

Knowledge and awareness of materials, finish line configurations and occlusal tooth reduction for single crowns and FPD among general dental practitioners - A survey

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Abstract

Introduction: With the current trends in the market, various materials are available for single crowns and FPDs. Many general dental practitioners are unaware of the specific preparations that are required for each situation. The aim of this survey was to conduct a survey of the choice of materials, finish line configurations and occlusal reduction for single crowns and fixed partial dentures among general dental practitioners.

Materials and methods: A cross-sectional survey was conducted among 100 general dental practitioners in Chennai in December 2016. The survey instrument was a structured, self-administered multiple choice questionnaire. It comprised of 11 questions in total. All the questionnaires were then compiled and analysed.

Results: The results of the survey show wide variations in the knowledge and awareness of tooth preparation perceived among various general dental practitioners.

Conclusion: These findings suggest the importance in the need for various dental education programs and workshops to be conducted among the fraternity of General dental practitioners.

INTRODUCTION

Replacement of missing natural tooth/ teeth has always been a part of standard dental care provided by the general dental practitioners. Over centuries, various materials and extraordinary methods were attempted to replace the missing natural teeth. Initially, with the use of pivots, replacement crowns were made from bone, ivory, animal teeth, and sound natural tooth crowns. These natural substances gradually were replaced by porcelain. Porcelain, which was introduced into dental field in the year 1789 revolutionised the dental restorations by fixed prosthesis. With the advancements in ceramics over the last couple of decades, aesthetics was improved, the number of tooth fractures associated with combined crown-post restorations was reduced, impingement on soft tissue was lessened. In addition, the clinical procedures are less painful to the patient and less fatiguing to the General dental practitioners with the modernisation of dental armamentarium. [1] Here is a brief history of the evolution of materials being used and the tooth preparation being performed for crowns and FPDs.

Pierre Fauchard in 1747, elaborated the technique by which roots of maxillary anterior teeth were chosen for the restoration of single teeth and replacement of multiple teeth. Pivots (posts) made of gold or silver were retained in the roots by a heat-softened adhesive known as "mastic". Crowns were attached to these pivots. [2]

Adam Anton Brunner in 1766, described a process of applying pivot teeth by screwing the pivot into the base of

a crown, followed by enlargement of the root canal enough to snugly surround the root portion of the pivot. [3] Early "pivot" crowns in the United States of America used seasoned white hickory wood for pivots. [4] The wood would swell due to moisture and the pivot would get stained. Subsequently, pivot crowns were made using a combination of wood and metal and then durable all-metal pivots. Retention between metal and pivot was achieved with surface roughening, pins, split designs and threads that offered mechanical spring retention. [3]

With the use of pivots, replacement crowns were made from animal teeth, bone, ivory, and sound natural tooth crowns. These natural materials gradually were replaced by porcelain. Porcelain pivot crowns were described in 1802 by Dubois de Chemant and became the most opted choice. [3]

Clinical tooth preparations for pivot crowns stressed on removal of residual coronal tooth structure with files, saw blades, and excising forceps, followed by creation of post spaces with broaches, spiral drills, or burs. [3,4]

At the time when Charles Henry Land formulated his technique for fabrication of porcelain crowns, a change was needed in the guidelines for tooth reduction because coronal tooth structure was preserved for crown retention and the vitality of the pulp was retained. He advocated porcelain jacket crowns because they preserved tooth structure, [5-7] were more aesthetic than pivot crowns, [5] and lowered the number of tooth fractures associated with combined crown-post restorations. [8] He also reported

less impingement on soft tissue. [6,7] He recognised the significance of acceptable marginal fit and indicated that the clinical procedures were not as painful to the patient and as fatiguing to the clinician. [5] Thus, in Land's early publications, [5-10] the biologic, psychological, aesthetic, and mechanical advantages of preserving tooth structure and performing minimal tooth reduction were first described. However, specific details regarding the form of a prepared tooth and written guidelines on tooth reduction were not present in the literature.

During the next few years, myriad aspects of tooth preparation were mentioned in publications. The first feature discussed in detail was finish line configurations. Dr Edward Spalding adopted Dr Land's principles, and they developed the concept of a complete shoulder finish line that gave uniform thickness to all-ceramic crown and enabled platinum foil matrix adaptation. Dr Spalding's 1904 article [11] was the first to explain the all-ceramic crown fabrication process in detail and clearly illustrate a shoulder finish line.

