

## Cross-Infection Control Policy Adopted by Dental Technicians

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**Abstract:** In order to prevent the transmission of infectious disease, effective infection control procedures should be exercised by all dentists, in-office dental auxiliaries and dental technicians. This survey aimed to gather information from routine practice about cross-infection control of dental laboratory work in relation to whether impressions and items of laboratory work were routinely disinfected or not. One hundred and thirty-one subjects were interviewed by the same interviewer, using a structured questionnaire. There were 17 women (13%) and 114 men (87%). The results revealed that 51% of the interviewed technicians attended a specific technical prosthetic course. Fifty four percent of the professionals in this study have been practicing for over 20 years; 13.1%, between 15 and 20 years; 8.5%, between 11 and 15 years; 16.9% between 5 and 10 years and 7.7% started practice in the last five years. According to the results, 88% percent of the respondents routinely rinsed dental impressions with water. When a prosthesis reaches the laboratory for finishing and polishing, the professionals answered to proceed as follows: 79.2% washed the piece in tap water on arrival; 10.8% did the polishing without previously undertaking any prophylactic measure; 9.2% disinfected the item and 0.8% did not answer. Although a great number of respondents are aware of the transmission of viral and bacterial infections, the results of this study demonstrated that there is a need for more education to prevent cross-contamination in the carrying of the items from the clinic to the laboratory and vice-versa.

**Keywords:** *Laboratory infection; contamination; infection control, dental; disinfection; dental technicians.*

**Resumo:** Com o objetivo de evitar a transmissão de doenças infecciosas, medidas que visem o controle de infecção cruzada devem ser adotadas pelos cirurgiões dentistas, auxiliares odontológicos e técnicos de laboratório. Este estudo investigou as condutas de rotina adotadas pelos técnicos para prevenir a contaminação cruzada no laboratório de prótese. Foram coletadas informações referentes à desinfecção de moldes e outros itens protéticos. Questionários foram aplicados verbalmente a 131 profissionais pelo mesmo entrevistador. Entre os técnicos entrevistados, 17 eram mulheres (13%) e 114 eram homens (87%). Os resultados revelaram que 51% dos técnicos frequentaram um curso técnico. Cinquenta e quatro por cento dos técnicos praticavam a profissão por mais de 20 anos; 13,1%, entre 15 e 20 anos; 8,5%, entre 11 e 15 anos; 16,9% entre 5 e 10 anos e 7,7% iniciaram suas atividades nos últimos 5 anos. De acordo com os resultados, 88% dos entrevistados enxaguavam rotineiramente os moldes com água. Com relação aos procedimentos adotados quando uma prótese é recebida no laboratório para polimento e acabamento, foram obtidos os seguintes resultados: 79,2% dos técnicos somente lavavam a prótese em água corrente, 10,8% realizavam o polimento sem medidas profiláticas, 9,2% desinfetavam a prótese e 0,8% não responderam. Embora grande parte dos entrevistados estivesse consciente da transmissão de infecções virais e bacterianas, os resultados deste estudo demonstraram que há a necessidade de maior motivação e instrução aos técnicos para a prevenção de contaminação cruzada durante o envio e o recebimento de trabalhos protéticos entre o laboratório de prótese e o consultório odontológico.

**Palavras-chave:** *Infecção laboratorial; contaminação; controle de infecções dentárias; desinfecção; técnicos em prótese dentária.*

## Introduction

Dentists, auxiliary personnel and dental laboratory technicians are daily exposed to a wide variety of microorganisms that can cause infectious-diseases. Prosthetic appliances that have been in contact with oral tissues, saliva and blood, after removed from patients mouths, can be contaminated with pathogenic microorganisms. These microorganisms can be transmitted to laboratory staff through direct contact or from the aerosols from grinding and/or finishing and polishing procedures<sup>5</sup>. In this case, bacteria of varying degrees of virulence can be spread and disseminated in the air, leading to cross-infection.

In order to prevent cross-infection, all prosthetic appliances should be properly disinfected by soaking them in an effective chemical solution on arrival at the laboratory and again when received by the dental office. Furthermore, all laboratory personnel should wear physical protective barriers, such as gloves, mask, protective eyewear, gown and cap<sup>2</sup>. The fore-mentioned procedures should be followed as part of a cross-infection control program to be established and routinely exercised in all dental laboratories.

