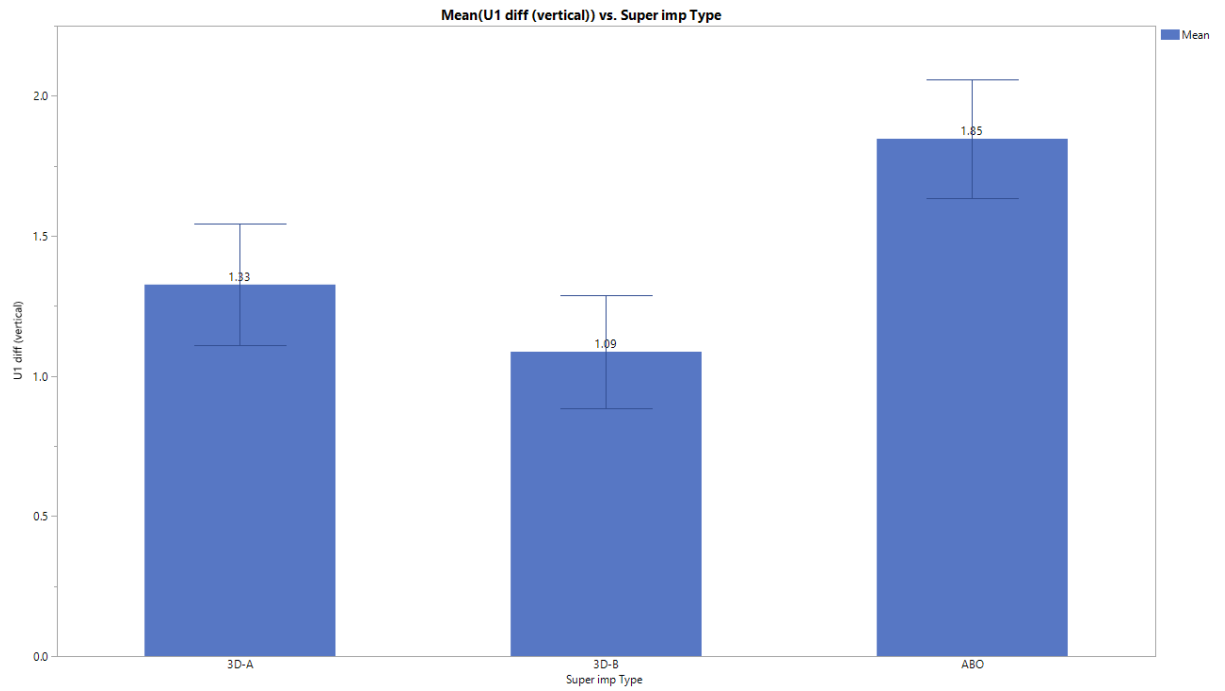
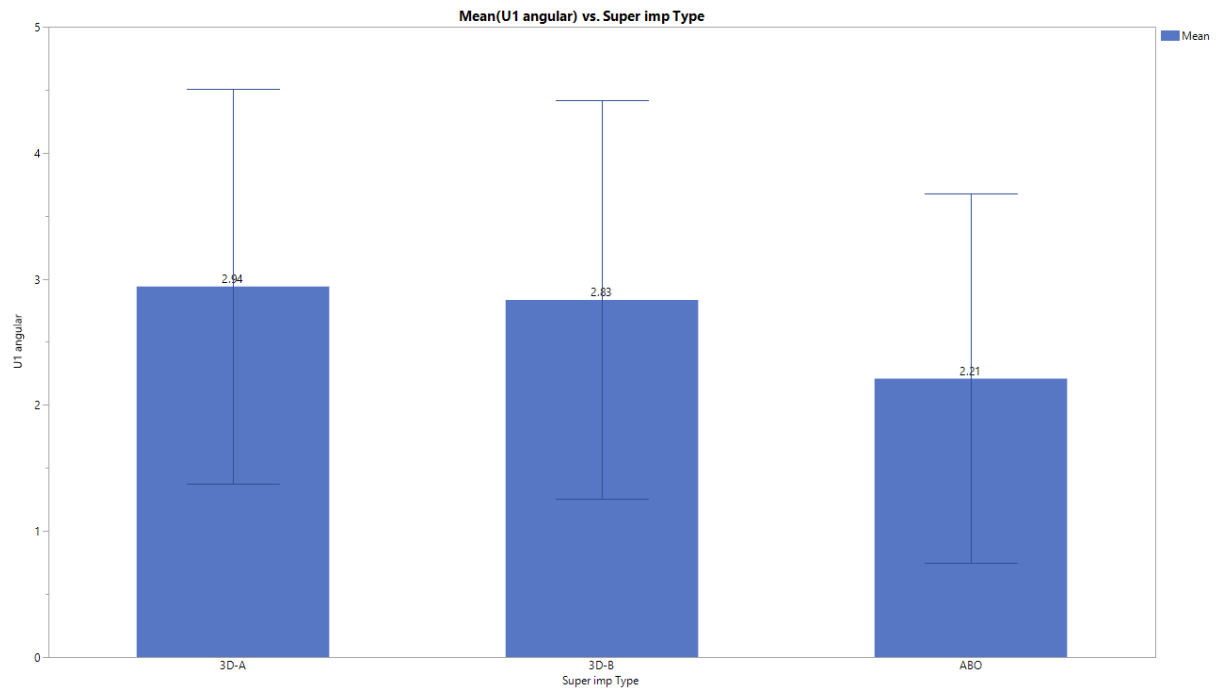Table-1: Mean vertical differences of the upper right central incisor between the 3 superimposition types