In the 1920s and 1930s, articles were published regarding these relatively new porcelain jacket crowns and the preparation design for the coronal tooth structure. Commendable focus was still directed toward the most suitable finish line. Articles were published describing different variations of shoulder finish lines. [12-15] Shoulder finish lines were promoted because of high restoration strength, [16] porcelain bulk and marginal strength, [14,17] and accuracy in fabrication. [18] Shoulderless tooth preparations with a tapering finish line and were shoulders with a marginal bevel were also advocated. [19]

Based on early dental literature, it was clear that tooth preparations and finish lines important factors affected the clinical longevity of porcelain crowns. [12,16,17,20-22] Yet, different opinions prevailed for the optimal form, and no scientific data were available. Similar conditions existed as different types of restorations and associated tooth preparations were developed in the following years. It was not until the 1950s and 1960s that scientific research began to analyse tooth preparations and identify features that were necessary for success.

Single crowns and fixed dental prosthesis are now available such as: all metal, metal ceramic (porcelain fused to metal) and all ceramic restorations. Each of these type of materials requires specific amount of tooth reduction and finish line configurations. Adequate tooth reduction is mandatory for structural durability of the restoration. Most of the forces acting on the restoration, act directly on the occlusal surface. [23] Inadequate occlusal clearance may lead to a weaker restoration which is prone to fracture or perforation, whereas excessive tooth reduction violates the law of preservation of tooth structure. The finish line configuration is of utmost importance as it provides the marginal integrity for the restoration. Improper finish line configuration may lead to fracture of restoration margins, over contoured restorations, marginal leakage, etc. Nowadays, there are many dental companies providing various solutions for dental restorations. Coupled with this is the ever increasing number of dental graduates every

year. The aim of this survey was to conduct a survey of choice of materials, finish line configurations and amount of occlusal reduction for single crowns and FPD among general dental practitioners.

MATERIALS AND METHODS:

A cross-sectional survey was conducted among general dental practitioners in Chennai in December 2016 after receiving approval from the Review Board of Saveetha Dental College. The study included a random convenience sample comprising of 100 participants. Prosthodontists and Endodontists were excluded from the study. The survey instrument was a structured, self-administered multiple choice questionnaire which comprised of 11 questions in total, regarding number of crown preparations performed in a week, most commonly preferred full coverage restorative material for anterior and posterior teeth, finish line configuration and amount of occlusal reduction for all metal, all ceramic and metal ceramic restorations. All the questionnaires were then compiled and analysed.