Based on these considerations, the aims of this study were: 1) To assess the knowledge of dental laboratory technicians as regards to pathogenic microorganism diffusion between dental office and prosthetic laboratory and 2) To evaluate the usual procedures performed by these professionals to avoid cross-contamination as well.

## Material and method

A questionnaire was formulated and submitted to 131 laboratory technicians selected in three cities from São Paulo State (Araraquara: 20, São José do Rio Preto: 91, and Catanduva: 20) as a convenient sample selected. There were 17 women (13%) and 114 men (87%). The spoken interview, conducted by a single research was composed by 23 questions, which aimed to gather information about the following subjects: training and practice time of the interviewed technicians: professionals were asked whether or not they had attended a technical prosthetic course and how long they had been practicing; specific knowledge concerning cross-contamination in their dental laboratory and the use of protective barriers: technicians were asked if they were aware of the possible existence of pathogenic microorganisms in prosthetic appliances or other dental works and about the use of protective barriers; and disinfection procedures: whether or not the professionals routinely disinfected prosthetic items and which disinfectant solutions were most used. The questions were directed to each of the dental technicians in the dental laboratory.

Data were gathered in a DBase III Plus database file specifically created to organize and assess the collected information. This database file was further exported to EPI-

INFO 6.0 for descriptive analysis, according to the relative frequencies.

## Result

Only 51% of the interviewed technicians attended a specific technical prosthetic course. Fifty four percent of the professionals in this study have been practicing for over 20 years; 13.1%, between 15 and 20 years; 8.5%, between 11 and 15 years; 16.9% between 5 and 10 years and 7.7% started practice in the last five years. This survey showed that 72.1% of the technicians knew that prosthetic appliances that reach the laboratory are contaminated while 16.3% claimed these appliances are not contaminated and 11.7% did not know. The findings of this study also disclosed that for 86.2% of the professionals, the prosthetic appliances should be disinfected and only 13.8% believed that disinfection is a useless procedure.

However, 90% of the technicians never carried out the disinfection of incoming and outgoing dental works; 3.8% did it solely when the prosthetic appliances arrived from the dental office; 0.8% disinfected the appliances before sending them back to the dentist; 3.1% did it on arrival at the laboratory as well as on sending back to the dental office; and 2.3% did not answer this question. It was also noticed that 86.2% of the technicians were not aware whether or not the prosthetic appliances sent to the laboratory by dentists were from patients of risk groups; 7.7% were always warned and 5.4% were only sometimes warned (only some dentists notify the high risk patients).

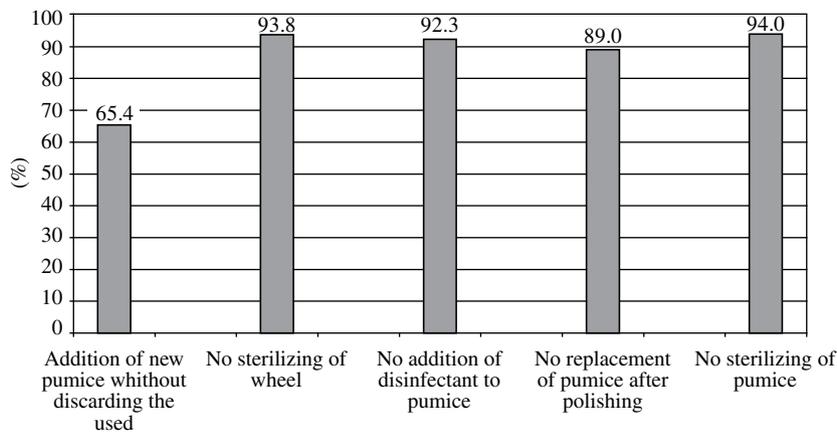
Among the technicians included in this study, 77.7% never used gloves; 21.5% did sometimes and only 0.8% always used gloves while handling dental appliances at the prosthetic laboratory. Concerning to the wear of mask, 26.2% have never worn it; 67.7% have worn it sometimes and 6.2% have always worn a mask while working. Regarding the wear of protective eyewear, the answers revealed that 35.4% of the professionals have never worn it; 52.3% have it sometimes and only 12.3% have always worn safety glasses. Table 1 summarizes the number of dental technicians that used barriers and were immunized against Hepatitis B, according to the professional practice time.

