Molar Buccal Tubes Front and Back Openings Dimensions and Torsional Play

Hiyam J. Al-Zubaidi B.D.S. [1]
Akram F. Alhuwaizi B.D.S., M.Sc., Ph.D. [2]

ABSTRACT

Background/: *Buccal tubes are orthodontic attachments used on the posterior teeth instead of bands, so it is important to focus on the effect of their properties on orthodontic treatment. The aims of the present in vitro study are to evaluate and compare the buccal tube front and back openings dimensions and the torsional play angle of six different brands.*

Materials and Methods*: The samples consisted of Single bondable, non-convertible first molar buccal tubes from six brands supplied from six companies (Dentaurum, Forestadent, Ormco, 3M, American Orthodontic, A-Star). Regarding tube opening dimension, ten buccal tubes of each brand were examined by an optical microscope. Each tube was fixed during examination using synthetic mud and oriented for observation of the front and back slot openings. A picture was taken for both tube openings and the result appeared on the computer's screen where width and height measurements were made. While regarding torsional play angle, ten buccal tubes of each brand were used. Each tube was fixed on a metal block attached to a surveyor base. Then an L-shaped wire was inserted inside the front opening of the tube. Two photographs were taken, one with the wire in free fall position and the other with the wire elevated by a 10g weight with the same angle of shooting as the first photograph. Later, the two images were superimposed in Adobe Photoshop program, and an electronic MB-ruler Software was used to calculate the angle which represents the torsional play within each tube. The data were then statistically analyzed using ANOVA and LSD tests.*

Results: *There are marked differences between measured tube dimensions and the manufacturer stated dimensions with the front tube openings being generally larger than the back opening dimensions. Furthermore, the torsional play angle was highest in A-Star and smallest in Ormco's tubes. This angle was significantly correlated to the height of the tube front opening.*

Conclusion: *It can be concluded that tube dimension varies among different companies and effect greatly torsional play angle.*

Keywords: Buccal tube, tube dimension, torsional play. **(J Bagh Coll Dentistry 2018; 30(3): 32-39)**

INTRODUCTION

The buccal tube is a metal tube fixed to the facial (buccal) surface of an orthodontic molar band or directly to the surface of the tooth which allows the arch wire to pass through while applying either a torqueing force or allowing the wire to slide as tooth movement occurs [1]. There are four basic types of buccal tubes available: 1. Mandrel formed - the tube is pressed and machine-folded to the required size. 2. Drilled formed - the tube is machine-formed and drilled to the size. 3. MIM (Metal Injection Mold) formed - the tube with its slot created by milling machine, which consider as an accurate manufacturing process. 4. The CNC machine - using computer numerical control machining [2,3].

In orthodontics, the effect on a tooth of the force delivered by a twisted (torqued) wire represents the "torque". Torsion is the actual twisting that results from torque [4].

1Ministry of health, Baghdad, Iraq
2 Professor, Department of Orthodontics, College of Dentistry, University of Baghdad, Baghdad, Iraq

Oversized slots lead to a clinically relevant torque loss. If torque control with rectangular wire is needed, the wire should have a close engagement with the tube lumen [5].

Proffit *et al.* [6] stated that "Oversize slots undermine the whole basis of pre-adjusted edgewise, which is intended to minimize wire bending". He further stated that there should be a reasonable anticipation that the appliance accuracy should be exactly as appealed in advertising brochures. While theoretical tooth positions or prescription values may be debated, few have questioned whether a specific bracket or bracket series is even capable of moving the tooth to the desired position.

Orthodontic bracket slot profile variances have an impact on torque play and third-order torque expression [7,8].

Meling *et al.* [5] used torque play to measure slot height indirectly in an attempt to overcome the difficulties of measuring non rectangular profiles.

Cash *et al.* [9] measured bottom and top slot height and suggested that different bracket types have different slot shapes.