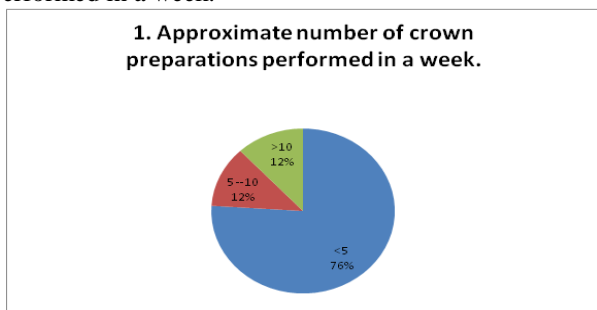
Figure 1. Questionnaire

1. What is the approximate number of crown preparations that you perform in a week?
(A) < 5
(B) 5 - 10
(C) >10
2. Which material is most commonly preferred by patients for anterior teeth?
(A) Metal ceramic
(B) All ceramic
(C) All metal
3. Which material is most commonly preferred by patients for posterior teeth?
(A) Metal ceramic
(B) All ceramic
(C) All metal
4. Which material do you prefer using for anterior teeth?
(A) Metal ceramic
(B) All ceramic
(C) All metal
5. Which material do you prefer using for posterior teeth?
(A) Metal ceramic
(B) All ceramic
(C) All metal
6. Which is your preferred finish line configuration for ALL METAL restorations?
(A) Chamfer
(B) Shoulder
(C) Shoulder with bevel
(D) Knife edge
7. Which is your preferred finish line configuration for ALL CERAMIC restorations?
(A) Chamfer (29%)
(B) Shoulder (54.5%)
(C) Shoulder with bevel (12.5%)
(D) Knife edge (4%)
8. Which is your preferred finish line configuration for METAL CERAMIC restorations?
(A) Chamfer
(B) Shoulder
(C) Shoulder with bevel
(D) Knife edge
9. How much of occlusal reduction do you perform for ALL CERAMIC restorations
(A) 1 mm
(B) 1.5 mm
(C) 2 mm
(D) 2.5 mm
10. How much of occlusal reduction do you perform for ALL METAL restorations?
(A) 0.5 - 1 mm
(B) 1 - 1.5 mm
(C) 1.5 - 2 mm
(D) 2 - 2.5 mm
11. How much of occlusal reduction do you perform for METAL CERAMIC restorations?
(A) 0.5 - 1 mm
(B) 1 - 1.5 mm
(C) 1.5 - 2 mm
(D) 2 - 2.5 mm

RESULTS

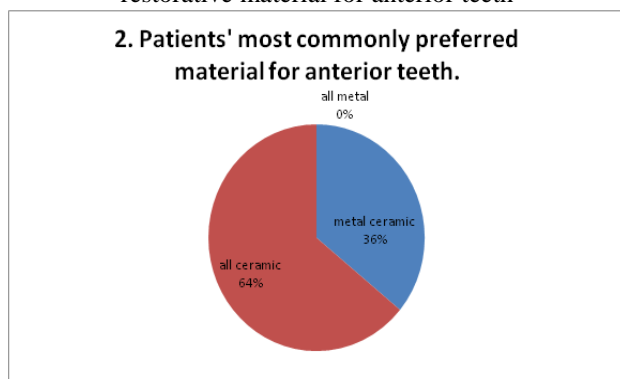
1. When asked for the number of crown preparations performed by the general dental practitioner in a week, 76% of them said "less than 5". (graph 1)

Graph 1: approximate number of crown preparations performed in a week.



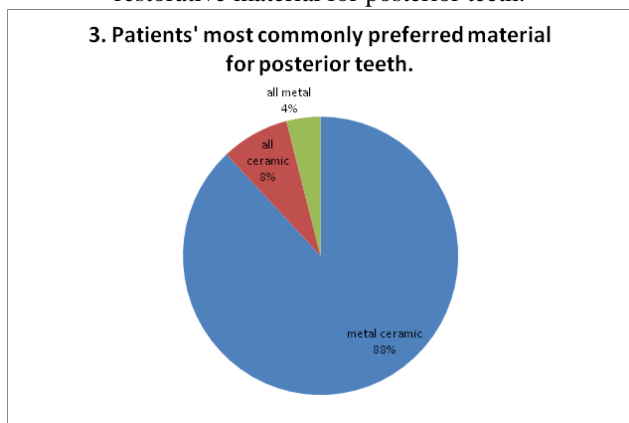
2. When asked for the patient's most commonly preferred full coverage restorative material for anterior teeth, 64% of the practitioners said "all ceramic". (graph 2)

Graph 2: Patient's most commonly preferred full coverage restorative material for anterior teeth



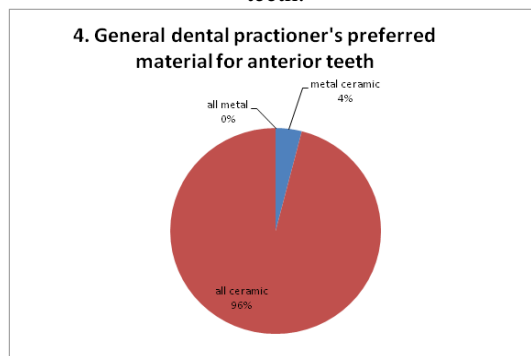
3. When asked for the patient's most commonly preferred full coverage restorative material for posterior teeth, 88% of the practitioners said "metal ceramic". (graph 3)

Graph 3: Patient's most commonly preferred full coverage restorative material for posterior teeth.



