

# Reliability of Glass Bead Sterilization for Tried-in Orthodontic Bands

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## ABSTRACT

**Objective:** To evaluate the efficacy of two methods of sterilization for the decontamination of tried-in orthodontic bands after initial cleaning procedures.

**Materials and methods:** A total of 68 molar bands were tried-in mouth of 17 patients. After try-in, 60 bands were cleaned in ultrasonic cleaning bath and then were equally divided into two groups (n = 30). Bands from group 1 were autoclaved in benchtop autoclave. Bands from group 2 were sterilized in glass bead sterilizer. After sterilization, the bands from both the groups were incubated in 50 ml brain heart infusion (BHI) broth. Eight remaining bands were neither cleaned nor sterilized. They served as positive control and were directly incubated in BHI broth. One bottle of BHI broth which did not contain any orthodontic band, served as negative control was incubated. Incubation of BHI broth for all the groups was done at 37°C for 5 days. After 5 days of incubation, BHI broth samples from all the groups were taken and incubated in blood agar culture medium.

**Results:** All the groups except the positive control group did not show any turbidity in the BHI broth and growth in blood agar culture media. The broth containing positive control group had increase turbidity after 5 days and growth of gram-positive cocci in blood agar culture media.

**Conclusion:** Glass bead sterilization is equally effective as benchtop autoclave for sterilization of orthodontic bands.

**Keywords:** Glass bead, Sterilization, Orthodontic bands.

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## INTRODUCTION

In present clinical practice, preformed molar bands are commonly used as one of the time-saving procedure rather than conventional band pinching. The wide use of these bands has also made the reuse of tried-in bands common, try-in is often required for the selection of a proper fitting band. Hence, the chances of cross contamination with these bands are very high as the design of these bands presents a significant potential for contamination by saliva and even blood.

Studies by Lowe et al<sup>1,2</sup> demonstrated that following decontamination of Siqveland matrix bands in the dental surgery, there was a high level of residual contamination. The presence of residual restorative materials and dental cements may compromise the subsequent decontamination process.

According to the recommendations by British Dental Association,<sup>3</sup> there are three stages of the decontamination

process of dental instruments. These are presterilization cleaning, sterilization and storage. Presterilization cleaning can be done as hand cleaning or by ultrasonic cleaners which should be used and serviced according to the manufacturer's instructions and should contain a detergent not a disinfectant—disinfectant solutions alone can precipitate proteins and make them resistant to removal.

Recent studies by Benson and Douglas<sup>4</sup> have shown that ultrasonic cleaning for 15 minutes reduces, but does not eliminate, detectable salivary proteins (amylase) from tried-in bands.

George S Payne and Santa Rosa<sup>5</sup> suggested that bands and brackets should be removed from boxes with cotton forceps. Those that have been tried for fit and rejected bands should be sterilized in glutaraldehyde.

Fulford MR, Ireland AJ and Main BG<sup>6</sup> suggested that the decontamination of orthodontic bands contaminated with oral secretions is safely achieved using an enzymatic cleaning agent and a benchtop steam sterilizer.

The use of a glass bead sterilizer to sterilize orthodontic bands was proposed by Gerald E Smith.<sup>7</sup> He compared this technique with other means of disinfection. He recommended that one minute be used to sterilize single bands in a 226°C bead sterilizer.

Hohlt Miller, et al<sup>8</sup> determined the effectiveness of three methods; standard steam, chemical vapor or dry-heat sterilizing cycles for the decontamination of orthodontic instruments and bands contaminated with blood or saliva and bacterial spores.

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He concluded that the residual spores on the instruments and bands after ultrasonic cleaning and rinsing had indeed been killed in all cases and the three types of sterilization were equally effective.

The aim of the present study was to evaluate the efficacy of two methods of sterilization for the decontamination of tried-in orthodontic bands after initial cleaning procedures.