The percentage of dental technicians related to the routine procedures carried out when handling pumice, or immediately after receiving an impression at the laboratory are shown in Figures 1 and 2, respectively. Table 2 summarizes the routine procedures carried out by dental technicians after receiving an impression from the dental office, according to the dental technicians training. The percentage of dental technicians that did not routinely carry out disinfection procedures according to the different prosthetic items are shown in Figure 3. Table 3 summarizes the dental technicians that carried out the disinfection of prosthetic items, according to gender.

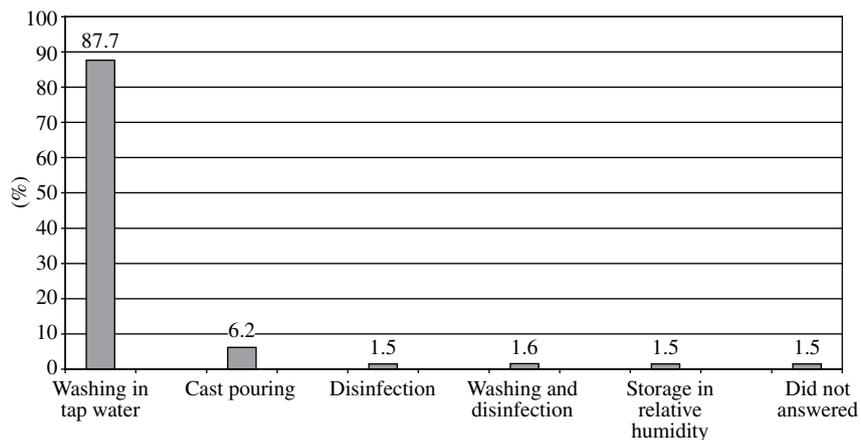
Among the professionals, which routinely disinfected the prosthetic appliances before handling, most used the following chemical solutions: alcohol, sodium hypochlorite and glutaraldehyde. For disinfecting impressions, 4.6% of pro-

**Table 1.** Dental technicians use of barriers and the immunization against Hepatitis B according to the professional practice time

Practice time (years)	Routine procedure			
	Aways use gloves	Aways use masks	Aways use safety glasses	Vaccination aganist Hepatitis B
From 0 to 10 (35 subjects)	-	01 (2.9%)	02 (5.7%)	18 (51.4%)
From 11 to 20 (42 subjects)	-	03 (7.1%)	06 (14.3%)	23 (54.8%)
From 21 to 30 (32 subjects)	01 (3.1%)	02 (4.8%)	06 (18.7%)	24 (75.0%)
From 31 to 40 (8 subjects)	-	02 (25.0%)	03 (37.5%)	05 (62.5%)
From 41 to 50 (6 subjects)	-	-	-	-
From 51 to 60 (3 subjects)	-	-	-	03 (100.0%)
Did not respond (5 subjects)	-	01 (20.0%)	-	05 (100.0%)
Total	01 (0.8%)	09 (6.9%)	17 (12.9%)	78 (59.6%)



**Figure 1.** Percentage of dental technicians related to the routine procedures carried out when handling pumice at the dental laboratory.



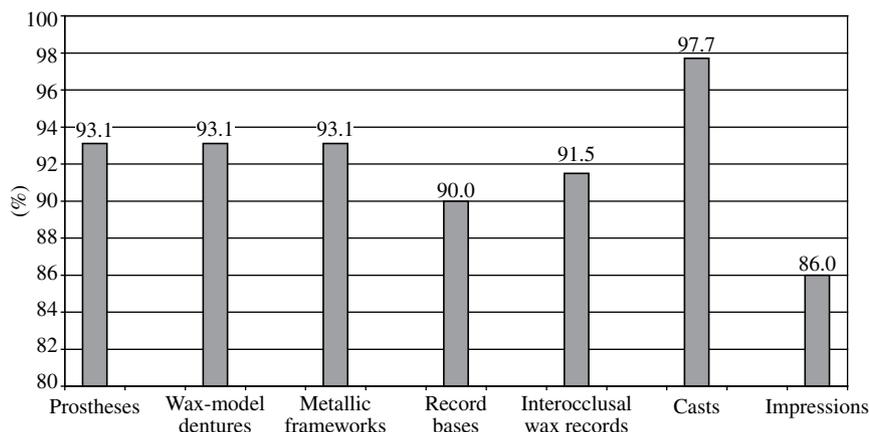
**Figure 2.** Percentage of dental technicians related to the routine procedures carried out immediately after receiving an impression at the laboratory.

