COMPARISON OF VISUAL APPROXIMATION METHOD AND BRASS WIRE METHOD IN ASSESSING MODERATE AND SEVERE CROWDING IN KHYBER COLLEGE OF DENTISTRY, PESHAWAR

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ABSTRACT

Objectives: *To compare whether visual approximation and brass wire method give the same results when assessing moderate and severe crowding. The secondary objective is to compare time taken by two groups of residents in calculating crowding using the two methods.*

Methods and materials: *This cross sectional study was conducted in Orthodontics Department, Khyber College of Dentistry, using two dental models, one with moderate crowding and one with severe crowding. Visual approximation and Brass wire method were performed to assess crowding by 32 orthodontic residents. Results were recorded as mean, standard deviation, frequency and percentage. Participants were divided into two groups based on residency year and time taken using each method was noted. Data was analyzed by SPSS version 22. One sample t test was used to compare means of estimated crowding values with the actual value. Independent samples t test was used to compare means of times taken by the two group. P value ≤.05 considered significant.*

Results: *For moderate crowding, visual approximation over estimates crowding, while brass wire gives accurate results. For severe crowding, both methods underestimate it. More experienced residents took significantly less time to calculate crowding using both methods.*

Conclusion: *Visual approximation is an unreliable method to assess moderate to severe crowding. Brass wire is reliable for moderate crowding, but underestimates severity of severe crowding. As experience of resident increases, time taken to measure crowding decreases.*

Key words: *Arch Length Discrepancy, Guesstimate, Eye-Balling Method, Brass-Wire Technique*

INTRODUCTION

Improving esthetics and function are the major goals of orthodontic treatment. To achieve these, a proper diagnosis is of utmost importance, which is based on the patient's chief complaint, clinical and radiographic examination, supplemented by photographs and plaster models[1]. Plaster models permit three dimensional evaluation of teeth, allowing better judgement of the severity of tooth malpositions[2]. "Space available" is the basal region of the jaw available for teeth, whereas "space required" is equal to the sum of mesiodistal widths of all teeth mesial to first molar[3]. If space available for teeth is less than space required by them in an arch, it indicates an arch length discrepancy (ALD) and is called crowding[2]. It results in overlapping and rotations of teeth[3]. Although manual methods of measuring ALD are shown to be just as accurate as digital cast scanning,[4,5] measuring it manually with gauges is tiring and time consuming, and increases the chances of error[2]. Yet, ALD is a critical component of treatment planning, as it guides the need for tooth extractions

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and overall mechanics[6]. Thus, orthodontists have always been searching for an easy and accurate way of estimating ALD.

Visual approximation, also called eye balling and guesstimation, is the easiest and most widely used method amongst practitioners for calculating ALD[1]. But studies show that it tends to overestimate crowding[1]. Other techniques for calculating ALD include brass wire method, Vernier caliper method and computer aided methods[7]. In brass wire method, a brass wire is used to measure space available and tooth widths are measured by a gauge.

This study will show whether the visual approximation and brass wire method give similar results for assessing crowding, which is a critical component of treatment planning, as it guides the need for tooth extractions[6].

This study aims to compare the accuracy of visual approximation method and brass wire method when assessing moderate and severe crowding. The secondary objective is to compare the time taken by two groups of residents in calculating crowding while using the two methods. The assumptions are that the two methods are equally accurate at assessing crowding, and the experience level of the resident does not increase the efficiency in calculating crowding.

MATERIALS AND METHODS

This cross sectional study was conducted in Orthodontics Department of Khyber College of Dentistry from September to November, 2020, after obtaining ethical approval form the hospital.

By using OpenEpi, total calculated sample size was 32 by mesio-distal width of right premolar in upper arch (6.6mm ± 0.4) and lower arch (7.0mm ± 0.4) by using plaster model, while keeping 95% confidence interval and 80% power of test[1].

Thirty two orthodontic residents were employed using non-probability consecutive sampling.

Two plaster models were used which had all teeth well-erupted, with no anatomical defect, no missing tooth and no bubbles or voids. Model 1 had moderate crowding (between 4-7mm) and Model 2 had severe crowding (8mm and greater). To standardize the ALD of the casts, five faculty members calculated the ALD of both models using the brass wire method and the measurement on which majority agreed was set as the standard measurement.

For the brass wire method, plaster models, brass wire, 150 mm scale, stop watch, pencil and eraser was used. To calculate the mesiodistal widths of teeth, 20mm measuring gauge was used.

For the eye-balling method, plaster models, stop watch, pencil and eraser was used.

First, model 1 was given to a participant and they were asked to perform the visual approximation method. After they were done, they were asked to perform the brass wire method on the same model. Both procedures were timed by the examiner using a stop watch. The procedure was repeated on model 2. SPSS version 22 was used for data analysis. The number of correct and incorrect estimates are shown as frequency and percentage. Estimated values are shown as mean with its standard deviation. One sam-

Table 1: Accuracy of Visual approximation method when assessing different severity of crowding

Crowding Severity	Visual Approximation						
	Participants who estimated correctly	%	Participants who estimated incorrectly	%	Mean (mm)	SD	P value
Moderate	11	34	21	66	6.56	1.43	<.001*
Severe	4	12.5	28	87.5	8.62	1.82	<.001*

%=Rounded off Percentage, SD= Standard Deviation, *=statistically significant.

Table 2: Accuracy of Brass wire method when assessing different severity of crowding.

Crowding Severity	Brass Wire Method						
	Participants who estimated correctly	%	Participants who estimated incorrectly	%	Mean (mm)	SD	P value
Moderate	19	59	13	41	4.78	2.87	.583
Severe	13	41	19	59	9.40	2.15	<.001*

%= Percentage, SD= Standard Deviation, *=statistically significant.

ple t test was used to compare the estimated crowding mean with the standard measurement.

