

Comparison of Accuracy and Time Duration Between Direct and Indirect Bonding By Photographic Method: A Short Clinical Study

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ABSTRACT

Introduction: Indirect bonding has been in orthodontics for a long time. It has been recognized that accurate bracket positioning is of clinical importance for efficient application of biomechanics. Previously so many methods have been used for checking accuracy which is very technique sensitive, require special equipments, difficult to fabricate and cost effective. Here, to make it more simplified, photographic method is used for accuracy measurement. The aim of this study was to compare the accuracy, and time consuming between direct and indirect bonding by photographic method.

Material and methods: Study was performed on 5 patients with split mouth technique in upper arch where brackets were bonded on one quadrant of orthodontic models for Indirect bonding one set as predetermined "ideal" bonding. A transfer tray was prepared using biostar sheet and glue gun, then tray is placed into patients mouth and other half quadrant was directly bonded to patients teeth. The accuracy was checked using photographic method in three parameters Bracket height, Mesiodistal position and Angulation. Time taken for bonding direct and indirect procedures were calculated.

Results Unpaired t test was done which showed statistical significant difference in bracket height and angulation and insignificant for mesiodistal position. Proving indirect bonding is more accurate and less time consuming than the direct bonding of braces.

Conclusion: There is difference between mean bracket placement errors for direct and indirect methods, the range of errors in the three directions assessed and time taken were greater for direct than indirect bracket placement. The magnitudes of the findings are of clinically relevant and this method is clinically feasible and cost ineffective.

Keywords: Indirect Bonding, Split Mouth, Biostar, Double Sided Tape, Glue Gun.

placement of brackets on the bands. Then direct bonding in orthodontics practice enabled the clinician to position the bracket directly on the tooth, thus eliminating the use of banding and also improve the accuracy of bracket position to certain level.³ The disadvantage of this technique was, it requires more chair side time and limited visibility makes, access and placement of brackets especially on posterior teeth quite difficult.

Aiming at improving the precision and attaining excellence in orthodontic procedures silverman et al in 1972⁴ develop indirect bonding technique. It overcomes the disadvantages of direct bonding as it consumes less chair side time and accurate positioning of bracket. Here the study is conducted to compare which among both the direct and indirect bonding techniques is better regarding accuracy and time duration for bonding brackets.

MATERIAL AND METHODS

Five patients with midline diastema were selected from the department of orthodontics at triveni dental college Bilaspur Chhattisgarh. The maxillary arch was divided into hemi arches, splitting it into two sections Right and Left, each from central incisor to 2nd premolar. Where left side bonded by indirect bonding and right side by direct bonding technique.

Direct Bonding Method

In direct bonding technique brackets are directly and

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How to cite this article: Preeti Singh, CH. Sudheer Kumar, Abin Mohammed BN, Sharad Kumar Sinha, Praveen Kalai, Ritika Motghare, Nidhi Agrawal. Comparison of accuracy and time duration between direct and indirect bonding by photographic method: a short clinical study. International Journal of Contemporary Medical Research 2019;6(12):L14-L17.

DOI: <http://dx.doi.org/10.21276/ijcmr.2019.6.12.19>

INTRODUCTION

Today the main aim of orthodontics is to create good occlusal relationship with the framework of acceptable facial esthetics and stability which require accurate bracket placement for optimum function of pre-adjusted appliance and efficient application of biomechanics¹ The use of Straight wire appliance is based on concept that ideal bracket placement will correct tooth position in all 3 planes of spaces during treatment with placement of archwires²

Initially banding was done for placing the brackets on individual tooth But there were limitations in the accurate

manually placed on the teeth(except molars). The composite (transbond XT) placed on the bracket and bracket was bonded to the tooth and evaluated the time period of direct bonding technique. All the bracket placement was done by visual inspection and bracket position was checked with MBT guage.

Indirect Bonding Method

The long axis of each tooth are marked on the prepared dental casts and the brackets are positioned according to the MBT prescription by means of double sided tape.⁵ Next a soft tray is made with silicon glue gun and allowed to set and a hard tray is prepared by using 1.5mm thick biostar sheet .The excess portion of tray is trimmed and base of the brackets are washed and dried, then tray is inserted into the patients mouth.(Figure 1)

Accuracy

To evaluate bracket positioning , photograph of each bonded teeth of indirect bonding was taken and compared to the same tooth on opposite side of the arch done with direct bonding method.