**Table 2.** Immediate routine procedure carried out after receiving an impression at the laboratory according to the dental technicians training

Training	Routine procedure					
	Washing in tap water	Cast pouring	Disinfection	Washing followed by disinfection	Storage in relative humidity	Did not answered
Attended a technical prosthetic course	61 (53.0%)	05 (62.5%)	01 (50.0%)	03 (100%)	01 (50.0%)	01 (50.0%)
Did not attend a technical prosthetic course	54 (47.0%)	03 (37.5%)	01 (50.0%)	-	01 (50.0%)	-
Total	115 (87.7%)	8 (6.2%)	02 (1.5%)	03 (1.6%)	02 (1.5%)	01 (1.5%)

**Table 3.** Disinfection of prosthetic items according to the gender of the dental technicians

Gender	Disinfected Items						
	Prostheses	Wax model dentures	Methalic frameworks	Record bases	Interocclusal wax records	Casts	Impressions
Male (114 subjects)	07 (6.1%)	08 (7.0%)	08 (7.0%)	12 (10.5%)	11 (9.6%)	02 (1.7%)	17 (14.9%)
Female (17 subjects)	02 (11.8%)	01 (5.9%)	01 (5.9%)	-	-	01 (5.9%)	01 (5.9%)
Total (131 subjects)	09 (6.9%)	09 (6.9%)	09 (6.9%)	12 (9.2%)	11 (8.4%)	03 (2.3%)	18 (13.7%)

**Figure 3.** Percentage of dental laboratory technicians that did not routinely carry out disinfection procedures according to the different prosthetic items.

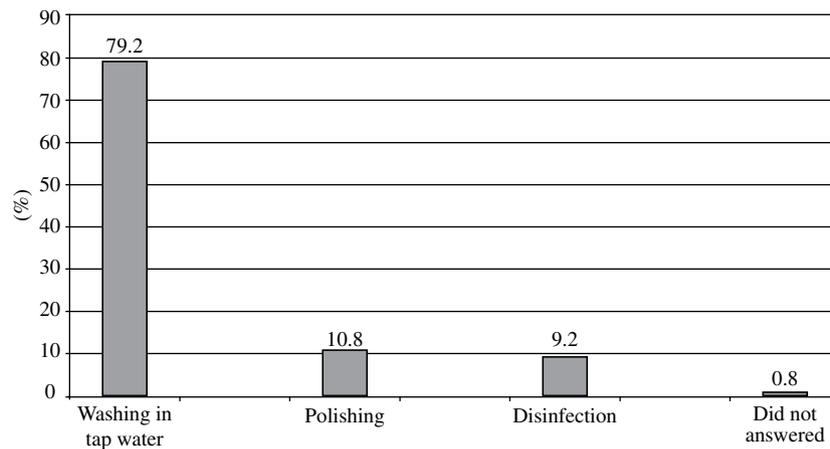
professionals used alcohol (70% optimum); 1.5% used 5.25% sodium hypochlorite, 0.8% used 1% sodium hypochlorite and 0.8% used glutaraldehyde.

The percentage of dental technicians routine procedures carried out immediately after receiving a prosthesis for polishing is shown in Figure 4. On disinfecting prostheses, 1.5% of the respondents used alcohol and 5.25% sodium hypochlorite; 0.8% used 1% sodium hypochlorite to disinfect the occlusion rims, 3.1% used alcohol and 0.8% used 1% sodium hypochlorite. The disinfection of waxed dentures after esthetic and functional try-in was accomplished using 1%

sodium hypochlorite (0.8% of the technicians) and alcohol (0.8% of the professionals). And finally, for metal frameworks, 1.5% used alcohol and 0.8% used glutaraldehyde.

