

Evaluation of Preformed Stainless Steel Crown's Crazing by Various Sterilization Methods of Steam Autoclave: A Pilot Study

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ABSTRACT

Aim: To evaluate the crazing of preformed stainless steel crowns by two different temperatures of autoclave sterilization.

Materials and Method: 15 stainless steel crowns (3M ESP) were divided into 3 groups namely Group 1(G1) which was taken as control, Group 2(G2) which underwent Steam autoclaving at 121°C, 15psi pressure for 20 minutes and Group 3(G3) which underwent Steam autoclaving at 132°C, 30psi pressure for 8 min. The changes on the vestibular surface were then scored for presence or absence of crazing by using stereomicroscopy. The data was then analysed.

Results: In control group the surface was relatively smooth when observed under stereomicroscope. However, in Group 2 cracks involving one-third to one-half of the surface were seen under stereomicroscope. Similar results were obtained in Group 3.

Conclusion: Technique of steam autoclaving of sterilization has harmful effect on the surface of stainless steel crowns.

Keywords: Clinical competence, Dental crowns, Pediatric dentistry.

INTRODUCTION

Prevention and control of dental caries especially in children is the ongoing dilemma for the dentists. There are numerous restorative materials and techniques mentioned in the literature for prevention of dental caries. One of the major drawbacks of such treatment is the cooperation of the child which can be pitiable, and often these procedures can be time consuming. To overcome



these problems to a major extent, stainless steel crowns come to play their part to major extent¹. The stainless steel crown is a precious and indispensable element of the pedodontist's armamentarium and is in no way the substandard restoration that various practitioners, inexperienced in its use, would have us believe². It is popularized because of number of advantages like it is durable, inexpensive, easily and quickly placed. The crowns are manufactured in different sizes as a metal shell with some preformed anatomy and are trimmed and contoured as necessary to fit individual teeth³.

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In dentistry, maintenance of proper sterilization and disinfection is an essential part of dental excellence. The most common and effective method of sterilization is the steam under pressure accepted by most of the dental practitioners⁴. During the crown fitting procedure, the tooth is prepared by reducing the occlusal and interproximal surfaces. The selected crown may not fit completely to the prepared tooth which necessitates the try-in of the different sized crowns by trial and error method to achieve the desired fit⁵. During trial fitting, the redundant crowns tainted with blood and saliva should be sterilized prior to their use in another patients as they may risk the threat of infections like HBV, HCV and HIV⁶. Usually as per the manufacturer's directions who propose cold sterilization only, the amount of microbial killing cannot be confirmed by this process. But subjective reports show that many clinicians are unaware of this recommendation of cold sterilization so they use sterilization by heat⁷. Till date there are few studies which reported the effect of sterilization methods on the vestibular surfaces of stainless steel crowns^{8,5}. The aim of the present study was to evaluate the Stainless steel crown's crazing by two sterilization methods: 121°C, at 15psi pressure for 20 minutes and 132°C at 30psi for 8 minutes followed by examination of vestibular surface of stainless steel crowns under stereomicroscope.

MATERIAL AND METHODS

For this study, a total sample of 15 stainless steel crowns (3M ESPE) was taken. They were divided into three equal sized groups of 5 samples in each group namely G1, G2, and G3.

- G1-in which no sterilization/disinfection, control group,
- G2-Autoclaving at 121°C, 15 psi pressure for 20 minutes and
- G3- Autoclaving at 132 °C, 30 psi pressure for 8 minutes.

Group 1 was examined firstly with an explorer and it was subjected to 40X stereomicroscope (Laica) evaluation. Group 2 was examined initially with an explorer followed by sterilization and evaluation under 40X stereomicroscope (Laica). Similarly, Group 3 was examined at the start with an explorer followed by sterilization and evaluation under 40X

stereomicroscope (Laica). For microscopic examination, vestibular surface of each crown from the group was examined from occlusal to cervical portion of the stainless steel crowns. In the all 15 stainless steel crowns, crazing was evaluated using the criteria of Wickersham 1998⁸ (Table 1).

Table 1: Evaluation of crazing by the criteria of Wickersham 1998⁸.

