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SHORT REPORT

Contaminated dental instruments

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Summary: There is current concern in the UK over the possible transmission of prions via contaminated surgical instruments. Some dental instruments (endodontic files) raise particular concerns by virtue of their intimate contact with terminal branches of the trigeminal nerve. A visual assessment using a dissecting light microscope and scanning electron microscopy of endodontic files after clinical use and subsequent decontamination was performed. The instruments examined were collected from general dental practices and from a dental hospital. Seventy-six per cent (22/29) of the files retrieved from general dental practices remained visibly contaminated, compared with 14% (5/37) from the dental hospital. Current methods for decontaminating endodontic instruments used in dentistry may be of an insufficient standard to completely remove biological material. Improved cleaning methods and the feasibility of single use endodontic instruments require further investigation.

Keywords: CJD; prions; decontamination; endodontics; dentistry.

Introduction

Following concern over the currently unquantified risk of iatrogenic transmission of variant creutzfeldt-Jakob disease (vCJD), the UK Department of Health has emphasized the importance of following published guidelines on the cleaning and sterilization of medical devices.[1] There is evidence that classic sporadic CJD can be transmitted via certain medical procedures.[2] In the light of the wider tissue distribution of the agent of vCJD, consideration is now being given to the possible risks of transmission via re-usable devices, particularly if these are difficult to clean. For example, attention has recently been drawn to the possible role of diathermy pencils in prion transmission.[3] Within dentistry, there is particular concern that endodontic treatment (root canal therapy) may present a risk of transmission by virtue of the intimate contact of endodontic instruments with peripheral branches of the trigeminal nerve. Endodontic instruments are used to remove dental pulpal tissue and to clean and shape the root canal system prior to filling. These instruments are typically of a small size (approximately 25 mm in length and tapered to a tip diameter of 0.08 mm to 0.8 mm) and have spiral cutting edges. Within UK dentistry these instruments are typically recycled after use.[4] Whilst current data suggest that prion proteins cannot be detected in pulpal tissue from patients with sporadic CJD, it is unknown whether the agent of vCJD is present in dental pulps.[5] Furthermore, work using a hamster model has suggested that there is the potential for onward transmission of scrapie agent via the dental route.[6] The aim of this study was to investigate the efficacy of current decontamination processes applied to endodontic instruments.

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Methods

General dental practitioners from seven general dental practices were invited to submit endodontic

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Table I *Scoring system for visual assessment of the degree of contamination of dental endodontic files*

Extent of contamination	Score
Debris found on >75% instrument length	++++
Debris found on 50–75% instrument length	+++
Debris found on 25–50% instrument length	++
Debris found on 1–25% instrument length	+
No debris visible at low or high power	0

files that had been used, decontaminated using normal practices and were ready for subsequent re-use. A larger number of used files that had been decontaminated were collected from Glasgow Dental Hospital. No information was available on the total number of times each instrument had been through decontamination cycles on previous occasions.

Files were visually examined for the presence of debris by two independent examiners using the scoring system shown in Table I. All files were viewed under a dissecting microscope (Wild M3Z-Heerbrugg, Switzeland) at ×16 magnification, which permitted visualization of the whole length of each file. Confirmation of contamination was obtained by viewing at ×40 magnification. A random selection of files ($N = 10$) were also viewed with a scanning electron microscope (SEM). The files were cut into pieces approximately 10 mm long and put on to SEM stubs using adhesive carbon discs (Agar Scientific Ltd, Stansted, Essex, UK). They were then viewed directly in a JEOL JSM-T100 SEM. Digital images were collected using analysis software with ADDA 11 SEM interface. Images were taken at 50–200× magnification.

Results

The results (Table II) demonstrate that a large number of files remained visibly contaminated following the decontamination process. In total, 76% ($N = 22/29$) of the instruments from general practice and 14% ($N = 5/37$) from a dental hospital showed evidence of surface debris. There were no details of the age of the files or number of times the instrument had been re-used. The endodontic files from general practice, however, were cleaned by hand brushing prior to autoclaving. The files from the dental hospital were decontaminated by immersion in a proprietary detergent agent within an ultrasonic bath for 6 min and autoclaved twice. A photomicrograph and scanning electron micrograph of a grossly contaminated endodontic file are shown in Figures 1 and 2.

