



ELSEVIER

Contents lists available at ScienceDirect

American Journal of Infection Control

journal homepage: www.ajicjournal.org

AIC
American Journal of
Infection Control

Letters to the Editor

Orthodontic instruments and supplies: Are they semicritical or critical items?



To the Editor:

Rutala and Weber recently stated: “Semicritical items represent the greatest risk of disease transmission because far more health care-associated infections have been caused by reusable, semicritical items than critical or noncritical items” and that “strict adherence to current guidelines is required for semicritical items because more outbreaks have been linked to inadequately cleaned or disinfected semicritical items, such as endoscopes undergoing high-level disinfection, than any other reusable medical device.”¹

Here, we discuss these statements concerning orthodontic items. It is only recently that the reprocessing of orthodontic instruments (OIs), orthodontic supplies (OSs), and accessories (eg, photographic mirrors, orthodontic markers, and so on) has become a matter of interest.²⁻⁷ Conventionally, they are considered semicritical items because they touch the mucous membranes or nonintact skin. The original Spaulding classification remains valid, but it is debated, because the oral cavity they enter is full of bacterial strains.⁸ In general, OIs (eg, distal-end cutters, ligature cutters, arch-forming pliers, torquing keys, bracket positioning gauges, V-bend forming pliers, bracket placement tweezers, and orthodontic scalers) are heat-tolerant and sharp, and minimally require high-level disinfection using chemical disinfectants. Because of the high turnover of orthodontic patients, reprocessing of OIs has to be very rapid and effective, and must not damage the OIs. Nevertheless, the current user recommendations issued by instrument manufacturers must be followed, and the warranty requires limited or no use of peracetic-based disinfectants and ultrasound washers, and specifies resistance to specific steam autoclave cycles. Chemical disinfection is more aggressive and more detrimental to the lifespan of orthodontic cutters than autoclave sterilization, and is responsible for localized corrosion in the form of pitting, which is more dangerous than surface corrosion.²⁻⁷ The widespread use of spray surface disinfectants on OIs is a risky error because their pH may damage the chromium oxide layer, and their efficacy is insufficient.⁴ It is a matter of recent discussion as to whether the sharp tips, recesses, joints, and inaccessible zones of almost all OIs require packaging and steam sterilization. In this case, the optimal automatic cleaning and rinsing (due to no contact and the open position of OIs) and thermodisinfection and terminal sterilization (in steam autoclave) of OIs is possible using cassettes with modern hole patterns (ie, more open area and less instrument contact) or containers (with perforations in the lid and bottom) with autoclavable silicon mats (Fig 1).



Fig 1. A standard kit for fixed orthodontics with an integrator and green silicon mat.

Routine quality control is achievable by inserting appropriate controls for cleaning efficacy and the moist heat process inside the cassette. Nevertheless, some disadvantages are the overall working time, higher requirement of OIs, and the overall weight (number of orthodontic kits, cassettes, and containers) in light of the maximum load of small steam autoclaves.

There are indications (but no guidelines) concerning the reconditioning of received-from-manufacturer and clinic-exposed OSs (eg, brackets, orthodontics bands, buttons, ligatures, and arch wires), and the European Norm standards define them as single-use.^{3,4,9-11} Single-patient packaged OSs are the best choice because they are protected from air and hand contamination, whereas unpackaged assorted arch wires or other supplies in dispenser-holders should be avoided. In addition, the market for reused brackets is thriving even in developed countries, although it is unclear how producers can certify the absence of microbial contamination, changes in metallurgical microstructure, and resistance to corrosion of reused metallic brackets. No guideline is available for reprocessing orthodontic molar bands used after the trying practice of band selection (size determination) on a patient's diagnostic casts or at the chairside.¹² Nevertheless, the buccal tubes of molar bands (Fig 2A) and ligatures (Fig 2B) have very poorly accessible sections for cleaning and disinfection.¹³

Polyurethane elastic chains and ligatures are subject to contamination, but spool dispensers for chains, ligature assembly for the treatment of a single patient, and cold sterilization are ways of reducing this (Fig 2B); unfortunately, elastic chains and ligatures are not heat resistant and their repeated disinfection can accelerate the destruction of the cross-links of polyurethane polyesters.^{3,4} Recently, Losito et al¹⁴ reported that immersion in chlorhexidine solution (0.12% for 10 minutes) or peracetic acid solution (0.2% for 30 minutes) has no significant effect on the degradation of elastic chains.