When a smaller dimension wire is used in a slot there would be a gap between the slot walls and the

wire. This gap will cause certain rotation or free play of the wire in the slot. Because of this play or free space, not all the torque built within the bracket is expressed on passing the wire. To express the required amount of torque either we have to introduce torque or torsion in the wire by pliers or have to use a bracket with extra torque built within to accommodate the amount of play of the wire. The amount of torsion in the wire or extra torque built within the bracket should be equal to the amount of play of the wire with in the slot. Torque or wire play is affected by manufacture tolerance of slot and wire, edge bevel of slot and wire, mechanotherapy, type of ligation, defects in brackets slot, and aging of brackets [10].

MATERIALS AND METHODS

This in vitro study focused on upper first molar buccal tube made by six different international companies in which samples were tested to measure slot dimension and torsional play within the slot.

One hundred and ten single bondable, non-convertible first molar buccal tubes from six companies, ten tubes form each company were used in this study. All the tubes had an MBT 0.022 prescription and from the following companies:

1- Dentaurum (Dentaurum, Ispringen, Germany).
2- Forestadent (Forestadent, Pforzheim, Germany).
3- Ormco (Ormco, California, USA).
4- 3M (3M Unitek, Monrovia, California, USA).
5- AO (American Orthodontics, Washington Avenue, Sheboygan, USA).
6- A-Star (A-star Orthodontics Inc., Shanghai, China).

Slot Dimension Measurement:

Sixty buccal tubes of upper first molar from six different companies were used for this test (ten from each company). Each tube was fixed during examination using synthetic mud and oriented for observation of the front and back slot openings using a metallurgic optical microscope (Olympus, Japan) (Fig. 1). A picture was taken for the front and back openings of the tube and the result appeared on the computer's screen where width and height measurements were made (Fig. 2).

Figure 1: Method of tube's fixation during slot dimension examination.

Figure 2: The Optical microscope.

Torsional Play Test:

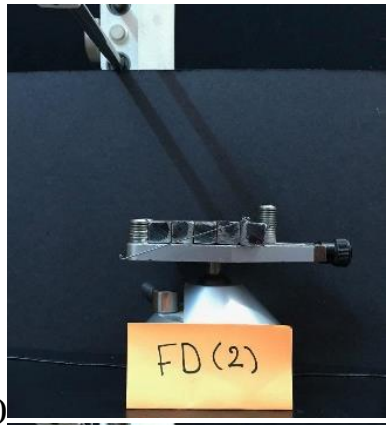
A CNC machine (CNC Freza, Japan) which is a computer controlled machine was used to make 30 steel blocks (6 x 1.2 x 1.2 cm in dimension). Eighteen blocked were used for the torsional play test on which the molar tubes were fixed and the torsional play was measured.

Ten sections of 0.021" x 0.025" straight stainless steel archwires (Dentaurum, Ispringe, Germany) were cut. Each wire was 3 inches long and the 0.5-inch end was bent at 90 degrees to be inserted in tube's opening in accordance with Bennett and McLaughlin [3] (Fig. 3). A half circle was made at the end of long side of the wire.

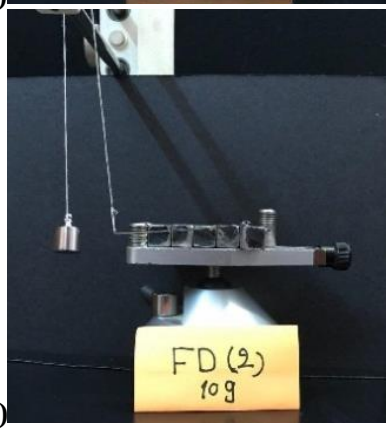
Fifty buccal tubes of upper first molar were collected from five companies (10 tubes for each

company). They were fixed on the prepared blocks and the blocks were attached to the surveyor base which was kept parallel to the floor. Then the prepared wire was inserted inside the front opening of the tube and permitted to fall freely and a photograph was taken in this position (Fig. 4a). After that a 10g weight was tied to a thread placed around the horizontal arm of the surveyor. The other end of the thread was tied to the end of the wire (Fig. 4b). As a result, the wire was elevated till it engaged with the tube slot and another photograph was taken with the same angle of shooting as the first photograph. Later, each two images were superimposed in Adobe Photoshop program and transformed into one photograph, and then an electronic MB-ruler (Markus Bader) Software was used to calculate the angle which represents the torsional play within each slot (Fig. 5).

