ORIGINAL RESEARCH

Microbiological evaluation of reprocessed endodontic files collected from general dental practices in Istanbul

İstanbul'daki dişhekimi muayenehanelerinden toplanan yeniden kullanıma hazır haldeki endodontik eğelerin mikrobiyolojik olarak incelenmesi

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SUMMARY

Aim: The aim of this preliminary study was to examine the presence of microbial contamination on reprocessed endodontic instruments those were subjected to different cleaning methods prior to sterilization.

Materials and Methods: A questionnaire was administered to 20 general dental practitioners to obtain information on the re-processing of used endodontic files. A hedström file, a rotary instrument and a lentulo spiral which had been used and reprocessed were collected from each practice. A total of sixty endodontic instruments were analysed. Each file was transferred aseptically to tubes containing brain heart infusion (BHI) broth culture medium for bacteriological analysis. Statistical analysis was carried out using chi-square test.

Results: Of the twenty questionnaires distributed, seventeen were deemed usable. None of the practitioners used endodontic files as a disposable instrument. In addition to the use of an autoclave or a dry-heat sterilizer for the sterilization of instruments, various cleaning methods before sterilization, which ranged from manual brushing to chemical immersion and the use of a washer-disinfector were reported. The most frequently employed combination for decontamination was manual cleaning followed by autoclaving. Of the sixty endodontic instruments, twelve instruments (20%); six hedström files, five rotary instruments and one lentulo spiral, produced growth on BHI agar.

Conclusions: There have been variations in decontamination methods reported and applied. The methods used to clean endodontic instruments appear to be generally ineffective for the complete sterility. As a result, potentially infective material could be transmitted from an infected individual to other patients. These instruments should be viewed as single-use devices, unless significantly more efficient cleaning processes can be validated for use in general dental practice.

Key words: Biological debris, contamination, disinfection, endodontic file, sterilization.

ÖZET

Amaç: Bu ön çalışmanın amacı, İstanbul'daki dişhekimi muayenehanelerinden toplanan, çeşitli dezenfeksiyon ve sterilizasyon işlemleri uygulanıp yeniden kullanıma hazır hale getirilmiş endodontik eğeler üzerindeki mikrobiyolojik bulaşı tespit etmektir.

Gereç ve Yöntem: İstanbul'daki 20 dişhekimi muayenehanesine dezenfeksiyon ve sterilizasyon protokollerini öğrenebilmek için birer anket dağıtılmıştır. Yeniden kullanıma hazır haldeki endodontik eğelerin üzerindeki mikrobiyal bulaşı inceleyebilmek amacıyla, bu muayenehanelerden birer adet Hedström eğe, döner sistem eğesi ve lentülo toplanmıştır. Toplamda altmış adet eğe incelenmiştir. Mikrobiyolojik inceleme için her eğe aseptik koşullarda beyin- kalp infüzyon agarına aktarılmıştır. Veriler ki-kare testi kullanılarak istatistiksel olarak incelenmiştir.

Bulgular: Dağıtılan 20 anketten 17 tanesi incelenmeye uygun bulunmuştur. Hiçbir dişhekimi endodontik eğeleri tek sefer kullanmamaktadır. Otoklav veya kuru sıcak hava ile sterilizasyonun yanısıra, pek çok farklı temizleme protokolü uygulanmaktadır. Elle fırçalama, kimyasala yatırma ve yıkayıcı-dezenfekte edici makina kullanımı rapor edilmiştir. En çok uygulanan dekontaminasyon yöntemi, elle temizleme sonrası otoklav kullanımıdır. İncelenen altmış adet endodontik aletin on ikisinde (%20) beyin- kalp infüzyon agarında üreme saptanmıştır. Bu aletler; altı hedström eğe, beş döner sistem eğesi ve bir lentülodur.