## Discussion

In the present study, 72.1% of the professionals were aware that the prosthetic appliances and dental works delivered at the laboratory are contaminated, and should therefore be subjected to a proper disinfecting process. However, most of professionals claimed not to disinfect the items arriving from dental offices. In an earlier investiga-



**Figure 4.** Percentage of dental technicians routine procedures carried out immediately after receiving a prosthesis for polishing.

tion<sup>23</sup>, it was noticed that 67% of all prosthetic pieces sent to prosthodontic laboratories were contaminated by pathogenic microorganisms including *Enterobacter cloacae*, *Klebsiella oxytoca*, *alpha-hemolytic Streptococcus species*, *Pseudomonas aeruginosa*, *Mycobacterium tuberculosis*, *Escherichia coli*. These microorganisms may cause infectious diseases such as pneumonia and tuberculosis. In addition, considering that the prosthetic items can be impregnated with saliva and blood, the risk from blood-borne viral infections such as those causing the acquired immune deficiency syndrome (AIDS) and hepatitis B are of particular concern<sup>18</sup>. Cross-contamination probability between patients and dental office and/or laboratory personnel is greater than contamination risks between dentist and patients or from one patient to another<sup>9</sup>. In that way, the establishment of infection control procedures at dental offices and prosthetic laboratories may be a definite step to avoid transmission of microorganisms. It has been stated that every patient must be considered as contaminated and infection control policy should be strictly followed by dentists as well as laboratory staff<sup>7</sup>. Although the laboratory personnel do not have the primary responsibility in cross-infection control, they are also responsible for the disinfection procedures of appliances received from and sent back to the dental office. However, according to Clifford e Burnett<sup>6</sup>, there is a lot of misinformation as to cross-contamination possibility, since they noticed that 56% of laboratory personnel included in their study had never accomplished any decontamination procedures on receiving prosthetic works.

Jagger et al.<sup>12</sup> noticed that 35% of the laboratory technicians did not adopt a disinfection routine at work; 29% usually did it and 34% did it occasionally. In regard to impressions and casts, laboratory technicians should follow a specific protocol. The dental appliances should be decontaminated on arrival at the laboratory by adding a

disinfecting agent to plaster before pouring or by soaking the poured cast in a disinfectant solution<sup>11,19</sup>. In an earlier survey<sup>15</sup>, only 44% of the technicians stated that they knew if the incoming impressions had been disinfected at the dental office. Nevertheless, it was observed in this study that 86.0% of the technicians did not disinfect impressions and 97.7% did not disinfect plaster casts.

There is a consensus that the prostheses are a major obstacle in the prevention of cross-contamination<sup>8,10,13,24-26</sup>. In this study, we noticed that most of professionals did not disinfect prostheses arriving at the laboratory. Therefore, the handling of these prostheses may spread microorganisms to the environment thus contaminating other materials, equipment or technicians<sup>10,13,25,26</sup>. It has been advocated that pumice used for finishing/polishing procedures consists of a major reservoir for bacterial contaminants in the prosthodontic laboratory<sup>27</sup>. Denture-base resin may be contaminated by harmful microorganisms on both external and internal surfaces, due to its porous nature<sup>5</sup>.

Polishing the prostheses without replacing pumice or previously disinfecting the ragwheel can lead to contamination of new prostheses by pathogenic microorganisms<sup>14,28</sup>. According to the ADA regulations<sup>2</sup>, polishing of prosthetic appliances should be accomplished in the aseptic way to avoid cross-contamination. Therefore, the ragwheel should be thoroughly washed and autoclaved after each polishing procedure, and brushes or other polishing instruments should also be properly disinfected. Moreover, a disinfectant solution (sodium hypochlorite 1:20) should be added to pumice, which would be used for polishing only one prosthesis and discarded afterwards. For that reason, ideal aseptic polishing would be carried out by using a sterile ragwheel, as well as adding disinfectant to pumice and discarding it after use<sup>16</sup>. Unfortunately, such procedures are time-consuming, costly and, in many situations, impracticable to most laboratory

technicians. A minority of respondents in this study complied with recommendations for using a sterile ragwheel, as well as adding disinfectant to pumice and discarding it after use. Therefore, it can be assumed that polishing is not an aseptic procedure. Thus, to minimize the probability of cross-contamination, prostheses should be disinfected in an appropriate chemical solution before being sent to dental offices and on arrival at the laboratory.