## MATERIALS AND METHODS

The sample consisted of 68 autoclaved stainless steel first molar bands that were tried-in the mouths of 17 patients. The inclusion criteria ascertained for the study were the patients requiring fixed mechanotherapy in both upper and lower jaws.

All the patients selected had undergone thorough oral prophylaxis at the beginning of the study. The separator modules were inserted and kept till adequate separation was achieved. Thereafter, the bands were tried-in. Each patient contributed four molar bands, i.e. two maxillary and two mandibular from all four quadrants. Out of the bands collected, 60 bands were cleaned thoroughly in ultrasonic cleaning bath (Dentaurum USG 4000 Ultraschall) for 15 minutes. Thereafter, all the bands were dried by oil and moisture-free compressed air and 60 bands were divided into two equal groups ( $n = 30$ ) in such a way that each group received 15 maxillary and 15 mandibular molar bands. The two groups selected underwent the following treatment.

**Group 1: The bands sterilized in an autoclave.** The bands were picked up aseptically by sterile cotton-holding pliers and kept in special pouch (Rup's RSSP100-250 self-seal pouch) (Fig. 1), with 10 bands in each pouch. Each pouch was autoclaved in a benchtop autoclave (Newclave Autohouse AD 7) at program 2 (134°C for 18 minutes at 15 psi pressure).

Thereafter, the pouches were opened and the bands were picked up aseptically by sterile cotton-holding pliers and placed in 50 ml of freshly prepared BHI (brain heart infusion) broth (HiMedia Laboratories) (Fig. 2). The broth was prepared in the department of microbiology of the same institution as per manufacturer's instructions.

**Group 2: The bands sterilized in a glass bead sterilizer.** Five bands at a time were kept at the periphery and 40 mm deep in the well of glass bead sterilizer (Ortho Organizers Inc. BS 300/220 V) for 90 seconds after the sterilizer is ready with maximum temperature recorded being 220°C. The bands were kept at a distance of approximately 5 to 6 mm from each other. Thereafter, each band was picked up aseptically by sterile cotton-holding pliers and was placed in 50 ml of BHI broth.

Thereafter, the bands from both groups were incubated in the BHI broth at 37°C for 5 days.

Eight remaining bands, four maxillary and four mandibular, were neither cleaned nor sterilized. They were directly incubated in BHI broth at 37°C for 5 days. This group served as positive control.



Fig. 1: Bands kept in pouches before autoclave



Fig. 2: Bands kept in BHI (brain-heart infusion) broth

One bottle of BHI broth containing no bands was also incubated in the same way as mentioned above, to serve as a negative control.

The BHI broth used in the study contained calf brain infusion 200 gm/l, beef heart 250 gm/l, proteose peptone 10 gm/l, dextrose 2 gm/l, sodium chloride 5 gm/l, disodium phosphate 2.50 gm/l, final pH (at 25°C)  $7.4 \pm 0.2$ .

After 5 days of incubation in BHI broth, the sample of broth from all the bottles was collected and incubated separately in blood agar culture medium to see the presence of any growth.

## RESULTS

BHI broth containing bands from both the groups and the negative control had shown no turbidity even after 5 days of incubation at 37°C (Fig. 3).

The positive control group had shown both turbidity in the broth and growth of gram-positive cocci in blood agar culture (Fig. 4).

The results of the study are summarized in Tables 1 and 2.

## DISCUSSION

According to CDC guidelines,<sup>9</sup> sterilization is defined as a process that destroys or eliminates all forms of microbial life and is carried out in health care facilities by physical or chemical



Fig. 3: Blood agar culture media showing no growth in both groups 1 and 2



Fig. 4: Blood agar culture media showing growth in positive control group

Table 1: Distribution of samples

	Group 1	Group 2	Positive control	Negative control
Maxillary bands	15	15	04	–
Mandibular bands	15	15	04	–
Total	30	30	08	–

Table 2: Summary of result

	Group 1	Group 2	Positive control	Negative control
Presterilization cleaning	+	+	–	–
Autoclave	+	–	–	–
Glass bead sterilization	–	+	–	–
Growth	Absent	Absent	Present	Absent

methods. Sterilization is of utmost importance in dental clinics where chances of cross contaminations are very high especially with the clinics with high turnover rates.