Sonuç: Uygulanan dekontaminasyon yöntemleri arasında farklılıklar bulunmaktadır. Endodontik aletleri temizlemek için kullanılan yöntemler genel olarak yetersiz bulunmuştur. Sonuç olarak, enfekte bir maddenin bir hastadan diğerine bulaşma riski mevcuttur. Endodontik aletler için daha etkin ve uygulanabilir bir dekontaminasyon yöntemi geçerli olana kadar bu aletler tek kullanımlık olarak değerlendirilmelidir.

Anahtar kelimeler: Biyolojik artık, kontaminasyon, dezenfeksiyon, endodontik eğe, sterilizasyon.

INTRODUCTION

Infection control procedures are essential to modern dentistry.[1] Cross-infection is a major issue in dental health care because of concerns about transmission of disease via the oral cavity.[2] Even though there is a lack of evidence linking endodontic treatment with the transmission of disease, there is a great potential to transmit pathogens via endodontic instruments in the absence of satisfactory infection control procedures.[1] Endodontic instruments come into contact with saliva, blood and infected pulp tissue.[2] As the instruments are frequently reused, it is essential they are disinfected and sterilized after each use, to avoid cross-infection between patients.[1]

There is a problem with removing organic debris from small dental instruments with a complex surface topography.[3] Some instruments used in endodontics are particularly difficult to clean, and may carry significant material residues after disinfection.[4,5] This might pose a threat of variant-Creutzfeldt Jakob disease (vCJD) transmission, thus, in response to this potential threat, the UK Government recommended that all endodontic files and reamers should be regarded as single-use.[6] However, traditionally, instruments are sterilized and reused after treatment. Endodontic files are considered as reusable instruments in Turkey. A critical factor in deciding whether endodontic files should be single use or reusable is whether they can be satisfactorily cleaned prior to appropriate sterilization.[4]

Recommendations concerning cleaning and sterilization processes should be based on scientifically obtained and clinically relevant data, and be justifiable, achievable, and consistent with known risks. Cleaning and sterilization recommendations made by various groups may in fact be too stringent and not reflect clinical practice.[7]

The aim of this preliminary study was to examine the presence of microbial contamination on reprocessed endodontic instruments those were subjected to different cleaning methods prior to sterilization and were ready to be used in general dental practices in Istanbul.

MATERIALS AND METHODS

Ethical approval and informed consent was obtained for distributing the questi onnaires and for collecting the instruments. A questionnaire was administered to 20 general dental practitioners to obtain information on the re-processing of used endodontic files. The questionnaires were anonymous. Questionnaires covered 15 multiple-choice questions, with only one personal question regarding the type of practice they are working in, e.g. a private practice or a private hospital.

Type of endodontic procedures applied in the practice, number of root canal treatments and retreatments completed weekly, type of preferred endodontic instruments were asked to attain information about the general dental practitioner's (GDP) attitudes towards endodontic therapy. It was also asked whether the person responsible for disinfection and sterilisation of instruments was the GDP him/herself or any other staff member. Disinfection methods and type chemical solutions used, time for presoaking, sterilization methods, packing and storage of endodontic instruments after sterilization, maintenance of sterilizers were asked amongst the questions regarding when and how the endodontic instruments were discarded and if the GDP would follow a specific protocol for the endodontic instruments that were used on patients with high risk of cross-transmission (Hepatitis B, Hepatitis C, AIDS, etc.).

After completion of the questionnaires a total of three instruments; a Hedström file, a rotary instrument and a lentulo spiral, which had been used and reprocessed were collected from each practice. A total of sixty endodontic instruments were analysed. Each file was transferred aseptically to tubes containing brain heart infusion (BHI) broth culture medium for bacteriological analysis. Statistical analysis was carried out using chi-square test.

RESULTS

Of the 20 questionnaires distributed, three were not completed, giving a total of 85% completion. In all, 17 questionnaires were analysed in this study. Twelve of the participants reported working at their own practice, the rest of the participants were working at private hospitals.