Figure 3: The wire used in the torsional play test.



(a)



(b)

Figure 4: The wire in two positions: (a) in free fall and (b) after application of 10g weight.

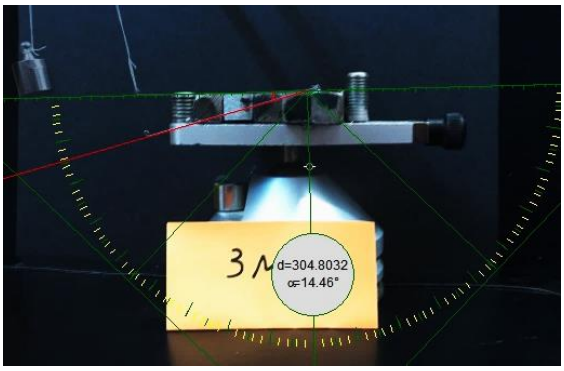


Figure 5: The two photographs after being edited in Adobe Photoshop and the angle measured by MB- ruler.

Statistical analysis:

Data were collected and analyzed using SPSS (statistical package of social science) software version 24 for windows 10 (Chicago, USA). Least significant difference (LSD) was used to test any statistically significant differences between each two subgroups when ANOVA test (One-way analysis of variance) showed a statistical significant difference within the same group.

A p-level of more than 0.05 was regarded as statistically non-significant. While a p-level of 0.05 or less was accepted as significant.

RESULTS

The data obtained from the present experimental study were managed statistically to compare and explain the tube dimension and the torsional play differences between six different brands of upper first molar tubes. These statistics included mean, standard deviation, standard error, minimum, and maximum values.

Normality of data distribution:

It was found that all data of this experimental study including the tube dimension and torsional play tests were normally distributed because the p-value of Shapiro-Wilk test is greater than 0.05 which mean non-significant.

Tube dimensions for front opening:

Table 1 illustrate the mean and standard deviation of the measured molar tube front opening dimensions (height and width) for the six tested brands.

A-Star molar tubes showed front opening dimensions markedly larger than the standard dimensions (22 mil height and 30 mil width) by 1.8-2.6 mil. Also, 3M molar tubes showed front tube opening dimensions larger than the standard dimensions by 1-1.6 mil. While, American Orthodontics molar tubes had front opening dimensions is larger in height by 1.2 mil but with a normal width.

Dentaurum molar tubes showed front openings slightly larger in height (1 mil) but smaller in width (0.7mil) which is similar to the same results of Forestadent molar tubes that showed front openings that are higher than standard one by 1.4 mil and narrower by 1.5 mil. Finally, Ormco molar tubes showed slightly larger dimensions than standard by 0.7-0.9 mil.

Regarding consistency, all the tested molar tubes from the 6 brands had front openings with a height more than the 22 mil standard. Moreover, height was more consistent than width with range values of 0.6 to 0.9 and 0.6 to 2.1 respectively. The highest variation was observed in A-Star and Dentaurum and Forestadent width measurement of about 2 mils.

Table 1: Dimensions of the molar tubes front opening.

	Height		Width	
	Mean	S.D.	Mean	S.D.
3M	23.640	0.196	31.030	0.221
As	23.780	0.326	32.590	0.638
AO	23.210	0.197	30.020	0.187
De	23.077	0.230	29.270	0.730
Fr	23.430	0.320	28.470	0.263
Or	22.890	0.242	30.690	0.318

***** All measurements are in mil.

Tube dimensions for back opening:

Table 2 illustrate the mean and standard deviation of the measured molar tube back opening dimensions (height and width) for the six tested brands.

Regarding A-Star molar tube, the back opening dimensions were markedly larger than the standard dimensions (0.9-2.4 mil). Ormco and 3M molar tubes both showed back tube opening dimensions similar to the standard dimensions differing by only 0.2 to 0.4 mil.

