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**SCIENTIFIC
SECTION**

Molar Band Re-use and Decontamination: a survey of specialists

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Objective: To determine the pattern of use and re-use of orthodontic molar bands, and examine infection control measures in a sample of UK orthodontists.

Design: Questionnaire survey.

Subjects and methods: Questionnaires were sent to 204 individuals selected at random from the UK Specialist Orthodontist list. Follow-up questionnaires were sent to those that had not replied within 8 weeks. An overall response rate of 74.5% was achieved.

Main outcome measures: Orthodontic band use and re-use and cross-infection control.

Results: The reported rates of pre-sterilization cleaning and sterilization of orthodontic instruments were 92 and 100%, respectively. Of the respondents, 90% were using bands for molar teeth with the remainder routinely used bonded attachments. Most clinicians (95%) using bands routinely re-used them after being tried-in with 5% discarding them. Pre-sterilization cleaning of re-used molar bands was carried out by 92% of respondents who reclaimed bands. Sterilization of these bands was then carried out by most specialists apart from 2.

Conclusions: The majority of UK specialist orthodontists who responded to the questionnaire are adhering to universal precautions for cross-infection control and are carrying out approved decontamination procedures. The majority are also re-using orthodontic bands that have been tried in the mouth, but found to be the wrong size. The great diversity of reported procedures for decontamination of instruments and bands suggest that more research is required to provide guidelines into the most effective method.

Key words: Decontamination, orthodontics, survey molar bands

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Introduction

The placement of bands on molar and premolar teeth is a common orthodontic practice; however, several bands may be used on a patient before an accurate fit is obtained. The discarding of bands that have been tried in the mouth and found to be the incorrect size would have enormous cost implications to the NHS, but there are few guidelines concerning the necessary procedures to adequately clean and sterilize the bands for re-use.

The dental profession has introduced universal precautions to address the issue of cross-infection control;¹ therefore, all patients should be treated as if they were potentially infectious. It is a legal, as well as an ethical and professional responsibility of practising clinicians to

ensure that all equipment that has been in actual or potential contact with oral or other body fluids is disposed of following recommended guidelines; or, if re-used, undergoes an adequate sterilization procedure to enable total destruction or denaturation of potentially harmful micro-organisms and other contaminants.

There are 3 stages to the decontamination process:¹

- pre-sterilization cleaning;
- sterilization;
- storage.

Recommendations for the initial cleaning process include removal of the contaminant by hand, the use of an ultrasonic bath and disinfectant, enzyme-based cleaning solution or instrument washer. Current

guidelines¹ advocate the use of the steam autoclave as the method of choice for sterilization of all dental instruments.

Orthodontists have been found to be less compliant with recommended cross-infection control procedures than both general dentists² and other dental specialties.³ A previous survey⁴ of 189 British orthodontists found that 41% were sterilizing bands with gluteraldehyde.

The aims of this investigation were to determine the pattern and extent of re-use of molar bands following try-in, and the methods used for their cleaning and sterilization in a sample of UK orthodontists. In addition, the general infection control measures relevant to safe orthodontic practice were examined and compared with current guidelines.

Materials and methods

Study group selection

The study sample was chosen from the 1018 specialist orthodontic practitioners whose names appear in the specialist register held by the General Dental Council in the UK. The sample size was based on an anticipated response rate of 70% from specialist orthodontic practitioners and comprised of 204 individuals chosen using a random method in which the list was split into blocks of 5 names, and a random number table was used to choose which practitioner was included.

Questionnaire

A 25-item self-reported questionnaire was designed. Questions were divided into 3 sub-sections. The first section assessed demographics to determine the sample population characteristics. The second section inquired into general cross-infection control procedures including cleaning, sterilization and training to assess the general level of compliance. The third section dealt with the pattern of orthodontic band use and re-use following size determination.

Initially, the questionnaire was pre-piloted prior to seeking ethical approval, which was obtained (South Sheffield Research Ethics Committee, Reference Number SSREC/03/189). A small pilot study was then carried out involving 6 specialist orthodontic practitioners to assess the acceptability of the questionnaire, which was modified following constructive suggestions.

Specialist orthodontists were allocated a coding to aid identification of responses and facilitate follow-up mailing to those who didn't respond initially. In December 2003, the questionnaire, a covering letter and a stamped addressed envelope were mailed to the

sample individuals. Each letter was addressed personally and signed. Emphasis was placed on the importance of practice-based research to support their clinical decisions. Replies were collected over an 8-week period and a duplicate questionnaire with modified covering letter and new stamped address envelope posted to those who failed to respond to the initial request. The second batch was distributed in February 2004 and replies were collected over a further 8-week period.

Data handling and statistical analysis

Data collected were entered into Microsoft Excel. Twenty questionnaires were chosen at random and were rechecked to verify accuracy of data entry. Data analysis involved descriptive statistics. The differences in the responses between the early and late responders was judged using a Pearson's chi-squared test.⁵ Non-response bias was not assessed, as the overall response rate was considered satisfactory, and because the differences between the early and late responders were minimal. This suggests that the non-response bias was unlikely to be a significant.⁵

Results

Figure 1 shows a flow diagram outlining the response rate at each stage of the survey. A total of 152 questionnaires were returned representing a response rate of 74.5%. During the initial 8-week data collection period, 111 replies were received with a further 41 during a subsequent follow-up period. Five respondents stated that they were no longer carrying out active orthodontic treatment; therefore, a total of 147 responses (65% male and 35% female) were assessed (Figure 1). No significant differences were identified among responses received within the first 8 weeks (early respondents) and those received after follow-up (late respondents), except early responders were statistically more likely to have attended a recent course on cross-infection control than late responders (41% compared with 23%).

