دراسة كمية التحضير للدعامات التي ستستقبل تيجاناً معدنية- خزفية والمحضرة من قبل طلاب الاختصاص

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الملخص

خلفية البحث وهدفه: إن المبدأ الأساسي في تحضير الأسنان لاستقبال تيجـــان كاملـــة هــو المحافظة على الأنسجة السنية. هدفت هذه الدراسة إلى تحري كمية التحضير للدعامات التي ستستقبل تيجاناً معدنية-خزفية، والمحضرة من قبل طلاب الماجستير فـــي قـــسم التيجــان والجسور، كلية طب الأسنان، جامعة دمشق.

طرائق البحث: جُمِعَ 100 مثال جبسي يحوي على سن محضرة لاستقبال تاج كامل مع وجود نظيرتها السن الطبيعية سليمة. حُسِبَتْ كمية التحضير بقياس أبعاد السن الطبيعية المقابلـــة منقوصاً منها أبعاد السن المحضرة.

النتائج: وجد أن كمية التحضير للأسنان مساوية من الكميات المقترحة في الأدب الطبـــي أو أكبر منها، وبالأخص في البعد الدهليزي اللساني؛ حيث كان متوسط كميات التحضير أكبـــر من الكميات المثالية بنحو 1 ملم.

الاستنتاج: نستنتج أن التحضير الزائد للأسنان هو نتيجة واضحة لهذه الدراسة.

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An Investigation of the Amount of Preparation of Abutments Receiving Metal-Ceramic Crowns by Postgraduate Students

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Abstract

Background and aim: The main principle of tooth preparation to receive full crowns is to preserve tooth structure. The aim of this study is to investigate the amount of preparation of abutments receiving Metal-Ceramic crowns provided by postgraduate (MSc) students at Dental School –Damascus University.

Methods: The data were collected from one hundred dental casts of teeth prepared to receive full crowns with their natural antimeres intact. The study investigated the dimensional characteristics of prepared teeth, in relation to unprepared antimeres.

Results: The mean amounts of tooth preparation were either comparable to or greater than the ideal amounts suggested in the literature. This was especially true of the buccolingual dimension, since the mean amounts of preparation exceeded the ideal amount by nearly 1.00 mm.

Conclusion: It can be concluded that over-preparation was a predominant finding in the course of this study.

Index Words: Overpreparation, Metal-ceramic crown, amount of preparation

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Introduction

Much has been written on preparing teeth for crowns and bridges which points to what is desirable or ideal in terms of tooth reduction. This is often at variance with what is actually achieved in practice. This may result from a variety of factors which determine what is humanly achievable given the individual circumstances operating in each particular situation.

It is considered, when one or more teeth are being restored, that the clinician should seek to duplicate the conditions and aesthetics of the remaining dentition[1]. However, this depends on the conditions of the remaining teeth and on patient's opinion.

Many investigators have demonstrated in their study that teeth are symmetrical in their mesiodistal and buccolingual dimensions [2-4].

The British Society for Restorative Dentistry[5] (1999) has outlined the principal considerations in tooth preparation as follows: (1) Conservation of tooth tissue. (2) Control of the path of insertion. (3) Optimum retention and resistance form. (4) Appropriate clearance in occlusion and articulation. (5) The removal of adequate tooth tissue to allow the manufacture of restorations with appropriate cosmetic results without the over-contouring of the finished restoration. Smith[6] stated that buccal and incisal reduction should be sufficient to enhance the appearance. (6) The retention of basic occlusal and axio-occlusal form. (7) The need for well-defined margins of appropriate design, wherever possible on supragingival sound tooth tissue. (8) Preservation of the periodontium: this concept can be best served by smooth margins that are exposed to a cleansing action[7]. (9) Damage limitation through the use of atraumatic techniques.

Tooth preparation for metal-ceramic crowns

A reduction of approximately 1.2 mm is needed on the facial surface. If facial reduction is less than 1.2 mm for a base metal-ceramic crown or 1.4 mm for a noble metal-ceramic crown, the crown will be either opaque or over-contoured[8]. The lingual surface should be reduced by minimum amount of 0.7 mm. Those portions of the lingual surface that will have a ceramic veneer should have 1.0 mm of clearance[9].

If posterior teeth to be crowned and in the areas where there will be ceramic coverage, reduction should be 1.5 mm to 2.0 mm. The reduction

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on the functional cusps should be 1.5 mm if the coverage will be metal only, and 2.0 mm if the metal will be veneered with ceramic.

Materials and methods

A sample consisted of 100 (dies) teeth prepared to receive metal-ceramic crowns was taken randomly from a collection of dental casts of work for postgraduate (MSc) students in Fixed Prosthodontics Department, Dental School, Damascus University.