The findings from this study clearly showed that only few laboratory technicians routinely disinfected the prosthetic appliances and that the most commonly used chemical solutions were: alcohol, sodium hypochlorite (5.25% and 1%) and glutaraldehyde. The 5.25% sodium hypochlorite solution appears to be quite effective against many microorganisms, including spores and Hepatitis B virus<sup>24</sup>. However, this solution has deleterious effects on some components of dental prostheses such as surface discoloration<sup>17</sup>. Moreover, it can lead to staining and corrosion of cobalt-chromium alloy frameworks of removable partial dentures<sup>4</sup>. Additionally, some patients complain of an unpleasant smell. The use of less concentrated sodium hypochlorite solutions (0.05% to 0.5%) has been recommended<sup>20</sup>. In a previous study<sup>21</sup>, it was observed that 1% sodium hypochlorite is effective in disinfecting prostheses, as it reduced the amount of microorganisms and did not adversely affect hardness and flexural strength of denture base acrylic resins<sup>22</sup>. Sodium hypochlorite and glutaraldehyde may also be used in disinfecting polyether and addition silicone impressions<sup>1</sup>. On the other hand, glutaraldehyde solution should not be used for disinfecting acrylic resin as it can cause tissue irritation. Since acrylic resin is relatively porous, there is a possibility that some glutaraldehyde solution remains impregnated and its complete removal from the acrylic porosities is difficult<sup>3</sup>. Alcohol should not be used for soaking prosthetic appliances, since it becomes ineffective if some proteins (from blood or saliva, for instance) are present. Alcohol is more properly indicated for skin and surface asepsis<sup>20</sup>. Therefore, communication between dentists and laboratory personnel concerning the most proper disinfection procedures could avoid the risks mentioned above. Furthermore, manufacturers should provide clear directions on the adequate disinfection method of their products. If such instructions are not usually available, technicians and dentists should follow the guidelines issued by American Dental Association<sup>2</sup>.

On grinding and polishing procedures, microorganisms may be spread and disseminated in the air through the aerosols and hence be inhaled by technicians, leading to cross-infection. Therefore, it is mandatory that the laboratory personnel wear physical protective barriers. The use of gloves while manipulating prosthetic appliances is a simple, effective measure to avoid the transmission of microorganisms<sup>12</sup>. A minority of respondents in this study complied with the appropriate use of barriers.

The limitations of this study include the fact that the sample selection was not homogenous regarding the working period. The results of this study showed that the great majority of the dental technicians had been working for more than 15 years. Thus the results of this study cannot be equally extrapolated for all dental technicians in the market, since more emphasis has been directed towards infection control in the last years.

## Conclusion

The results of the present study clearly show that, although most of dental technicians are aware that dental works may be potential sources of spreading pathogenic microorganisms, most laboratories do not adopt an infection control policy for working on prosthetic appliances and items related to them. These findings point out the need of a change of attitude by both dentists and dental office/laboratory staff in order to establish an effective and strict protocol to prevent cross-contamination.

## References

1. Adabo GL, Zanarotti E, Fonseca RG, Cruz CAS. Effect of disinfectant agents on dimensional stability of elastomeric impression materials. *J Prosthet Dent.* 1999; 81: 621-4.
2. American Dental Association. Council on Scientific Affairs and ADA Council on Dental Practice. Infection control recommendations for the dental office and the dental laboratory. *J Am Dent Assoc.* 1996;127: 672-80.
3. Anusavice KJ. Phillip's science of dental materials. 10th ed. Philadelphia: W.B. Saunders Company; 1996.
4. Backenstose WM, Wells JG. Side effects of immersion-type cleansers on the metal components of dentures. *J Prosthet Dent.* 1977; 37: 615-21.
5. Chau VB, Saunders TR, Pimsler M, Elfring DR. In-depth disinfection of acrylic resins. *J Prosthet Dent.* 1995;74: 309-13.
6. Clifford TJ, Burnett CA. The practice of consultants in restorative Dentistry (UK) in routine infection control for impressions and laboratory work. *Eur J Prosthodont Rest Dent.* 1995; 3: 175-7.
7. Federation Dentaire Internationale. Recommendations for hygiene in dental practice, including treatment for the infectious patient. A revision of Technical Report N°. 10. *Int Dent J.* 1987; 37: 142-5.
8. Gwinnett AJ, Caputo L. The effectiveness of ultrasonic denture cleaning: a scanning electron microscope study. *J Prosthet Dent.* 1983; 50: 20-5.
9. Hazelkorn HM, Bloom BE, Jovanovic BD. Infection control in the dental office. Has anything changed? *J Am Dent Assoc.* 1996; 127: 786-90.
10. Henderson CW, Schwartz RS, Herbold ET, Mayhew RB.

