Implementation of 3D Imaging In Precise Bracket Positioning

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By

Ahmed Medhat El Temamy

B.D.S Cairo University

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Faculty of Oral and Dental Medicine

Cairo University

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Supervisors

Dr. Faten H. K. Eid

Professor of Orthodontics

Head of Orthodontic Department

Faculty of Oral and Dental Medicine

Cairo University

Dr. Fouad A. El Sharaby

Lecturer of Orthodontics

Faculty of Oral and Dental medicine

Cairo University

To

My Parents,

My Family,

My Wife

&

My Lovely

Daughter

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Introduction

Since evolution of straight wire appliance, attentions were directed to precise bracket placement as it is the key factor for ideal tooth positioning. The ability to place brackets in their ideal position allows the clinician to achieve the best outcome in minimum time, and to minimize the need for further archwire bending and bracket repositioning. Clinicians focused on how to achieve best results in bracket placement through various techniques such as shifting to indirect bracket placement techniques and introduction of new tools which aid in bracket placement.

The problems in bracket positioning are many including difficulty in accessibility, anatomical variations and morphological diversity of the clinical crowns of different teeth. Another problem encountered during placement is the use of the long axis of the clinical crown as a guide during bracket positioning which could be different from the actual long axis of the tooth when the root is considered. The ability to align teeth considering both the crown and the root improves the treatment outcome and decreases the chances of relapse.

Attempts were made in order to reach the best method for bracket placement. Unfortunately, none of them was able to come out with a reproducible and reliable technique. Indirect bonding technique was introduced to avoid the obstacles of inaccessibility and lengthy appointments hence, obtaining standard results, yet the clinician factor can't be underestimated.

Bracket placement gauges are used extensively aiming to place the brackets in the accurate position. Despite the fact that these gauges could minimize bracket positioning errors yet, they can't negate it.

Many factors might affect the clinician precision in bracket positioning. These include years of experience, sharpness of sight and physical condition. Hence, unceasing attempts are going on trying to overcome these factors.

Evolution of imaging techniques has opened new horizons for both diagnoses and treatment. Recent imaging techniques allowed complete visualization of the different tissues in three dimensions.

Cone beam computed tomography has been proven to be of great diagnostic value, with the ability to produce accurate images of the patient's soft and hard tissues this could be utilized to solve the problems that clinician faces with bracket position. Hence, allowing implementation CBCT technology not only as diagnostic aid but as a treatment aid as well.

Review of Literature

This review will try to cover most of the attempts in improving the bracket positioning. In order to try to find what was the defect and reviewing the recent tools and technology in order to overcome these obstacles.

The review of this study will be presented under the following titles:

I. Accuracy of bracket placement.
II. Cone beam CT accuracy.
III. Different bracket positioning devices.
IV. Comparison between direct bonding and indirect bonding.
V. The influence of different bracket placement techniques.
VI. Recent methods for bracket positioning.

I. Accuracy of bracket placement:

Bracket position should be accurate in order to fully express the built in tip and torques in order to reach the proper alignment of teeth described by **Lawrence Andrews (1972)** [(2)]**.** Six keys of normal occlusion were described in order to reach proper alignment of teeth. The concept of straight wire appliance was explained clearly by **Lawrence Andrews (1976)** [(3)]**.**

Balut *et al.* (1992) [(5)] conducted a study on the variation in bracket placement in the preadjusted orthodontic appliance. The study was conducted to determine the accuracy of bracket placement with the direct bonded technique. Ten orthodontic faculty members bonded a preadjusted orthodontic appliance on models of five cases of malocclusion in a simulated clinical situation (mannequin). A total of 50 sets of models served as the population of the study. Photographs of the models were measured to determine vertical and angular discrepancies in position between adjacent bracket pairs from a constructed reference line. Variations were evaluated with respect to the classification of malocclusion, specific tooth type, and intra/inter operator differences. A mean of 0.34 mm for the vertical discrepancies and a mean of 5.54 degrees for the angular discrepancies were found in placement of the brackets.

Miethke and Melsen (1992) [(26)] conducted a study on the effect of variation in tooth morphology and bracket position on first and third order correction with preadjusted appliances. They found out that the rationale of the totally preadjusted appliance can be rejected. Considering the intertooth variation, it still made sense to use brackets individually designed for different teeth. On the other hand, minor differences related to different prescriptions did not have significant impact. Each of the