The measuring scale was placed adjacent to the particular tooth of the patient which reduce the magnification error, while reproducing the photograph on A4 sheet paper. To take the photograph of each tooth ,the patient was made to sit in upright position and photograph was taken with Nikon DSLR 5300 keeping the focussing lens perpendicular to the labial surface of each tooth.

The lens used was 85mm macro lens which was set on the magnification of 1:1. The camera was mount on the tripod stand and at a standard distance of 150cm from the object with focal length $f/16$, and with an attached ring flash on this. All the teeth were marked with horizontal and vertical as REFERENCE LINE Horizontal reference line was marked according to the MBT prescription (Red) .For vertical reference line Long axis of the tooth was marked (Red).

For Measuring Accuracy

Two parameters were taken and calculated for direct and indirect bonding procedures.

- 1)Angular measurement
- 2) Linear measurement: (i) Bracket height (ii) Mesiodistal position

Angular measurement: Angular measurement is made from calculating the difference between two linear measurements from the reproduced photograph taken. One from the horizontal reference line to the mesio gingival edge of bracket and other from horizontal reference line to disto-gingival edge, using digital vernier caliper (Figure 2).

Linear measurement: Two linear measurement were taken.

A) Bracket height: An experimental line is drawn horizontally through the centre of the bracket slot (green line). The vertical difference of the experimental line from the previously marked horizontal reference line(yellow line) was measured using digital vernier caliper . If the bracket was place occlusal to ideal ,the value is positive +ve ,and if placed gingival to ideal it is designated as negative -ve.

(Figure 3).

B) Mesio-distal position: A vertical line is drawn through the centre of the bracket slot as experimental line (green line) . The horizontal distance between the vertical reference line (Red line) and experimental line as measured with a caliper. (figure 4)

The +ve represents bracket was placed more mesial positioning of the bracket to that of reference line. The -ve indicates bracket was more distal to the reference line.

Time Measurement

Indirect technique: Total time duration of bonding the brackets on the dental casts and transfer of tray on the patients and curing were calculated . Calculated values of all the patients were summed up and the mean value was taken.

Direct bonding: Total time spent for placing the bracket and curing time on patients was recorded and then summed up



Figure-1: Indirect bonding

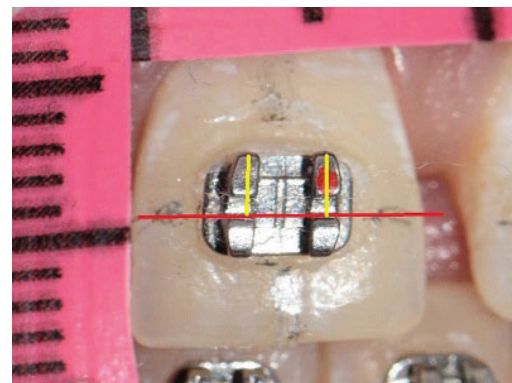


Figure-2: Angular measurement

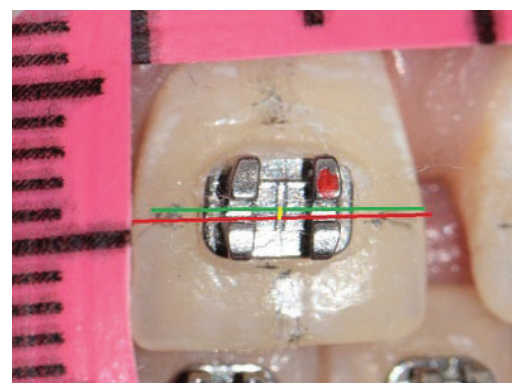


Figure-3: Linear measurement -bracket height

and mean value was calculated.

RESULTS

Bracket Height Inference: Unpaired t test is used to test the significance of difference in mean bracket height between direct and indirect technique. On applying the test highly significant in mean was observed for teeth C ($P=0.008$) and significant difference in mean bracket height for teeth PM1 ($P=0.033$). Rest all the comparison were found insignificant ($P>0.05$). (Table1)

Angular Measurement: Unpaired t test is used to test the significance of difference in mean angular measurement between direct and indirect technique. On applying the test highly significant in mean was observed for teeth PM2 ($P=0.004$). Rest all the comparison were found insignificant ($P>0.05$). (Table 2)

