UNIVERSITY OF BRESCIA

PhD Program
in
TECHNOLOGY FOR HEALTH

ELABORATION OF A DIGITAL SYSTEM FOR THREE-DIMENSIONAL MEASUREMENT OF ORTHODONTIC TEETH MOVEMENTS

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[XXXII Cycle]

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Background

The rapid advance of digital computer technology lead orthodontics to benefit from important digital innovations, such as the introduction of digital intra-oral camera to take digital scansions and avoid the conventional study models, of which the orthodontist can conduct 3D virtual on-screen measurements.

Objectives

The project consists of three passages:

a) elaboration of a method of digital analysis to conduct measurements on 3D virtual models
b) validation of the method of digital analysis
c) clinical application of the developed method in Dental Monitoring

Methodologies

a) Virtual scansion of the dental casts using ESM/3ShapeTMR-700 three-dimensional model scanner and convertion into .stl files. The .stl files were edited by placing 60 points per arch by using VAM software
b) Impressions were taken and measurements of tip and torque on traditional casts were made, to test the reproducibility and accuracy of the research tool
c) Questionnaire to analyze orthodontists' and patient's attitude towards the use of Dental Monitoring and elaboration of four protocols of research:
   - Accuracy of Dental Monitoring as a measurement tootl: comparison between scansions obtained through an intra-oral camera or conventional impressions and pictures of dental monitoring through conversion of .stl file by superimposition
   - GoLive, Dental Monitoring protocol
   - Use of Dental Monitoring in post-orthodontic retainer follow-up
   - Hygiene and Compliance using Dental Monitoring

Expected Results and Impact

The virtual method of digital analysis will permit to replace the time-consuming traditional manual measurements on plaster casts and obtain an accurate and reproducible method that is able to measure the absolute position of each tooth, in terms of traditional linear and angular measurements, and its change in spatial position.
Clinically, it will be applied on patients during orthodontic treatments in order to monitor orthodontic dental movements, patients' collaboration in wearing the retainer, elastics, oral hygiene, occurring of white lesions, integrity of the appliances. A strict monitor using Dental Monitoring will permit to reduce treatment time, decrease need of further refinement, identify dental relapse, make the patient more aware of the importance of his own compliance, to detect early cavities, reduce the number of extra-appointments based on emergencies.