The following data were registered for the natural antimeric teeth:

The buccolingual diameter of the natural antimeric teeth is the greatest distance between the labial/buccal surface and the lingual/palatal surface of the tooth crown. It was measured directly with a sliding calliper (Figure 1), held at right angles to the mesiodistal crown diameter of the tooth.

The mesiodistal diameter of the natural antimeric teeth is taken as the greatest distance between the approximal surfaces of the crown. In this study it was measured with a customised sliding calliper, in which the tips had been precision machined. This instrument was held parallel to the occlusal and vestibular surfaces of the crown (Figure 2).

The following data were registered for the prepared crowns:

• The mesiodistal dimension (MD) i.e. the minimum distance between the mesial and distal surfaces of the prepared crown. It was measured with the modified calliper held parallel to the occlusal and vestibular surfaces of the prepared crown (Figure 3).

• The buccolingual dimension (BL) i.e. the minimum distance between the labial/buccal surface and the lingual/palatal surfaces of the prepared crown. It was measured directly with a sliding calliper held at right angles to the mesiodistal crown diameter of the prepared crown (Figure 4).

The same investigator recorded the measurements. Calibration for zero was checked after each reading.

Only one prepared tooth per patient was studied. Prepared crowns, were included in the study only if their antimeres were natural sound teeth.

The amounts of tooth preparation in the studied dimensions were calculated as follows:

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· The amount of preparation in MD dimension = MD dimension of antimere –MD dimension of prepared crown.

· The amount of preparation in BL dimension = BL dimension of antimere –BL dimension of prepared crown.

Results

Measurement error was assessed by duplicate measurements of 20 sets of dental casts randomly drawn following a one-week interval. The method error was assessed by calculating the standard deviation of a single determination. The mean value for method error was (0.06 mm)

The minimum, maximum, mean, and standard deviation of the amount of tooth preparation in the mesiodistal and buccolingual dimensions are presented in Table (1).

A comparison in the mean amount of tooth preparation between the mesiodistal the buccolingual dimensions was carried out using paired sample t-test. The results are presented in Table (2).

It can be noticed from Table (1) that the mean amount of tooth preparation in the buccolingual dimension is significantly higher than the amount prepared in the mesiodistal dimension.

The teeth were categorised according to their position in the dental arch. It was found that the mean amount of tooth preparation in the mesiodistal dimension is only significantly higher in the upper molar area than any other position in the dental arch (Table 3). There was no statistically significant difference between the remaining groups.

Discussion

Many investigators have previously used the method utilised in this study for measuring tooth size [3,10,11].

The method error value of the study (0.06 mm) was found to be smaller or comparable with those reported by previous investigators. The corresponding mean values reported by previous investigators were 0.07 mm[3] and 0.09 mm [10].

Antimeric teeth are symmetrical in Mesiodistal dimension [4,11], except the lower first molar [3]. Antimeric teeth are also symmetrical in BL diameter [4,12].

As no significant difference between antimeric teeth in the dental arch in the MD and BL, this made it possible to estimate the original dimensions

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of teeth already prepared to receive full crown restorations, by measuring the antimeric natural teeth in the same arch.

The amount of tooth preparation

The amount of tooth preparation calculated in this study in the MD dimension is a combination of the amount of preparation in the mesial surface added to the amount of preparation in the distal surface. Similarly, the amount of tooth preparation in the BL dimension is a combination of the amount of preparation in the buccal surface added to the amount of preparation in the lingual surface.

The statistical analysis of the amount of preparation in the studied dimensions shows that the amount of preparation ranged from relatively very small amount (1.40 mm) in the BL dimension to relatively very large amount of preparation (4.81 mm) in the MD dimension. The small amount of preparation (under-preparation) would lead to an oversize crown restoration in the studied dimension or to a thin layer of restoring material [13,14]. On the other hand, a large amount of preparation would possibly lead to more damage to tooth and pulp. Differing percentages of endodontic complications following tooth preparation have been reported. These ranged from 5.7% [15] to 10% 5 years after cementation of restorations[16]. The frequency of pulpal involvement of abutment teeth was also compared with that of unrestored control teeth 13.3% vs. 0.5%[17] and 15% vs. 3% for teeth treated for advanced periodontal disease[18].

The mean amounts of preparation were compared with the ideal amounts stated in the previous literature (Table 4). The ideal amounts of preparation in the BL dimension were calculated as combination of the amount of preparation of the buccal surface plus the amount of preparation in the lingual surface.

For example the amount of preparation in BL dimension for metal-ceramic full crown in mm was calculated as the following:

1.2 to 1.4 (Buccal surface) + 0.7 to 1.00 (Lingual surface) = 1.9 to 2.4 mm.

It can be seen from Table (3) that the mean amount of preparation in MD dimension is higher than the ideal amount by nearly 0.5 mm (0.3-0.7

mm), whereas the mean amount of preparation in BL dimension exceeded the ideal by nearly 1.0 mm (0.7- 1.2 mm).