On the other hand, American Orthodontics, Dentaurum and Forestadent molar tubes all showed back opening which are considerably narrower than the standard width 30 mil. However, in them differ height. Forestadent tubes have a larger height dimensions, Dentaurum tubes have similar heights to the standard 22 mil, while American Orthodontics tubes have smaller height dimensions making them much smaller in both height and width than the standard dimensions (1.1 to 2.1 mil) as shown in figure 6.

Difference in the dimensions of the molar tubes front and back opening:

Table 3 and figure 7 illustrate the mean and standard deviation of the difference in the dimensions of the molar tubes front and back openings for the six brands tested in the study.

American Orthodontics, showed the highest differences between back and front tube openings in range 2.1-2.3 mil. While, 3M molar tubes showed slight differences between front and back dimensions in comparison with the stated dimensions about 0.7-1.4 mil.

A-Star, Ormco and Dentaurum molar tubes showed nearly the same range of differences between back and front tube dimensions in comparison with the stated dimensions (0.2-0.9 mil).

Forestadent molar tubes showed the least differences in back and front dimensions as compared to the stated dimensions (0.2-0.5 mil).

Table 2: Dimensions of the molar tubes back opening.

	Height		Width	
	Mean	S.D.	Mean	S.D.
3M	22.210	0.401	30.360	0.190
As	22.875	0.487	32.400	0.594
AO	20.880	0.270	27.920	0.270
De	22.160	0.227	28.650	0.268
Fr	22.930	0.221	28.270	0.271
Or	21.990	0.303	30.250	0.327

***** All measurements are in mil.

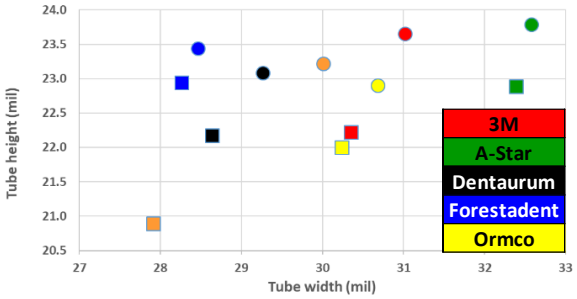


Figure 6: Scattered diagram of the mean height and width of the molar tube front (●) and back (■) openings.

Table 3: The difference in the dimensions of the molar tubes front and back openings.

	Height		Width	
	Mean	S.D.	Mean	S.D.
3M	1.430	0.481	0.670	0.353
As	0.905	0.614	0.190	1.019
AO	2.330	0.337	2.100	0.226
De	0.917	0.298	0.620	0.678
Fr	0.500	0.249	0.200	0.275
Or	0.900	0.298	0.440	0.515

***** All measurements are in mil.

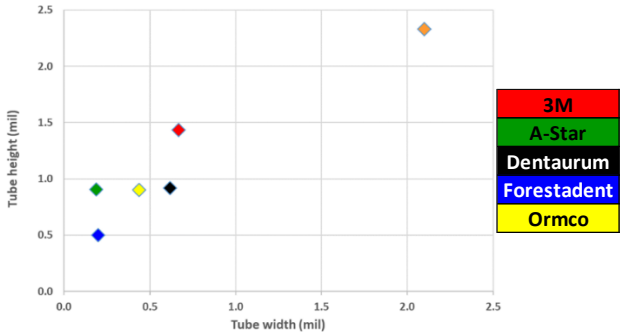


Figure 7: Mean difference between the molar tube front and back openings dimensions.

Difference between molar tube brands for front and back openings dimensions:

ANOVA test for both tube dimensions showed a highly significant differences among buccal tubes of the six brands (Table 4).

LSD test was performed for comparison between each two brands for height and width of the molar tube front and back tube openings and the results are displayed in table 5. The differences between the brands were all statistically significant with only some exception, most notable are between Ormco tubes on one hand and 3M tubes and Dentaurum tubes on the other.