Score	Crazing criteria
1	A few isolated cracks involving less than one-third of the surface
2	Cracks involving one-third to one-half of the surface
3	cracks involving greater than one-half of the surface

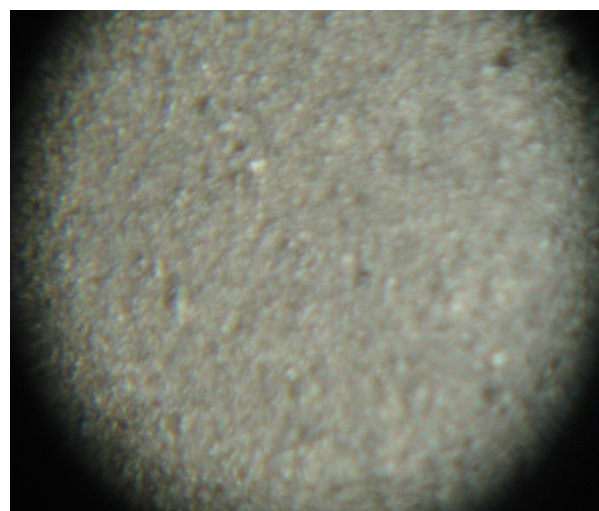


Fig 1: Examination of group I under stereomicroscope 40X for crazing.

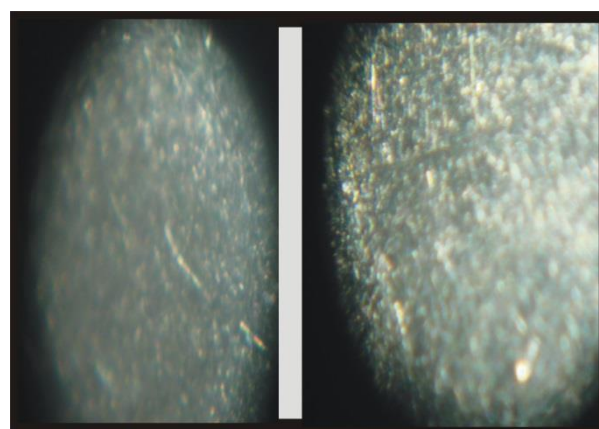


Fig 2: Examination of group II and group 3 under stereomicroscope 40X for crazing.

RESULTS

No noticeable crazing was observed in any of the group when examined with naked eye. In control group (G1), the surface of the crown was relatively smooth with few isolated cracks when examined under stereomicroscope (Figure 1) so, G1 group got the score 1. Whereas, in both G2 and G3 the one third to one half of the surface were involved by crazing when examined under stereomicroscope (Figures 2 and 3). Therefore G2 and G3 got the score 2 (Table 1 and 2).

Table 2: Mean of the crazing score of the three different groups

	Group 1 (n=100%)	Group 2 (n=100%)	Group 3 (n=100%)
Crazing (mean)	1	2	2

DISCUSSION

The stainless steel crown, formerly known as a chrome steel crown was introduced by Humphry in 1950. It later on proved a boon to the pediatric dentistry due to its unique composition. It contains chromium, nickel, iron and minor elements like Manganese, silicon & carbon (<2%). They are a kind of prefabricated crowns that are adapted on the individual tooth and luted with cement⁹.

The use of the stainless steel crown was begun in 1950 when Humphrey¹⁰ and Engel¹¹ tried it for badly broken teeth and for space maintenance. They have innumerable application in dentistry especially in pediatric dentistry like restoration of primary or young permanent teeth with extensive carious lesions, restoration of hypoplastic defects, following pulpectomy of pulpotomy procedures, as an abutment for space maintainers etc, utilize the stainless steel crown³.

Certain procedures like tooth preparation and selection of stainless steel crowns must be followed before cementing the crown. The crown selection is done by two methods: by measuring the mesio-distal width of the tooth and by trial and error method. In trial and error method, the superfluous crowns must be sterilized before trying in another patient. According to the universal precaution of sterilization to rule out the cross

infection control, all patients are considered as if they are infectious. In comparison with the adults, children are more prone to diseases and may exhibit prolonged transmission¹². If the crown is used devoid of sterilization in another patient it may lead to risk of various infections especially in the patient like HIV, HBV and HCV⁷.

This study investigated the changes in vestibular surface (crazing) following two different sterilization methods which are in association with studies done by Yilmaz Y, Guler C⁵. The surfaces of all dental restoration and prosthesis should be smooth otherwise it may lead to accumulation of plaque which subsequently irritates the gingiva¹³. Furthermore, the fracture resistance of such crowns are decreased, that should also not be ruled out as stated by Wickersham et al in 1998⁸.

The manufacturer's instruction recommends cold sterilization. But the amount of microbial elimination cannot be justified by this method⁷. Sterilization methods using the autoclave caused surface changes of the stainless steel crown when examined by stereomicroscopy. This crazing may be due to higher temperature and pressure during sterilization process. And also, in both the experimental groups, the extent of crazing found was similar regardless of temperature of sterilization.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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