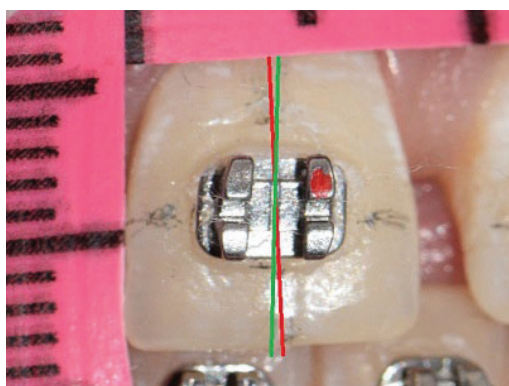


Figure-4: Linear measurement – mesio distal position

Teeth	Direct		Indirect		P value
	Mean	SD	Mean	SD	
CI	0.268	0.07	0.23	0.05	0.327
LI	0.22	0.03	0.172	0.03	0.018
C	0.244	0.06	0.142	0.03	0.008
PM1	0.23	0.04	0.166	0.04	0.033
PM2	0.304	0.1	0.202	0.05	0.085

Table-1: Bracket height

Teeth	Direct		Indirect		Pvalue
	Mean	SD	Mean	SD	
CI	0.232	0.09	0.158	0.06	0.172
LI	0.37	0.24	0.152	0.05	0.078
C	0.4	0.27	0.214	0.07	0.176
PM1	0.274	0.1	0.178	0.04	0.094
PM2	0.31	0.08	0.154	0.04	0.004

Table-2: Angular

Teeth	Direct		Indirect		Pvalue
	Mean	SD	Mean	SD	
CI	0.262	0.12	.21	0.11	0.501
LI	0.234	0.07	.182	0.05	0.23
C	0.254	0.1	.212	0.09	0.501
PM1	0.244	0.06	.182	0.06	0.143
PM2	0.254	0.05	.198	0.02	0.059

Table-3: Mesiodistal

Mesiodistal Measurement: Inference - All the comparison were found insignificant (Table 3)

Time Period: Comparison with direct and indirect bracket placement inference: $P<0.001$ highly significant difference.

DISCUSSION

Several studies were performed by many authors like Silverman et al 1972⁴, thomas 1979, hickman 1993, koo et al 1999.⁶ Using various methods to check superiority in terms of accurate bracket placement.

In this study Split mouth technique was used in which right side of upper arch was chosen for direct bonding and left for indirect bonding as many orthodontists believed that left side is difficult to bond due to improper visibility and accessibility especially in posterior teeth. The accuracy was measured in three parameters, one angular and two linear measurements. For evaluating these parameters we have used a photographic method with 1:1 magnification to reduce the bias.

As According to Lachen et al 2011⁷, the photographic assessment is a reliable way to study the position of the brackets provided same parameters and same protocols. Linear measurements were calculated in terms of bracket height, there was significant difference ($p<0.05$) seen in canine and 1st premolar and mesiodistal position shows there is no significant difference between direct and indirect bonding. Similar results concluded in 1982 Aguirre et al⁸ and Koo et al⁶ found that indirect bonding was more accurate on maxillary and mandibular canine: for vertical bracket positioning when compared to direct bonding. The angular measurements shown that there is significant difference seen in 2nd premolar ($p<0.05$) between direct and indirect bonding, with indirect bonding more closer to the ideal angulation. Similar results have been presented by Balut et al in 1992,⁹ indicated that the main advantage of indirect bonding is that it reduces the envelope of error of bracket position in each of three parameters. The time needed to complete the indirect bonding including laboratory work, is significantly longer than the time required to complete the direct bonding procedure. When only clinical time is considered, the indirect technique is significantly less time consuming than the direct technique. Similar results were achieved by Bozelli et al¹⁰ for clinical time taken.¹⁰

CONCLUSION

When comparing direct bonding technique to an indirect bonding, statistics values show that there was a difference between mean bracket placement errors for direct and indirect methods. The indirect bonding technique provides better bracket placement in respect to bracket height ($p<0.05$) and angulation ($p<0.05$) than direct bonding. Whereas Mesiodistal position shows there is no significant difference between direct and indirect bonding. The magnitudes of the findings are of clinical relevance. Indirect bonding method enables the majority of commercially available bracket systems to be bonded and allows both dental arches to be bonded in one stage consuming lesser time than direct bonding. The result shows that the photographic technique used in this study is

clinically feasible ,more simplified and cost ineffective.

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Source of Support: Nil; **Conflict of Interest:** None

Submitted: 11-11-2019; **Accepted:** 30-11-2019; **Published:** 26-12-2019