Introduction of preformed orthodontic bands has lead to frequent reuse of tried-in bands in clinical practice. Benson and Douglas<sup>4</sup> have shown that ultrasonic cleaning for 15 minutes reduces, but does not eliminate, detectable salivary proteins (amylase) from tried-in bands. They found that 50% of molar bands that had been tried for size in the mouth had detectable

amylase, albumin or both, even after 15 minutes in an ultrasonic cleaning bath. The volume of detectable amylase was significantly reduced compared with uncleaned bands; however, the reduction in the volume of albumin was not statistically significant.

Authors recommended the sterilization protocols for preformed orthodontic bands for both the in-received state as well as tried-in ones.<sup>10,11</sup> Their guidelines include ultrasonic cycle for 5 minutes depending on the capacity of the unit followed by rinsing with distilled water. After removal of excess moisture thorough drying with compressed air (oil-free), the bands should be sterilized using a dry-heat sterilizer at 190°C (375°) for 6 minutes followed by storage.

Studies by MR Fulford et al<sup>6</sup> have shown that the decontamination of orthodontic bands contaminated with oral secretions is safely achieved using an enzymatic cleaning agent and a bench top steam sterilizer.

In the present study, the benchtop steam sterilizer (NewclaveAutohouse AD 7) has been used. Preprogrammed program 2 of the autoclave was selected for group 1, i.e. sterilization at 134°C for 18 minutes at 15 psi pressure and then drying for 30 minutes as per recommendations by the manufacturer for the sterilization of instruments in pouches. Following the manufacturer’s guidelines, no growth was detected after incubation of the bands in BHI broth after 5 days.

William A Rutala et al<sup>9</sup> had recommended the use of portable (table-top) steam sterilizers for dental instruments and also recommended the steam sterilization to be used whenever possible on all critical and semicritical items that are heat and moisture resistant. They further quoted that Food and Drug Administration (FDA) believes, there is a risk of infection with glass bead sterilizer because of potential failure to sterilize dental instruments. Glass bead sterilization uses small glass beads (1.2-1.5 mm diameter) and high temperature (217°C-232°C) for brief exposure times (e.g. 45 seconds) to inactivate microorganisms. These devices have been used for several years in the dental profession especially for endodontic instruments.

In the present study, comparison of the efficacy of sterilization of tried-in molar bands was checked with glass bead sterilizer and with benchtop autoclave.

This study has shown the absence of any turbidity after 5 days of incubation of molar bands in BHI broth in both the groups.

BHI broth is a liquid culture medium used for cultivating wide varieties of bacteria (streptococci, pneumococci, meningococci, etc.), it is a highly nutritive medium. In the present study, any absence of contamination of the broth was confirmed by testing the negative control group where no growth was observed after 5 days of incubation.

The efficacy of the BHI broth was confirmed by the positive control group, which has shown the increase in turbidity of the broth after 5 days of incubation and has further shown growth of gram-positive cocci in blood agar culture media.

In group 2, the bands were first cleaned in ultrasonic cleaning bath and then sterilized in glass bead sterilizer as per the recommendations by Smith.<sup>7</sup> The temperature measured at 40 mm depth at the periphery of the well of the sterilizer was 220°C, when the sterilizer was ready to be loaded with bands. This is within the 217° to 237°C range proposed by Koehler and Hefferren.<sup>12</sup> However, no growth was observed when the broth containing molar bands from group 2 was inoculated in blood agar culture medium. The results were similar to the results obtained with benchtop autoclave.

## CONCLUSION

The study validates the fact that autoclave is the gold standard of sterilization but as far as orthodontic bands are concerned glass bead sterilization is equally effective, time saving and reliable method, which can be followed routinely in the busy clinical practice, where rapid turnover is required.

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