Table 4: Statistical difference between the six brands for height and width of the molar tube front and back openings by ANOVA test.

		F	Sig.
Front	**Width**	104.467	0.000***
	Height	17.531	0.000***
Back	**Width**	240.544	0.000***
	Height	50.116	0.000***

***** p<0.001**

Table 5: Statistical difference between each two brands for height and width of the molar tube front and back openings by LSD test.

		Front		Back	
		Width	**Height**	**Width**	**Height**
3M	**As**	0.000***	0.229	0.000***	0.000***
	AO	0.000***	0.000***	0.000***	0.000***
	De	0.000***	0.000***	0.000***	0.738
	Fr	0.000***	0.074	0.000***	0.000***
	Or	0.094	0.000***	0.479	0.145
AS	**AO**	0.000***	0.000***	0.000***	0.000***
	De	0.000***	0.000***	0.000***	0.000***
	Fr	0.000***	0.004**	0.000***	0.713
	Or	0.000***	0.000***	0.000***	0.000***
AO	**De**	0.000***	0.253	0.000***	0.000***
	Fr	0.000***	0.061	0.027*	0.000***
	Or	0.001**	0.007**	0.000***	0.000***
De	**Fr**	0.000***	0.003**	0.017*	0.000***
	Or	0.000***	0.110	0.000***	0.258
Fr	**Or**	0.000***	0.000***	0.000***	0.000***

*** p<0.05, ** p<0.01, *** p<0.001**

Torsional Play of the Molar Tubes:

Table 6 revealed the mean and standard deviation values of torsional play test of molar tubes for five companies excluding AO molar tubes. AO tubes were not measured because the 21 x 25 mil wire did not exit from the back opening of the tube. The means for torsional play test of all molar tubes ranged from 14.5° for A-Star (highest torsional play) to 8.927° for Ormco (lowest torsional play).

Table 6: Molar tubes torsional play.

	Mean	S.D.
3M	13.625°	0.655°
AS	14.536°	0.268°
De	10.634°	0.245°
Fr	14.328°	0.651°
Or	8.927°	0.053°

Statistical Difference for Torsional Play Test:

ANOVA test was performed to demonstrate the statistical difference between the five brands for torsional play of the molar tubes and showed a highly significant difference among molar tubes (F=315.754, p=0.000).

LSD test was performed for comparison between each two types of molar tubes and the results are displayed in table 7. Torsional play showed significant differences between the brands except between Forestadent and A-Star.

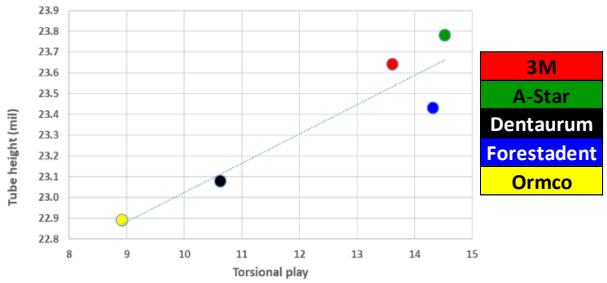
Table 7: Statistical difference between each two brands for the torsional play of the molar tubes by LSD test.

		P level
3M	**As**	0.000***
	De	0.000***
	Fr	0.001**
	Or	0.000***
As	**De**	0.000***
	Fr	0.301
	Or	0.000***
De	**Fr**	0.000***
	Or	0.000***
Fr	**Or**	0.000***

*** p<0.05, ** p<0.01, *** p<0.001.**

Correlation between variables:

All the variables were correlated with each other and displayed non-significant correlations except between torsional play and the molar tube front opening height which showed a significant correlation (Fig. 8). The data lie of all six brands of molar tube lie near a straight line which indicate a positive correlation.



Pearson Correlation= 0.924, p = 0.025 (p<0.05)

Figure 8: Scattered diagram of the torsional play with the tube height of the molar tube.