Table II *Results of visual contamination of endodontic files*

Location	Number of files examined	Contamination score
Practice A	5	All files = ++++
Practice B	8	3 files = +
		1 file = ++
		1 file = +++
		2 files = ++++
Practice C	3	1 file = 0
		2 files = +
Practice D	3	1 file = 0
		2 files = +
Practice E	4	3 files = 0
		1 file = +
Practice F	3	3 files = +
Practice G	4	2 files = 0
		2 files = +
Dental hospital	37	32 files = 0
		2 files = +
		1 file = ++
		1 file = +++
		1 file = ++++

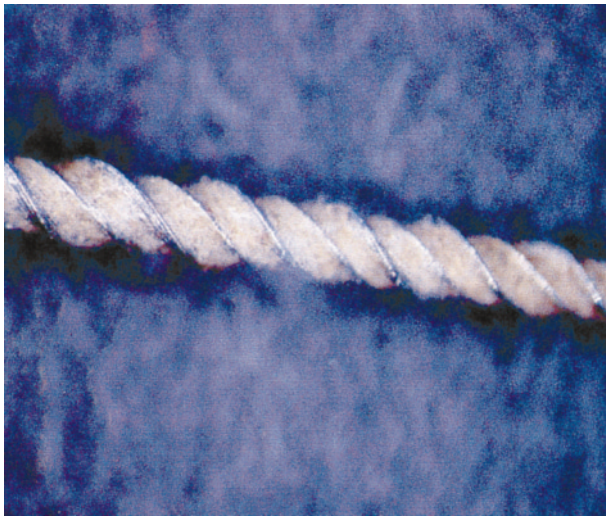

Figure 1 Photomicrograph of contaminated endodontic file. File (size 35) from general dental practice. Magnification ×16.

Discussion

Current advice from the Department of Health on the risks of transmission of vCJD via surgical instruments is that the effectiveness of routine instrument decontamination should be of the highest standard to minimize the risks of transmission.[1] There are no currently available data on the levels of

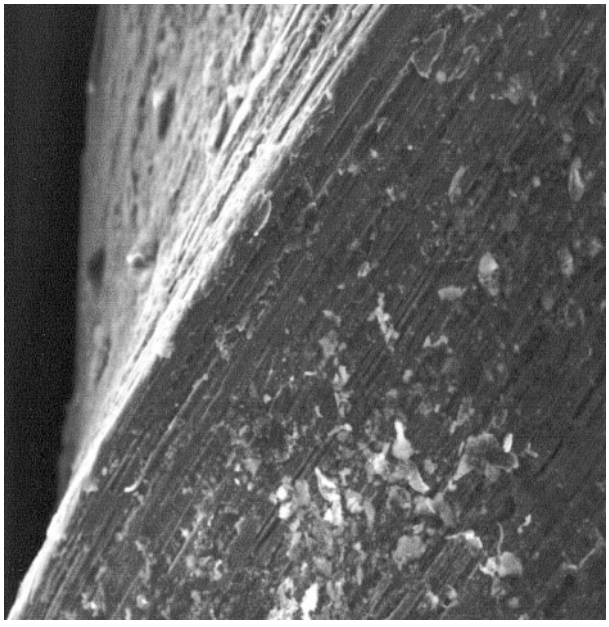

Figure 2 Scanning electron microscope view of contaminated endodontic file. File (size 35) from general dental practice. Magnification ×500.

prion proteins from the oral cavity in vCJD cases. Endodontic instruments were selected because of their potential for direct contact with peripheral nervous tissue, and because they may present difficulties in adequate decontamination by virtue of their design. Over one million endodontic operations are performed each year in England and Wales. Thus, even if endodontic procedures represent a relatively low risk, the large number of these interventions increases the chance of an adverse event occurring. The results of this small study suggest that current methods of decontamination of endodontic instruments used in some dental practices and dental hospital settings may be of insufficient standard to guarantee complete removal of debris. This is probably due to the difficulties in gaining adequate access to the intricate surface topography of these devices, by virtue of their small size and serrated edges. In a recent survey of decontamination practices used by UK general dental practitioners, 88% (288/327) re-processed endodontic files after use.[4] The use of an ultrasonic bath as part of the cleaning process was performed by 63% (207/327) and hand brushing was an element of cleaning reported by 91% (297) of those responding.[4]

Even the use of more stringent decontamination regimens by the central sterilization unit in a dental hospital, however, still resulted in a small number of files with visible contamination. These findings are more worrying in the light of recent work suggesting the adsorption of sufficient scrapie agent on to stainless steel surfaces to cause infection, despite prior washing and formaldehyde treatment.[7]

In conclusion, this study has demonstrated a significant degree of visible residual contamination of endodontic files following routine decontamination. A comparison of cleaning methods for application to endodontic instruments would be very valuable. For instruments that are difficult to clean by virtue of design, however, a cost–benefit analysis should be performed to assess their suitability for single use. This approach should certainly be examined in relation to endodontic instruments. If adopted, it would reduce the risk of transmission of all infectious agents, not just prion proteins.

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