



Evaluation of Visual Treatment Objective (VTO) Accuracy in Nonsurgical Orthodontic Treatment

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INTRODUCTION

Visual treatment objectives (VTOs) predict the effects that different hard tissue movements can have on a person's facial soft tissue.¹ This is a powerful tool that can provide doctors with a visual prediction of what a patient would look like through various surgical and/or orthodontic movements while also providing a means to effectively communicate with patients.

Initially, VTOs were drawn by hand, but technological innovations have provided the ability to perform VTOs digitally, building upon procedures and predictions that initial VTO founders employed.^{2,3} While numerous studies have been conducted evaluating the accuracy and validity of both manual and digital VTOs, most of these studies are implemented in the context of surgical orthodontic treatment.³⁻⁷ In consideration, this study will investigate VTOs strictly in a non-surgical context and evaluate the accuracy at various anatomic landmarks.

OBJECTIVES

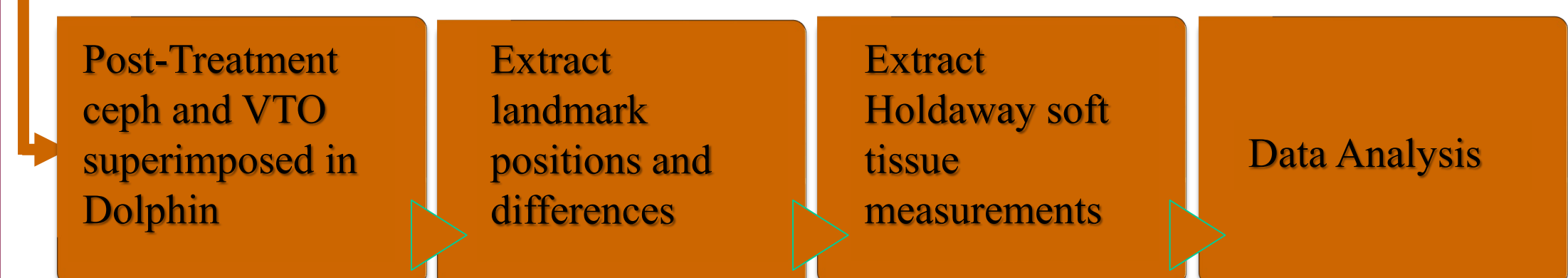
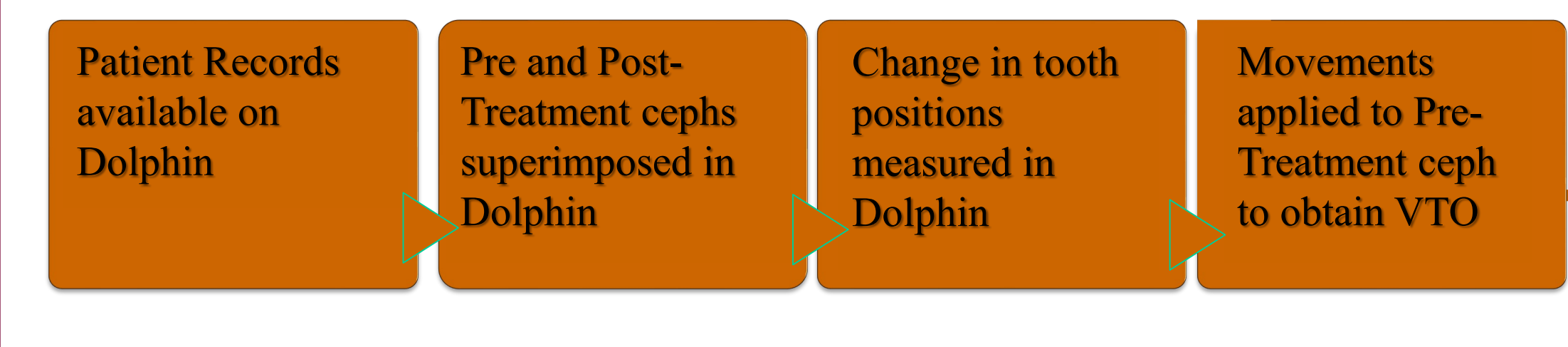
The primary objective of this study is to evaluate the accuracy of digital VTOs in nonsurgical orthodontic treatment at various anatomical landmarks. While it is accepted that VTOs do not provide a perfect prediction of a patient's profile, evaluating the soft tissue response as a result of tooth movement through a paired t-test will provide further insight on their relationship and supply orthodontists with a better understanding of VTOs inherent limitation.