There are no published data concerning the bioburden of OIs, and few data on OSs, but saliva contains more than 100 million bacteria per milliliter saliva.⁸⁻¹¹ Bacterial markers and occult blood in saliva worsen during fixed and removable orthodontic treatment, with a shift toward an increased prevalence of periodontal pathogens.^{15,16} In the last stages, *Streptococcus mutans* and *Lactobacillus* are both at concentrations of $>10^5$ CFU/mL, whereas occult blood is in the range

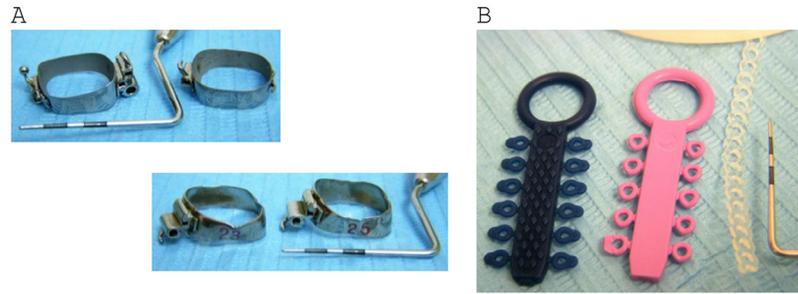


Fig 2. Some poorly accessible parts during the reprocessing of bands and elastomeric ligatures. (A) Molar bands (top: new molar bands; bottom: molar bands after band selection). (B) Easy-to-tie orthodontic ligatures, and lingual ligatures for fixed appliances. A probe marked at 3, 6, 9, and 12 mm has been included to show how small they are.

of 1-2.5 mg/dL in most orthodontic patients.¹⁶ Taking into account orthodontic patient safety, it is well known that children and adolescents are still developing their immune systems and often have asymptomatic infections (due to methicillin-resistant *Staphylococcus aureus*, *Streptococcus pneumonia*, *Haemophilus influenza*, *Moraxella catarrhalis*, hepatitis B virus, and HIV). Bacteremia after a sequence of different orthodontic treatments is unknown.¹⁷ Nevertheless, orthodontists recommend antibiotic prophylaxis most frequently during single procedures (eg, band placement or removal) when treating high-risk patients.¹⁸ In general, the Food and Drug Administration Manufacturer and User Facility Device Experience database and the National Patient Safety Agency of England and Wales have reported that orthodontic appliances and accessories are associated with a small proportion (0.7%-1%) of dental adverse events.^{19,20} But, if iatrogenic harm is considered by surgical specialty, the proportion of events associated with pedodontics and orthodontics increases to 10.3% and 8.2%, respectively, which is to some extent lower than that associated with dental surgery (14.3%).²⁰ It is quite alarming that there are no guidelines for cross-infection control and sterilization when placing temporary orthodontic anchorage devices.²¹⁻²³

We adopted the reported statements for orthodontia. We think that the classification of OIs as semicritical items does not guarantee the safety of orthodontic patients. Specific evidence-based guidelines are needed for OIs and OSS.

References

- Rutala WA, Weber DJ. Reprocessing semicritical items: Current issues and new technologies. *Am J Infect Control* 2016;44:e53-62.
- Bhatnagar S, Bagga DK, Sharma P, Kumar P, Sharma R, Singh V. Infection control strategy in orthodontic office. *European J Gen Dent* 2013;2:1-7.
- Kalra S, Tripathi T, Rai P. Infection Control in Orthodontics. *J Orthod* 2015;1:1-12.
- Aksoy A, Kılıç G, Hussein E, Aboukhalil D. Sterilization and Disinfection in Orthodontics. In: Naretto S, editor. *Principles in Contemporary Orthodontics*, Vol. 6. Rijeka, Croatia: InTech; 2011 ISBN: 978-953-307-687-4. Available from: <http://www.intechopen.com/books/principles-in-contemporary-orthodontics/sterilizationand-disinfection-in-orthodontics>. Accessed May 1, 2016.
- Vinay P, Giridhar G, Hegde N, Priyadarshini. Sterilization methods in orthodontics—a review. *Int J Dent Clin* 2011;3:44-7.
- Benvahia H, Merzouk N, Touhami ME, Zaoui F. Effects of sterilization and disinfection procedures on the corrosion of orthodontic ligature cutters. *Int Orthod* 2012;10:1-15.
- de Almeida FCM, de Carvalho AS, Duarte DAL. Evaluation of disinfection methods of orthodontic pliers. *Dental Press J Orthod* 2012;17:105-9.
- Belström D, Paster BJ, Fiehn N-E, Bardow A, Holmstrup P. Salivary bacterial fingerprints of established oral disease revealed by the Human Oral Microbe Identification using Next Generation Sequencing (HOMINGS) technique. *J Oral Microbiol* 2016;8:30170.
- Purmal K, Chin S, Pinto J, Yin W-F, Chan K-G. Microbial contamination of orthodontic buccal tubes from manufacturers. *Int J Mol Sci* 2010;11:3349-56.
- Dos Santos Gerzsona R, Simon D, dos Anjos AL, Freitas MPM. In vitro evaluation of microbial contamination of orthodontic brackets as received from the