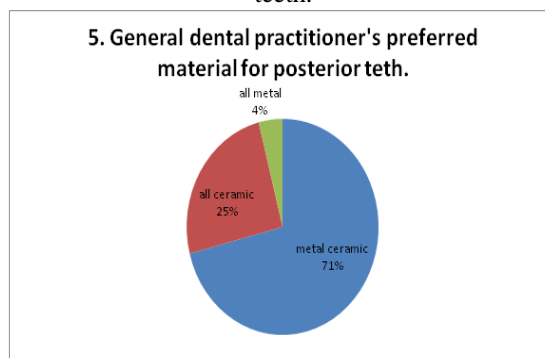
4. When asked for the practitioner's most commonly preferred full coverage restorative material for anterior teeth, 96% of them said "all ceramic". (graph 4)

Graph 4: General dental practitioner's most commonly preferred full coverage restorative material for anterior teeth.



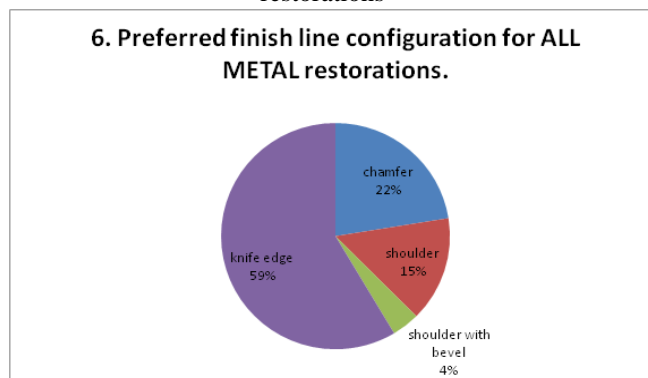
5. When asked for the practitioner's most commonly preferred full coverage restorative material for posterior teeth, 71% of them said "metal ceramic". (graph 5)

Graph 5: General dental practitioner's most commonly preferred full coverage restorative material for posterior teeth.



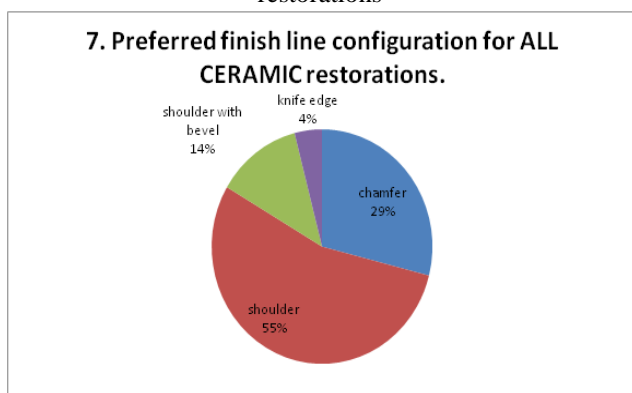
6. When asked for the practitioner's preferred finish line configuration for all metal restorations, 59% of them said "knife edge". (graph 6)

Graph 6: Preferred finish line configuration for all metal restorations



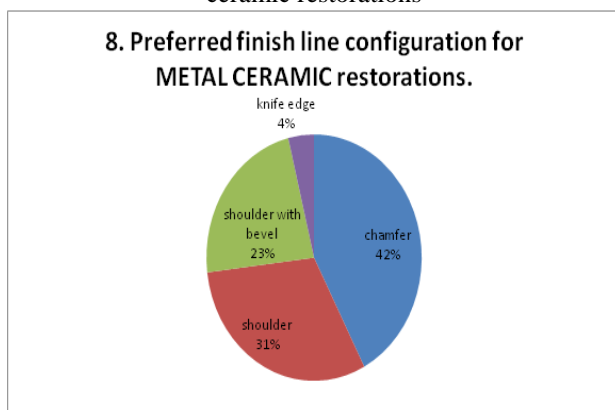
7. When asked for the practitioner’s preferred finish line configuration for all ceramic restorations, 55% of them said “shoulder”. (graph 7)