DISCUSSION

Due to the scarcity of researches on molar tubes some comparisons will be made with researches done on passive self-ligating brackets. According to Seo, passive self-ligating bracket used has a flat and rigid buccal slide made of stainless steel, which makes the slot configuration as a rectangular tube and maintains slot dimension even in an active configuration [11]. As the tubes resemble passive self-ligating bracket so the studies on SLB can be compared to this current study.

Tube Dimensions:

In this study, the tube dimension was measured by using metallurgic optical microscope in which the tube was fixed by using synthetic mud with the slot oriented vertically so that the line of view with the measuring microscope was parallel to the slot axis and this method have been previously reported by [12] in which the brackets were placed on a microscope slide using rope wax with the slots oriented vertically so that the line of view with the measuring microscope was parallel to the slot axis. The slide was then placed on the microscope table and the slot and light adjusted until a sharp, well-focused image was viewed on the screen and digitally captured and then two screenshots from the Automatic Reading System showing a bracket with rounded internal line angles and another with a divergent slot. The digitally imaged bracket is automatically scaled and loaded into the measuring software.

Tube Opening Dimensions:

None of the tested tubes matched the stated dimensions given by the manufacturer with a trend showing larger dimensions for all front openings of tested tubes. This inconsistency in tube and bracket dimensions and inability of manufacturer to produce the slots precisely have been previously reported by [13-16].

In general, the molar tube's front opening height was found to be larger than the stated dimensions but more regular than the width. According to previous studies which measured the actual slot configuration of PSLB (Passive Self Ligating Bracket) is known to have narrower width, longer height, deeper depth and consequently larger critical contact angle (θc) when compared to ASLB (Active Self Ligating Bracket) [17-19].

This study showed that there is a difference between back and front opening dimension for the same tube. These findings supported by many other studies on bracket slot dimensions which revealed nearly the same results including the differences in bracket slot width between top and base and differences in slot dimensions for the brackets from the same company [9].

Finally, American Orthodontics tubes founded to be smaller in both height and width of back opening in comparison with the other companies because of that it showed the highest differences between the front and back opening ant this result may be related to the method of manufacturing since it was mentioned previously in the AO buccal tube catalog that low profile buccal tubes are reduced in size by 25% over standard sized tubes. LP® tubes feature smooth contours for patient comfort, a funneled mesial opening for easy wire insertion, and occlusal/gingival positioning guides designed to make bonding easier at the posterior.

Torsional Play Test:

When an undersized wire is inserted, the wire can rotate in slot of attachment. This angle of freedom is called play and it would increase as the differences in size between the slot and wire [20].

In this study, A-Star had higher torsional angle and Ormco had the least torsional angle. These results can be related to the differences in tube dimension among the tested brands. A-Star tubes showed higher dimension which can be considered the cause for higher torsional angle. While, Ormco tubes showed the smallest dimensions and least torsional angle.

Many studies demonstrated that in reality, torque loss is higher because the dimensions of the slot aren't 100% precise. As measured by several authors, the dimension of the slots tends to be mostly larger than stated [7,8,9,15,21].

According to several authors, the mean engagement angle measured was greater than the theoretical engagement angle because the bracket slot dimensions were larger than stated dimensions [7.22,23].

In a 0.022-inch bracket slot, the nominal values for play are 1.74 degree according to Dellinger [24] and 3.9 degree according to Creekmore [25] for a 0.021 * 0.025 inch archwire. While in the current study, the torsional play of all molar tubes ranged from 14.5° for A-Star to 8.927° for Ormco so these result can be explained by the larger dimensions of A-Star tubes than stated dimensions and Ormco showed a slightly larger dimensions of front opening but the same dimensions of back opening when compared with the stated ones.

Tube height is more important in relation to the torsional play since the height is smaller than width so any simple change in height will greatly show an effect on the torsional play degree.

Limitation of The Study

1. There is limited information from the manufacturers regarding the manufacturing process of making molar tubes especially the nature of the slot inner surfaces.
2. Molar tubes from American Orthodontics were not tested for torsional play because it was not possible to insert a 0.021" x 0.025' wire which used for testing because of the small back opening.