- manufacturer using microbiological and molecular tests. *Angle Orthod* 2015;85:992-6.
- Buchman DJL. Effects of recycling on metallic direct-bond orthodontic brackets. *Am J Orthod* 1980;77:654-66.
- Dowsing P, Benson PE. Molar band re-use and decontamination: a survey of specialists. *J Orthod* 2006;33:30-7.
- Benson PE, Douglas CWI. Decontamination of orthodontic bands following size determination and cleaning. *J Orthod* 2007;84:18-24.
- Losito KAB, Lucato AS, Tubel CAM, Correa CA, dos Santos JCB. Force decay in orthodontic elastomeric chains after immersion in disinfection solutions. *Braz J Oral Sci.* 2014;13:266-9.
- Freitas AOA, Markezan M, Nojima MCG, Alviano DS, Maia LC. The influence of orthodontic fixed appliances on the oral microbiota: a systematic review. *Dental Press J Orthod* 2014;19:46-55.
- Lara-Carrillo E, Norma Montiel-Bastida M, Sánchez-Pérez L, Alanís-Tavira J. Changes in the oral environment during four stages of orthodontic treatment. *Korean J Orthod* 2010;40:95-105.
- Livas C, Delli K, Karapsias S, Pandis N, Ren Y. Investigation of bacteremia induced by orthodontic mini-implants. *Eur J Orthod* 2014;36:16-21.
- Leong JW, Kunzel C, Cangialosi TJ. Management of the American Heart Association's guidelines for orthodontic treatment of patients at risk for infective endocarditis. *Am J Orthod Dentofacial Orthop* 2012;142:348-54.
- Hebballi NB, Ramoni R, Kalenderian E, Delattre VF, Stewart DCL, Kent K, et al. The dangers of dental devices as reported in the Food and Drug Administration Manufacturer and User Facility Device Experience Database. *J Am Dent Assoc* 2015;146:102-10.
- Thusu S, Panesar S, Bedi R. Patient safety in dentistry—state of play as revealed by a national database of errors. *Br Dent J* 2012;213:1-8.
- Giuliano MB, Pagin P, Di Blasio A. Success of miniscrews used as anchorage for orthodontic treatment: analysis of different factors. *Prog Orthod* 2012;13:202-9.
- Scholz RP, Cook A. Sterilization requirements for the placement of temporary anchorage devices. *Am J Orthod Dentofacial Orthop* 2009;135:S20.
- Cleveland JL, Kohn W. CDC weighs in on TADs. *Am J Orthod Dentofacial Orthop* 2009;136:622-3.

Conflicts of interest: L.B. had a service agreement with KerrHawe and is a consultant for DentalTrey il Blog (<http://blog.dental Trey.it/>), neither of which gave any input or financial support to the writing of this article. There are no other conflicts of interest to report.

Livia Barenghi, PhD*

Integrated Orthodontic Services Srl, Lecco, Italy

* Address correspondence to Livia Barenghi, PhD, Integrated Orthodontic Services Srl, Via Cavour 52 C, 23900 Lecco, Italy. E-mail address: livia.barenghi@libero.it (L. Barenghi).

Alberto Di Blasio, MD, DDS

Department of Orthodontics, Parma University, Parma, Italy

Department of Biomedical, Biotechnological, and Translational Sciences, Parma University, Parma, Italy

<http://dx.doi.org/10.1016/j.ajic.2016.09.028>