ORIGINAL ARTICLE

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Accuracy of 3-dimensional-printed customized transfer tray using a flash-free adhesive system in digital indirect bonding: An in vivo study

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Introduction: This paper evaluated the accuracy of a computer-aided design and manufacturing indirect bonding technique using a new customized 3D-printed transfer tray and a flash-free adhesive system for orthodontic bonding. **Methods:** This in vivo study analyzed 106 teeth selected from 9 patients undergoing orthodontic treatment. Quantitative deviation analysis was performed to evaluate the bonding positioning errors, assessing the differences between the virtually planned and the clinically transferred bracket position after indirect bonding procedures by superimposing 3-dimensional dental scans. Estimated marginal means were evaluated for individual brackets and tubes, arch sectors, and overall collected measurements. **Results:** A total of 86 brackets and 20 buccal tubes were analyzed. Among individual teeth, mandibular second molars showed the highest positioning errors, whereas maxillary incisors reported the lowest values. Considering arch sectors, the posterior areas showed greater displacements than the anterior areas, as the right side compared to the left side, with a higher error rate reported for the mandibular arch than the maxillary arch. The overall bonding inaccuracy measurement was 0.35 mm, below the clinical acceptability limit of 0.50 mm. **Conclusions:** The accuracy of a 3-dimensional-printed customized transfer tray using a flash-free adhesive system in computer-aided design and manufacturing indirect bonding was generally high, with greater positioning errors for posterior teeth. (Am J Orthod Dentofacial Orthop 2023;■:■-■)

Since the introduction of preadjusted appliances, accurate bracket placement has become a key factor for a successful orthodontic treatment to achieve the ideal dental position during the final phase of therapy.[1] Frequently, orthodontic brackets are directly positioned on dental crowns (direct bonding),[2] but many orthodontists prefer indirect bonding for its greater accuracy.[3]

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The indirect bonding technique was first described in 1972 by Silverman et al,[4] and over the years, it has been reported that this method could reduce chair time[5] and overall treatment time,[6] improving the patient's comfort.[7] In the traditional indirect bonding, brackets are positioned on plaster models and then transferred to the teeth through transfer trays by a laboratory process.[2] Although indirect technique could reduce the positioning errors because of clinical variables (low visibility, limited mouth opening, excessive salivary flow or complex dental morphology),[8,9] the traditional laboratory steps could induce many errors related to the inner technical procedures or the professional experience of the operator.[10,11] The manual bonding of brackets on models or the use of conventional materials could influence the bracket placement, reducing the accuracy of the trays during their fabrication, transfer, and removal.[11,12]

Computer-aided design and manufacturing (CAD-CAM) technology has recently been introduced for indirect bonding,[5,13] as an alternative to the traditional method.[5,9] Among its advantages, this digital process