For the secondary objective, the participants were divided into two groups. Group A had 16 residents of first year and second year. Group B had 16 residents of third year and fourth year. The results were assorted according to the grouping. Independent-samples t test was applied to check the difference in time taken by group A and group B in assessing crowding using the two methods.

RESULT

The mean age of the participants was 24.91 years ± 1.46, ranging from 23 to 29 years. There were 3 males and 29 females.

When assessing moderate crowding, the brass wire method had a higher rate of correct estimation compared to visual approximation method for the same plaster model. Most participants over-estimated crowding using the visual estimation method. Whereas, in brass wire methods, most participants correctly estimated crowding. (Table 1 and 2).

When assessing severe crowding, the brass wire method was better at estimation than the visual approximation method, which gave very low results for correct estimation, although both did not exceed a 50% correct estimation rate. In both methods, the mean was less than the actual values, and most participants underestimated crowding. (Table 1 and 2).

One sample t test showed that there was a significant difference between actual crowding and estimated measurement when measuring severe crowding using both methods, with p value <.05 (Table 1 and 2). Whereas for moderate crowding, there was a significant difference between actual and estimated measurement using the visual method (p<.05). The brass wire gave results consistent with the actual crowding (p=.583).

For visual approximation, when assessing moderate crowding, almost equal number of participants form both groups correctly estimated crowding. Similarly, when assessing severe crowding, only 2 participants form both groups correctly calculated crowding. (Table 3).

Table 3: Frequency of correct estimation of crowding using two different methods among the two groups

Method	Crowding severity	Group	N	Participants who estimated correctly	%	Participants who estimated incorrectly	%
Visual Approximation Method	Moderate	Group A	16	5	31	11	69
		Group B	16	6	37.5	10	62.5
	Severe	Group A	16	2	12.5	14	87.5
		Group B	16	2	12.5	14	87.5
Brass Wire Method	Moderate	Group A	16	9	56	7	44
		Group B	16	10	62	6	38
	Severe	Group A	16	7	44	9	56
		Group B	16	6	37.5	10	62.5

N= number of participants, %= Percentage

Table 4: Time taken by the two groups in calculating crowding using the two methods

Method	Crowding severity	Group	N	Mean Time (seconds)	SD	P value
Visual Approximation Method	Moderate	Group A	16	25.9	13.4	0.01*
		Group B	16	18.9	11.1	
	Severe	Group A	16	37.2	22.2	0.2
		Group B	16	28.4	17.9	
Brass Wire Method	Moderate	Group A	16	322.5	129.3	0.001*
		Group B	16	180.0	60.0	
	Severe	Group A	16	307.5	75.4	0.01*
		Group B	16	228.7	97.9	

N= Number of participants, SD= Standard Deviation, *=statistically significant.

In visual approximation, for moderate crowding, group B took less time (around 7 seconds) than group A to calculate crowding (p=0.01). Group B also took less time when measuring moderate crowding, but the results were insignificant (p=0.2). (Table 4)

For brass wire method, when assessing moderate crowding, almost half the participants of group A correctly calculated crowding, whereas two thirds of the participants of group B correctly calculated it. Similarly when assessing severe crowding, almost half the participants of group A correctly calculated crowding, whereas one thirds of the participants of group B correctly calculated it. (Table 3)

For brass wire method, group B took significantly less time than group A in measuring moderate crowding (difference of 142 seconds) and severe crowding (difference of 78 seconds), with p value <.05. (Table 4)

DISCUSSION

In our study, when assessing moderate crowding, most participants overestimated it using visual method but calculated the actual value using brass method.

Similarly, Wurm found that for moderate crowding, visual approximation over-estimates crowding[1]. Wallis et al., also found that when assessing moderate crowding using visual approximation, most participants tend to over-estimate the degree of crowding[8].

Contrarily to our findings, Johal et al. found that the brass wire method under-estimates moderate crowding[9].

In our study, when assessing severe crowding, both methods under estimated the degree of crowding. In contrast to our study, Naish et al. found that for severe crowding of 8.4mm, the mean value of estimated crowding was calculated to be 8.5mm ± 2.3 using visual approximation. Also, visual method tended to over-estimate crowding severity[10].

In our study, residents who had more experience took less time to calculate crowding using both methods than those with less experience which shows that with increasing experience, efficiency increases. Although an almost equal number of residents from both groups gave the correct results.

Similarly, Wallis et al. found that operator experience did not affect the accuracy of calculating crowding[8].

In contrast, Wurm et al. concluded that with increasing experience, rate of correct estimation decreased, although residents were better at calculating crowding than practicing orthodontists[1].

The results of our study show that when assessing moderate crowding, the visual approximation method cannot be relied upon, and one must turn to the brass wire method to get accurate results, which may lead to extraction of less teeth in borderline cases[6]. For severe crowding, both methods were unreliable, as has been shown by other studies as well[11].

The limitation of this study is the small sample size and that mild crowding was not assessed. Only two models were used to assess which method is better, rather than using multiple models. Most of the participants were females, so gender roles in measuring ALD could not be assessed. Whether residents would plan arch expansion, enamel stripping, incisor proclamation or extraction with their calculated crowding was not found out.

CONCLUSION

1. Visual approximation method tends to over-estimate crowding when it is moderate.

2. Visual approximation method tends to under-estimate crowding when it is severe.

3. Brass wire method correctly estimates crowding when it is moderate.

4. Brass wire method tends to under-estimate crowding when it is severe.

5. As the experience of the resident increases, the time taken to measure crowding using both methods decreases, but the accuracy does not increase.

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