In previous literature it was stated that over-preparation at the approximal surface is inevitable if damage to the adjacent teeth is to be avoided[6]. Al-Omari and Al-Wahadni [19] measured the convergence angle, incisal/occlusal clearance, and finish line depth, which indicate the amount of axial reduction of full metal-ceramic crown preparations made by final-year dental students. They found that the mean convergence angle was clinically acceptable. However, shoulder depth was less than the recommended depth of 1.0 to 1.5 mm for metal ceramic crowns. Incisal/occlusal reduction was clinically adequate to provide enough structural durability and color matching.

On the other hand, other authors have found in both in-vitro and in-vivo studies that under-preparation is predominant during tooth preparation.

Under-preparation in the labial shoulder was found in two different studies by Seymour et al. [20,21]. It was predicted also by Dunne[22], in a study that looked into the visual perception of size and distance. He examined the ability of dental undergraduates and practitioners to adjust the gap of callipers to their estimate of various test sizes. When trying to estimate a 1 mm gap, 70% of readings were below this size. If similar errors were repeated during clinical preparation, they would lead to under-preparation. Cassidy and Gutteridge[23] stated tooth reduction is often overestimated by clinicians.

Conclusion

The amount of tooth preparation for full crown restorations was investigated by comparing the dimensions of prepared crowns to their natural antimeres. The mean amounts of tooth preparation found in this study were comparable to or more than the ideal amounts suggested in the previous literature. This was especially presented in the BL direction, since the mean amounts of preparation exceeded the ideal amount by nearly 1.00 mm. It can be concluded that over-preparation was a predominant finding in the course of this study.

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Figure 1 The buccolingual crown diameter measured with a sliding calliper held at right angles to the mesiodistal crown diameter


Figure 2 The sliding calliper with customised jaws to facilitate measurement of the mesiodistal crown diameter
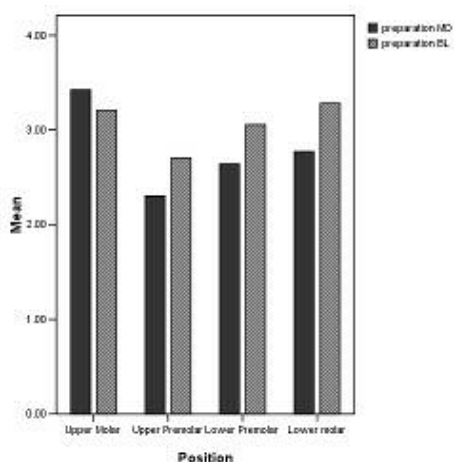

Figure 3 The mesiodistal dimension of the prepared crown measured with the customised calliper held parallel to the occlusal and vestibular surfaces of the crown

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Figure 4 The buccolingual dimension of the prepared crown measured with a sliding calliper held at right angles to the mesiodistal crown diameter
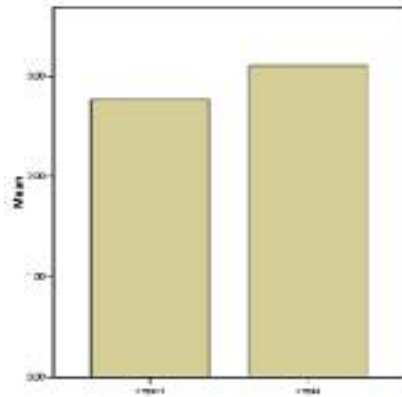
Figure(5) A Diagram Representing A Comparison In The Mean Amount Of Tooth Preparation Between The Mesiodistal And Buccolingual Dimensions

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Figure(6) A diagram representing a comparison in the mean amount of tooth preparation between the mesiodistal and buccolingual dimensions according to the position of the preparation in the dental arch

Table (1) descriptive statistics of the amount of tooth preparation in mesiodistal dimension(prepmd) and in buccolingual dimension (prepbl)

	N	Minimum	Maximum	Mean	Std. Deviation
Prepmd	100	1.50	4.81	2.7627	.82384
Prepbl	100	1.40	4.76	3.1045	.84553
Valid N (listwise)	100				

Table (2) Paired t-test of the amount of tooth preparation between the mesiodistal and buccolingual dimensions.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	prepmd	2.7627	100	.82384	.08238
	prepbl	3.1045	100	.84553	.08455

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	prepmd & prepbl	100	.292	.003

Paired Samples Test

	Paired Differences					t	df	Sig. (2-tailed)
				95% Confidence Interval of the Difference				
	Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1 prepmd - prepbl	-.34180	.99358	.09936	-.53895	-.14465	-3.440	99	.001

Table 3 Statistical comparison between the ideal amounts of preparation and the mean amounts of preparation found in the study

Type	Dimension	N	Mean (Study)	Range (Ideal)
Metal-ceramic	Prep MD	100	2.76	2.0-2.4
	Prep BL	100	3.10	1.9-2.4

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