Clinical Consideration:

1. The orthodontist must be aware about the inaccuracy of the stated slot dimensions of the molar tubes mentioned by the manufacturer.
2. Using a 0.021" x 0.025" stainless wire is a simple technique to examine the precision of the size of the tube openings.

CONCLUSIONS:

1. The measured tube dimensions do not match those stated by the manufacturer.
2. There are large differences between front and back openings dimension.
3. Torsional play angle is significantly related to tube opening height.

REFERENCES

1. Jones Jr JH, Kantor G, Stevens MD, Watt DE. Convertible buccal tube. US Patent 6 2002; 428-314 B1.
2. Raphael E. Angular rotation of rectangular wire in rectangular buccal tubes. Loyola University Chicago, Master thesis, 1978.
3. Bennett J and McLaughlin. Fundamentals of Orthodontic Treatment Mechanics. London, UK: LeGrande Publishing 2014; 1st ed,
4. Thurow CR. Edgewise Orthodontics. Mosby, St. Louis 3rd Ed, 1972; P.35-7, 160-70, 181-7.
5. Melling TR, Odegaard J, Seqner D. On bracket slot height: a methodologic study. Am J Orthod Dentofacial Orthp 1998; 113(4): 387-93.
6. Proffit WR, Fields HW Jr, Sarver DM. Contemporary orthodontics. 5th ed. St. Louis: Elsevier Health Sciences, 2014.
7. Fischer-Brandies H, Orthuber W, Es-Souni M, Meyer S. Torque transmission between square wire and bracket as a function of measurement, form and hardness parameters. J Orofacial Orthop 2000;.61(4): 258-65.
8. Gioka C, Eliades T. Materials-induced variation in the torque expression of preadjusted appliances. Am J Orthod Dentofacial Orthop 2004; 125(3): 323-8.
9. Cash C, Good SA, Curtis RV, McDonald F. An evaluation of slot size in orthodontic brackets are Standards as expected? Angle Orthod 2004; 74(4): 450-3.
10. Khan H. Orthodontic brackets selection, placement and debonding. Orthodontic book, 1st ed, 2016.
11. Seo Yu-Jin, Bum-Soon Lim, Young Guk Park, Il-Hyung Yang, Seok-Joon Ahn, Tae-Woo Kim, Seung-Hak Baek. Effect of self-ligating bracket type and vibration on frictional force and stick-slip phenomenon in diverse tooth displacement conditions: an in vitro mechanical analysis. Eur J Orthod 2015; 37(5): 474-80.
12. Brown P, Warren Wagner, Hyden Choi. Orthodontic bracket slot dimensions as measured from entire bracket series. Angle Orthod 2015; 85(4): 678-82.
13. Kusy RP, Whitley JQ. Assessment of second-order clearances between orthodontic archwires and bracket slots via the critical contact angle for binding. Angle Orthod 1999; 69(1):71-80.
14. Bhalla NB, Good SA, McDonald F, Sherriff M, Cash AC. Assessment of slot sizes in self-ligating brackets using electron microscopy. Aust Orthod J 2010; 26(1): 38-41.
15. Major TW, Carey JP, Nobes DS, Major PW. Orthodontic bracket manufacturing tolerances and dimensional differences between select self-ligating brackets. J Dent Biomech. 2010; 2010: 781321.
16. Daratsianos N, Bourauel C, Fimmers R, Jäger A, Schwestka-Polly R. In vitro biomechanical analysis of torque capabilities of various 0.018″ lingual bracket–wire systems: total torque play and slot size. Eur J Orthod 2016; 38(5): 459-69.
17. Thorstenson GA, Kusy RP. Effect of archwire size and material on the resistance to sliding of self-ligating brackets with second-order angulation in the dry state. Am J Orthod Dentofacial Orthop 2001; 122(3): 295-305.
18. Chang CJ, Lee TM, Liu JK. Effect of bracket bevel design and oral environmental factors on frictional resistance. Angle Orthod 2013; 83(6): 956-65.
19. Nucera R, Lo Giudice A, Matarese G, Artemisia A, Bramanti E, Crupi P, Cordasco G. Analysis of the characteristics of slot design affecting resistance to sliding during active archwire configurations. Prog Orthod 2013; 14:35.
20. Meling TR, Ødegaard J. The effect of cross-sectional dimensional variations of square and rectangular chrome-cobalt archwires on torsion. Angle Orthod 1998; 68(3): 239-48.
21. Siatkowski R. Loss of anterior torque control due to variations in bracket slot and archwire dimensions. Journal of Clinical Orthodontics: J Clin Orthod 1999; 33(9): 508-10.
22. Sebanc J, Brantley WA, Pincsak JJ, Conover JP. Variability of effective root torque as a function of edge bevel on orthodontic arch wires. Am J Orthod 1984; 86(1): 43-51.
23. Meling TR, Odegaard J, Meling EO. On mechanical properties of square and rectangular stainless steel wires tested in torsion. Am J Orthod Dentofacial Orthop 1997; 111(3): 310-20.
24. Dellinger EL. A scientific assessment of the straight-wire appliance. Am J Orthod. 1978; 73:290–299.
25. Creekmore TD. Dr. Thomas D. Creekmore on torque. J Clin Orthod. 1979; 13:305–310.