Table-2: Mean angular differences of the upper right central incisor between the 3 superimposition types.
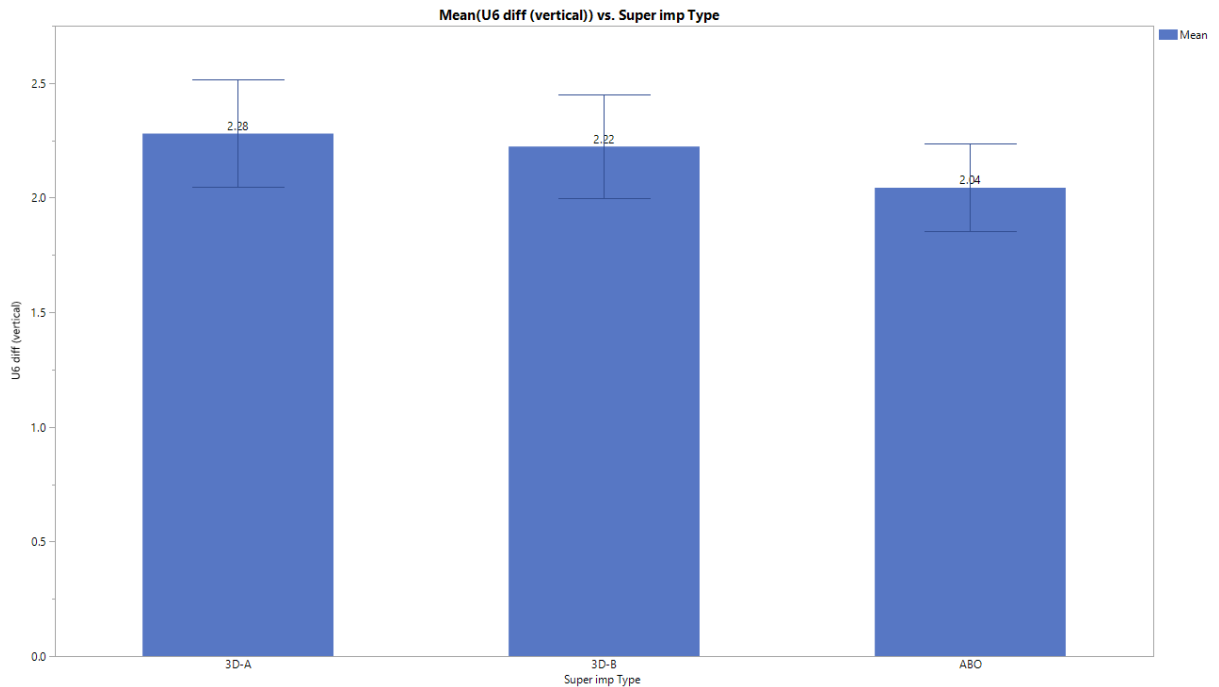
Mean(U6 diff (vertical)) vs. Super imp Type

Table-3: Mean vertical differences of the upper right first molar between the 3 superimposition types

Respond to the following questions:

1. Were the original, specific aims of the proposal realized? Yes, the aim of the study was to test a user-friendly software program for precision and reliability of 3D maxillary superimposition, and we believe that our study answered that question.

2. Were the results published? Not yet. We are in the process of submitting the paper to AJODO
   a. If so, cite reference/s for publication/s including titles, dates, author or co-authors, journal, issue and page numbers
   b. Was AAOF support acknowledged? The AAOF support will be acknowledged
   c. If not, are there plans to publish? If not, why not? Yes
3. Have the results of this proposal been presented?
   a. If so, list titles, author or co-authors of these presentation/s, year and locations. Yes, my student presented this paper for the Proffit award this year (2021) and won the second place. I am planning to present it to the Angle Midwest group in the near future.
   b. Was AAOF support acknowledged?
   c. If not, are there plans to do so? If not, why not? The AAOF support will be acknowledged when I present the paper to the Angle group
4. To what extent have you used, or how do you intend to use, AAOF funding to further your career? AAOF fund was and will be very helpful for junior faculty members like myself.

Accounting for Project; (i.e.), any leftover funds, etc. 1091$ is leftover