- Evaluation of the barrier system, an infection control system for the dental laboratory. *J Prosthet Dent.* 1987; 58: 517-21.
11. Ivanoviski S, Savage NW, Brockhurst PJ, Bird PS. Disinfection of dental stone casts: antimicrobial effects and physical property alterations. *Dent Mater.* 1995; 11: 19-23.
  12. Jagger DC, Huggett R, Harrison A. Cross-infection control in dental laboratories. *Br Dent J.* 1995; 179: 93-6.
  13. Kahn RC, Lancaster MV, Kate W Jr. The microbiologic cross-contamination of dental prostheses. *J Prosthet Dent.* 1982; 47: 556-9.
  14. Katberg JW Jr. Cross-contamination via the prosthodontic laboratory. *J Prosthet Dent.* 1974; 32: 412-9.
  15. Kugel G, Perry RD, Ferrari M, Lalicata P. Disinfection and communication practices: a survey of U. S. laboratories. *J Am Dent Assoc.* 2000;131: 786-92.
  16. Larato DC. Disinfection of pumice. *J Prosthet Dent.* 1967; 18: 534-5.
  17. Ma T, Johnson GH, Gordon, GE. Effects of chemical disinfectants on the surface characteristics and color of denture resins. *J Prosthet Dent.* 1997; 77: 197-204.
  18. McCarthy GM, Koval JJ, MacDonald JK. Compliance with recommended infection control procedures among Canadian dentists: results of a national survey. *Am J Infect Control.* 1999; 27: 377-84.
  19. Merchant MV. An update on infection control in the dental laboratory. *QDT 1997* (special issue): 157-65.
  20. Molinari JA, Runnells RR. Role of disinfectants in infection control. *Dent Clin North Am.* 1991; 35: 323-7.
  21. Pavarina AC, Pizzolitto AC, Machado AL, Vergani CE, Giampaolo ET. An infection control protocol: effectiveness of immersion solutions to reduce the microbial growth on dental prostheses. *J Oral Rehabil.* 2003; 30: 532-6.
  22. Pavarina AC, Machado AL, Giampaolo ET, Vergani CE. Effects of chemical disinfectants on the transverse strength of denture base acrylic resins. *J Oral Rehabil.* 2003; 30: 1085-9.
  23. Powell GL, Runnells RD, Saxon BA, Whisenant BK. The presence and identification of organisms transmitted to dental laboratories. *J Prosthet Dent.* 1990; 64: 235-7.
  24. Rudd RW, Senia ES, McCleskey FK, Adams ED. Sterilization of complete dentures with sodium hypochlorite. *J Prosthet Dent.* 1984; 51: 318-21.
  25. Stern MA, Whitacre RJ. Avoiding cross-contamination in prosthodontics. *J Prosthet Dent.* 1981; 46: 120-2.
  26. Vig RG. Reducing laboratory aerosol contamination. *J Prosthet Dent.* 1969; 22: 156-7.
  27. Williams HN, Falkler WA Jr, Hasler JF, Libonati JP. The recovery and significance of nonoral opportunistic pathogenic bacteria in dental laboratory pumice. *J Prosthet Dent.* 1985; 54: 725-30.
  28. Witt S, Hart P. Cross-infection hazards associated with the use of pumice in dental laboratories. *J Dent.* 1990; 18: 281-3.