Graph 7: Preferred finish line configuration for all ceramic restorations



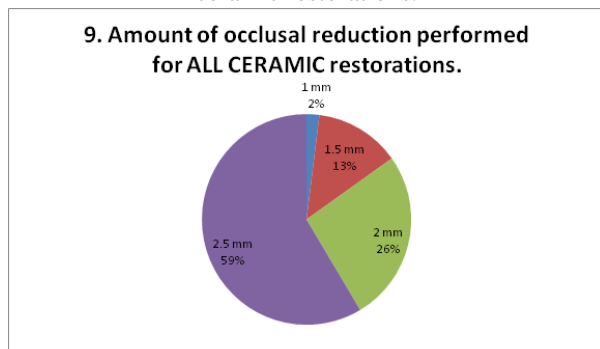
8. When asked for the practitioner’s preferred finish line configuration for metal ceramic restorations, 42% of them said “chamfer”. (graph 8)

Graph 8: Preferred finish line configuration for metal ceramic restorations



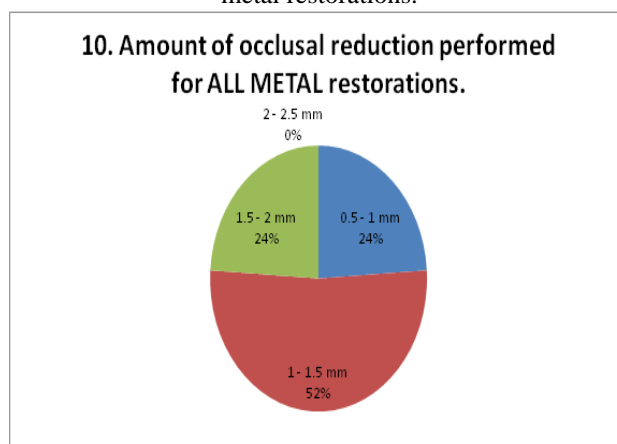
9. When asked for the amount of occlusal reduction performed by practitioners for all ceramic restorations, 59% of them said “2.5 mm”. (graph 9)

Graph 9: Amount of occlusal reduction performed for all ceramic restorations.



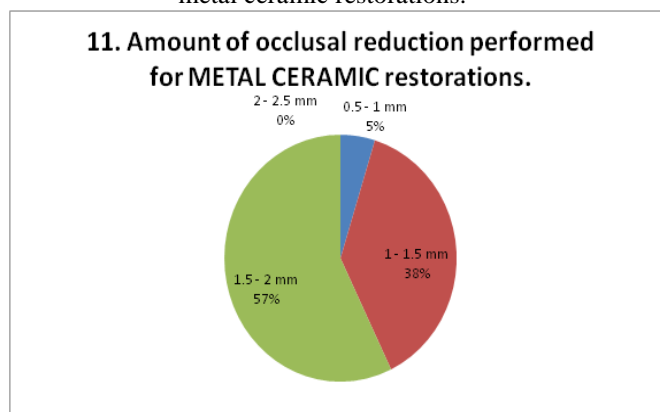
10. When asked for the amount of occlusal reduction performed by practitioners for all metal restorations, 52% of them said “1-1.5 mm”. (graph 10)

Graph 10: Amount of occlusal reduction performed for all metal restorations.



11. When asked for the amount of occlusal reduction performed by practitioners for metal ceramic restorations, 57% of them said “1.5-2 mm”. (graph 11)

Graph 11: Amount of occlusal reduction performed for metal ceramic restorations.



DISCUSSION

In our study, majority of the study participants preferred “all ceramic” restorations for anterior teeth and “metal ceramic” for posterior teeth. The results were similar to those in a study by Sonia K. Makhija. Porcelain-fused-to-metal (PFM) has been used for many years and studied extensively. Studies have demonstrated a 94% success rate over a 10-year period [24] and good long- term clinical reliability [25]. Although chipping of veneering porcelain is a possible complication, fracture of the metal framework is uncommon [26]. Metal crowns are among the strongest options, although their major disadvantage is poor aesthetics. All-metal restorations are often considered the gold standard in dentistry due to their excellent biocompatibility and strength. However, the increasing price of precious metals and patients’ demands for aesthetics have reduced the use of both metal-ceramic and full metal restorations [27],

The results of the study Sonia K Makhija, also shows a high prevalence of use of ceramic crowns compared to metal-based crowns. These results are in contrast to a study from about 30 years ago which reported a higher selection rate of PFM crowns (55% of Swiss and 56% of Canadian dentists) and metal crowns (17% of Swiss and 35% of Canadian dentists) than porcelain jacket crowns (1% of Swiss and 2% of Canadian dentists). [28]. The shift in material choice from metal ceramic could be due to significant improvements in dental ceramics, patient demands for aesthetic ceramics, and the high cost of fabrication of metal-based crowns. The study results also show that material choice for single-unit crowns is associated with factors other than the clinical presentation of a patient. Generally, these associations are related to practice type, years since graduation, insurance, and practice busyness.