The majority of respondentss (47.1%) reported performing all endodontic procedures including root canal treatment (RCT) to teeth with or without lesions, retreatment and post treatment. There was a variation in the number of RCTs completed per week ranging from 1 to over 20. Forty one percent of respondents stated that they complete more than 20 root canal fillings each week. Seventy percent of the respondents performed less than 5 retreatments, followed by 5-10 retreatments (11.2%), 10-20 retreatments (10.8%) and more than 20 retreatments (5.9%) per week.

All practitioners reported that they used stainless steel instruments in combination with nickel titanium instruments, except for one practitioner who used stainless steel instruments alone. Sixteen of the respondents stated that there was a staff member who was responsible for disinfecting and sterilising the endodontic instruments in their practices.

Of all respondents, 88.2% reported using autoclaves and only 5.9% reported using a dry-heat sterilizer for the sterilization of instruments. Various cleaning methods before sterilization, which ranged from manual brushing (82.4%) to chemical immersion in enzimatic solution (47.1%) and the use of a washer-disinfector (5.9%) were reported. Fifty nine percent of respondents immersed the instruments into chemical solution for over 30 minutes. The most frequently employed combination for decontamination was manual cleaning followed by autoclaving. Forty seven percent of all respondents stored the endodontic instruments in autoclave packages after sterilization whereas 53% stored them at endodontic containers (i.e. endo-boxes).

None of the practitioners used endodontic files as a disposable instrument. Fifty three percent of the respondents reported discarding the instrument only when there was a visible deformation on it.

After treating patients with a high cross-transmission risk, 64.7% of practitioners reported discarding the instruments afterwards, with only 5.9% sterilising them before disposal. There was a wide variation in the protocols for discarding

endodontic instruments; 47% discarded them at sharps disposal containers, 23.5% at non-medical waste containers, the remainders did not specify the type of containers they disposed the instruments to. None of the practitioners sterilized the instruments before disposal. Only 35.3% of sterilisers in dental practices were calibrated and controlled regularly.

Of the sixty endodontic instruments collected from the general dental practices, twelve instruments (20%) produced growth on BHI agar. The infected instruments consisted of six Hedström files, five rotary instruments and one lentulo spiral (Figure 1). The number of infected Hedström files were significantly greater than the number of infected lentulo spirals (p<0.05).

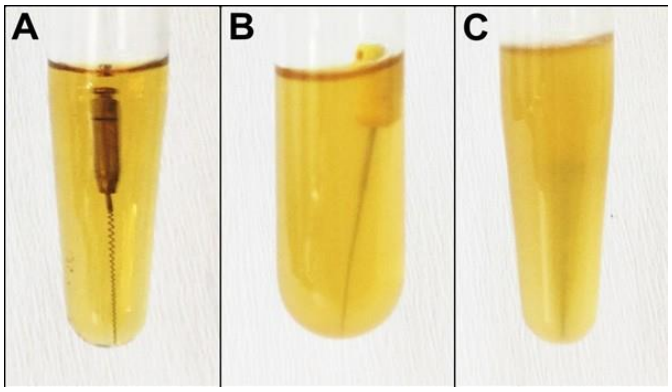

Figure 1: Microbiological evaluation of endodontic files demonstrated: A) A sterile lentulo spiral B) An infected stainless steel instrument C) A heavily infected nickel titanium rotary instrument.

DISCUSSION

As in the majority of dental practices endodontic files are considered as re-usable instruments, their cleaning and sterilization is of paramount importance.[4] The results of this preliminary study showed that of the 60 reprocessed instruments collected from general dental practices in Istanbul, 20% were found infected.

There has been little evaluation of the efficacy of cleaning procedures used for reprocessed endodontic files. In 1977, Segall et al.[8] reported that manual cleaning procedures were ineffective in producing completely clean files. In 1990, Murgel et al.[9] also confirmed this finding. In 2002, Smith et al.[10] reported that neither hand brushing or ultrasonic cleaning completely removed the biological material on endodontic instruments. Letters et al.[11] examined 250 reprocessed endodontic files gathered from general dental practice and reported that 75% showed some degree of visual contamination and 7% tested positive for residual blood. In a similar study, Popovic et al.[12] demonstrated residual debris in 96% of reprocessed instruments. The methods for decontaminating endodontic instruments that are routinely applied in dental practices are generally ineffective in removing biological debris.[12] The results of these studies are also in accordance with our findings.