Materials

1. iCAT FLX17-19
2. Dolphin Software
3. Microsoft Excel
4. IBM SPSS

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Methods



1. Obtain complete patient records on Dolphin
2. Superimpose pre-treatment and post-treatment cephalograms on cranial base
3. Measure the change in tooth positions as a result of orthodontic treatment
4. Apply the tooth movements to the pre-treatment cephalogram and obtain the resulting VTO
5. Superimpose the post-treatment cephalogram and the VTO
6. Quantify and record the differences at various anatomical landmarks between the post-treatment cephalogram and the VTO in the XY plane.
7. Quantify and record the Holdaway soft tissue measurements in the XY plane
8. Analyze the data using IBM SPSS

RESEARCH DESIGN & SAMPLE

- Retrospective Observational Study
- With type I error set at 0.05 and type II error at 0.20 and previous study showing a difference of 0.25 the sample size was determined to be 24.

HYPOTHESIS

The difference in soft tissue anatomical landmarks produced by VTOs compared to that of the actual post treatment measurements in nonsurgical cases is statistically significant.

HYPOTHESIS & VARIABLES

Treatment Variables

$$\Delta U6x = \text{Final } U6x - \text{Initial } U6x$$

$$\Delta U6y = \text{Final } U6y - \text{Initial } U6y$$

$$\Delta L6x = \text{Final } L6x - \text{Initial } L6x$$

$$\Delta L6y = \text{Final } L6y - \text{Initial } L6y$$

$$\Delta U1\angle = \text{Final } U1\angle - \text{Initial } U1\angle$$

$$\Delta U1x = \text{Final } U1x - \text{Initial } U1x$$

$$\Delta U1y = \text{Final } U1y - \text{Initial } U1y$$

$$\Delta L1x = \text{Final } L1x - \text{Initial } L1x$$

$$\Delta L1y = \text{Final } L1y - \text{Initial } L1y$$

$$\Delta L1\angle = \text{Final } L1\angle - \text{Initial } L1\angle$$

Anatomical Variables

Exact Error – denotes directional difference between predicted and actual positions

Subnasale Exact Error
Nasiolabial Angle Exact Error
ST A Exact Error
ST B Exact Error
Stomion Superius Exact Error
Stomion Inferius Exact Error
Mentolabial Sulcus Exact Error
ST Pg Exact Error
ST Mn Exact Error
Gn Exact Error

Absolute Error – denotes directional magnitude difference between predicted and actual positions

Subnasale Absolute Error
Nasiolabial Angle Absolute Error
ST A Absolute Error
ST B Absolute Error
Stomion Superius Absolute Error
Stomion Inferius Absolute Error
Mentolabial Sulcus Absolute Error
ST Pg Absolute Error
ST Mn Absolute Error
Gn Absolute Error

INCLUSION & EXCLUSION CRITERIA

- Inclusion criteria: Roseman orthodontic patients with existing pre-treatment and post-treatment cephalograms. Orthodontic treatment included extraction of premolars. Treatment was initiated while CVMS 5 or at least 20 years old if C4 cannot be visualized. Minimum of 2mm of AP incisor movements.
- Exclusion criteria: Patients who underwent orthognathic surgery as part of treatment. Patients with craniofacial abnormalities. Patients who had initiated treatment before completion of growth. Patients with Gross asymmetry. Patients with TMJ disorders.

Statistics

Data will be analyzed using the Statistical Package for the Social Sciences (SPSS) version 25. Intra-operator reliabilities will be tested using intraclass coefficients. Exact error will be equal to the discrepancy between the predicted position of each landmark relative to the actual position. Absolute error will describe the magnitude of error between the prediction and the actual position. Paired t-tests will be used to compare the predicted and actual treatment outcomes. P values of <0.05 will be considered statistically significant.

RESULTS

No results or conclusions have been made at this time because the data collection process is currently ongoing.

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