Regarding the interpretation of years since graduation, the dentist may either have developed preferences for restorative material by gaining exposure to materials in dental school or learning from clinical experience while in practice. Differences in materials selection by practice type may be related to the financial responsibility of the dentist or employer to pay the laboratory costs. For most dental laboratories, all-zirconia or all-lithium disilicate restorations can be offered at a lower price than layered restorations due to the easier fabrication process. Additionally, the price of noble or high-noble PFM restorations will be affected by the price of the precious metals present in the metal coping, which is often more expensive than the cost of purchasing ceramic materials. Likely the group of dentists who would be most directly impacted by the laboratory cost of their materials would be private practice owners. Practice busyness was also shown to correlate with material selection. The busiest dentists also preferred full metal and PFM posterior crowns, which may also be related to perceived ease of use. Tooth preparation is simplified because minimal tooth reduction is required if metal is used for the occlusal surface. Adjustment and polishing of metal restorations is also quicker and more forgiving than adjusting or polishing ceramic. [29]

“Chamfer” finish lines have been used often for “all-metal crowns.” But in our survey, majority of the study participants’ preferred finish line configuration for all metal restorations was “knife edge”. No scientific studies have stated the superiority of chamfer over other finish lines. However, they are used with all-metal crowns because they are easy to form with a tapered, round-end diamond instrument and because they are distinct, being readily visible on the prepared tooth, impression, and die. Chamfers also possess adequate bulk for restorative rigidity, and their depth is sufficient to permit the development of normal axial contours. Therefore, chamfer finish lines are suitable for all-metal crowns. Shoulder finish lines are recommended for “all-ceramic crowns” that are not etched and bonded to the teeth. Either shoulder or chamfer finish lines can be chosen for all-ceramic crowns bonded to prepared teeth. [1] In our study, majority of the participants’ preferred finish line

configuration for all ceramic restorations was “shoulder”. The following types of finish lines historically have been used with “metal-ceramic crowns”: chamfer, bevelled chamfer, shoulder, and bevelled shoulder. In our survey, majority of the study participants’ preferred finish line configuration for metal ceramic restorations was “chamfer”. Byrne collaborated the data relative to the effect of cementation and determined that finish line form did not affect the fit of cemented crowns. [30] On the basis of the previously discussed studies, it can be concluded that the selection of finish lines used with metal-ceramic crowns should not be based on marginal fit but on personal preference, aesthetics, ease of formation, and the type of metal-ceramic crown (metal marginal collar vs collarless design) being fabricated. In a survey conducted by Srilekha among working dental students in Chennai, the awareness of types of finish line for tooth preparation was found to be satisfactory. [31]

It is proposed that “all ceramic” restorations, incisal/occlusal surfaces be reduced “2 mm” because that depth permits the development of normal morphology and has been identified as a safe and reasonable amount to remove from teeth. [1] According to majority of the participants in our study, the amount of occlusal reduction performed by practitioners was “2.5 mm”. Incisal/occlusal reductions of “2.0 to 2.5 mm” have been recommended for “metal ceramic” restorations [32] According to our study, the amount of occlusal reduction performed by practitioners, was “1.5-2 mm”. For “all metal” restorations, the occlusal surface should be reduced at least “1 mm”. [1] According to our study, the amount of occlusal reduction performed by practitioners was “1-1.5 mm”.

This study does have certain limitations, and conclusions should consider these issues. This study relied on questionnaire information rather than direct observation of procedures; therefore, the inferences made are based on responses from this questionnaire. Additionally, the response rate was very good, but it is possible that non-respondents would have reported different behaviour.

CONCLUSION

The results of the survey show wide variations in the knowledge and awareness of tooth preparation perceived among various general dental practitioners. The results of this survey also suggests the importance in the need for various dental education programs and workshops to be conducted among the fraternity of General dental practitioners.

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