الخلاصة:

الغرض من الدراسة: الأنابيب الشدقية كمرتكزات تقويمية تستعمل في الاسنان الخلفية بدلا من الحلقات المعدنية لذا من المهم التركيز على تأثير خصائصها في مجال العلاج التقويمي. أهداف هذه الدراسة المختبرية هي تقييم ومقارنة قوة الأحتكاك الثابت وحجم الانبوب ودرجة الحركة الألتوائية للأنبوب التقويمي الاول العلوي من (6) شركات مختلفة.

الطريقة: أستعملت في هذه الدراسة أنابيب شدقية مفردة قابلة للصق، غير متحولة للضرس الأول من 6 شركات. بالنسبه لقياس حجم فتحة الأنبوب، تم فحص 10 أنابيب شدقية من كل شركة بواسطة المجهر الضوئي.ثم تم تثبيت كل أنبوب خلال الفحص بأستخدام الطين الأصطناعي ونُظمت من أجل ملاحظة الفتحات الامامية والخلفية للأنبوب. وقد ألتقطت صورة لفتحتي الأنبوب وظهرت النتائج على شاشة الكومبيوترحيث تم قياس العرض والارتفاع. بالنسبة لزاوية الحركة الألتوائية، حيث تم تثبيت كل أنبوب على قطعة معدنية مُثبتة بقاعدة جهاز (Surveyor) بعد ذلك تم ادخال سلك على شكل حرف(L) داخل الفتحة الأمامية للأنبوب بعدها تم التقاط صورتين، احداها مع سلك بوضع السقوط الحر والاخرى مع سلك مرفوع بواسطة وزن مقداره 10غم مع نفس زاوية التصوير للصورة الاولى. بعد ذلك تم دمج الصورتين بواسطة (Adobe Photoshop program) وتم استخدام برنامج MB-ruler لحساب الزاوية التي تمثل الحركة الألتوائية داخل كل أنبوب. تم تحليل النتائج احصائيا بأستخدام أختبار ANOVA و LSD.

النتائج: اظهرت النتائج بوجود اختلاف واضح بين حجم الانابيب المقاسه والحجم المتعارف عليه من قبل المصنع مع كون الفتحه الأماميه للأنبوب أكبر بشكل عام من ابعاد الفتحه الخلفيه. بالأضافه الى ذلك، كانت زاوية الحركة الالتوائية هي الأعلى مع شركة (A-Star) والأقل مع شركة (Ormco) .هذه الزاوية كانت مرتبطة بشكل اساسي بأرتفاع الفتحة الأمامية للأنبوب.

الأستنتاج: يمكن الأستنتاج بان ابعاد الانبوب تتغير ضمن قياسات الشركات المختلفة وهناك تاثير كبير على درجة الحركة الالتوائية داخل الأنبوب.