The highest number of infected files were of Hedström files followed by rotary files. Rotary files have a tendency to retain cultivable bacteria even after the ultrasonic cleaning was performed.[1] The aggressive action of the rotary files induces the packing of biological debris into the flutes, and the retention of biological debris protects the bacteria from the antibacterial mechanisms, in particular, the ultrasonic cleaning solution.[1] However, in another study, Van Eldik et al.[13] reported that the rotary files had a lower surface area of biological debris than the Hedström files after cleaning in the ultrasonic bath using a perforated container to hold the files. The number of infected Hedström files (6) and rotary files (5) are close and they are not statistically significant. Out of 20 lentulo spirals, one was detected as infected. Aasim et al.[4] reported that ultrasonic cleaning did not appear to have any effect on calcium hydroxide and that further research was needed to clarify the most efficient method of removing this commonly used interappointment dressing from endodontic instruments. These findings confirm that the endodontic instruments with complex surface structure are difficult to clean even after different type of disinfection methods applied. Also, Kazemi et al.[14] reported that endodontic files deteriorated when machining dentin and suggested that endodontic files be disposable.

Reprocessed endodontic instruments should be kept in sealed packages. GDPs must make sure to reclean, repack, and resterilize any instrument package that has been compromised.[15] However, the majority (53%) of respondents stored the endodontic instruments in endodontic containers (i.e. endo-boxes) and did not specify if these containers

were covered with a lid or not.

Although transmission of bloodborne pathogens (e.g., HBV, HCV, and HIV) in dental health-care settings can have serious consequences, such transmission is rare. Exposure to infected blood can result in cross-transmission from patient to GDP, from GDP to patient, and from one patient to another. The opportunity for transmission is greatest from patient to GDP, who frequently encounter patient blood and blood-contaminated saliva during dental procedures.[15] Patients infected with HBV can only transmit the virus for as long as they are HBsAg-positive. HBsAg is found in multiple other body fluids, including breast milk, bile, cerebrospinal fluid, feces, nasopharyngeal washings, saliva, semen, sweat, and synovial fluid.[15] Thus, it is strictly recommended for GDPs to wear indicated personal protective equipment (PPE-gowns, gloves, mask) on entry into the patient's room for patients who are on Contact and/or Droplet Precautions, because the nature of the interaction with the patient cannot be predicted with certainty, and contaminated surfaces are important sources for transmission of pathogens.[16] The transmission of bacterial and viral diseases via endodontic files can be reduced to negligible levels by careful handling and standard infection control procedures.[13] However, nearly 30% of respondents to our survey reported that they reprocess and re-use the instruments after treating a patient with a high cross-transmission risk. Since 20% of the reprocessed endodontic files were found infected, GDPs should consider items difficult to clean (e.g., endodontic files, broaches, and carbide and diamond burs) as single-use disposables and discard after one use.

Although complete removal of organic material from rotary nickel-titanium files can be achieved using a combination of cleaning procedures (moist storage, brushing followed by immersion in 1% sodium hypochlorite, ultrasonic cleaning), it requires a meticulous technique.[2] Unfortunately, cleaning techniques vary with each individual. Adequate infection control protocols require a cleaning procedure that produces consistent and effective cleaning of endodontic instruments so that there would be less reliance on subjective assessment.[13] For instruments that are difficult to clean because of their complex design, however, unless more reliable cleaning methods become available, then reprocessing will remain a procedure of uncertain quality.

CONCLUSIONS

There have been variations in decontamination methods reported and applied. The methods used to clean endodontic instruments appear to be generally ineffective for the complete sterility. As a result, potentially infective material could be transmitted from an infected individual to other patients. These instruments should be viewed as single-use devices, unless significantly more efficient cleaning processes can be validated for use in general dental practice.

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