Demographic data

The mean year of basic dental qualification was 1979 (range 1959–1995). No obvious differences were observed between those whose basic training was less than or equal to 20 years ago and those who had been qualified more than 20 years. The majority of respondents (91%) had a specialist orthodontic qualification and 50% also held the equivalent of a masters degree. The average

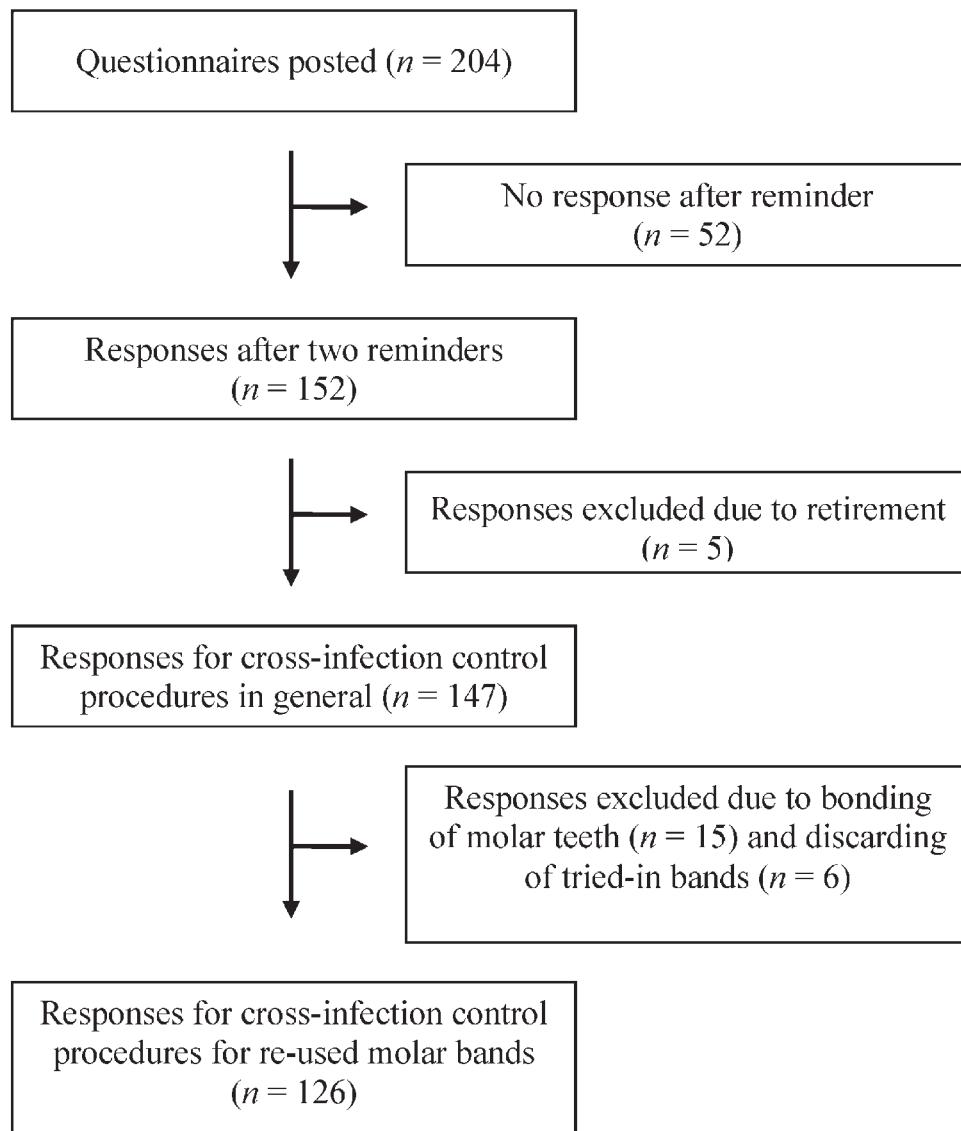


Figure 1 Numbers of responses at each stage of the survey and reasons for exclusion

year of qualification for M.Orth. was 1994 (range 1986–2002) and for D.Orth. was 1981 (range 1963–1993).

The majority (62%) worked primarily in specialist orthodontic practice, 32% spent most of their time within the hospital service and the remainder (6%) worked in the community service. The majority of respondents (67%) provided a combination of both NHS and private care; however, 31% were providing care solely within the NHS and only 2% were solely private. The number of cases completed on average per year was 243 with a range of 15–1000. These are similar proportions to a recent national survey of the orthodontic workforce⁶ and, therefore, should be an accurate representation of the profession.

General infection control procedures

Routine wearing of gloves and facemasks by all members of the dental team was used as a measure of compliance with established cross-infection control measures. There was excellent observance with glove wearing as 97% of respondents stated that all members of their team routinely wore gloves; however, only 33% complied with facemask wear. With regard to eye protection, 91% said that they routinely provided this for patients, whereas 76% of orthodontists and only 44% of assisting nurses routinely used it.

The vast majority of clinicians provided their dental nurses with training in cross-infection control (99%).

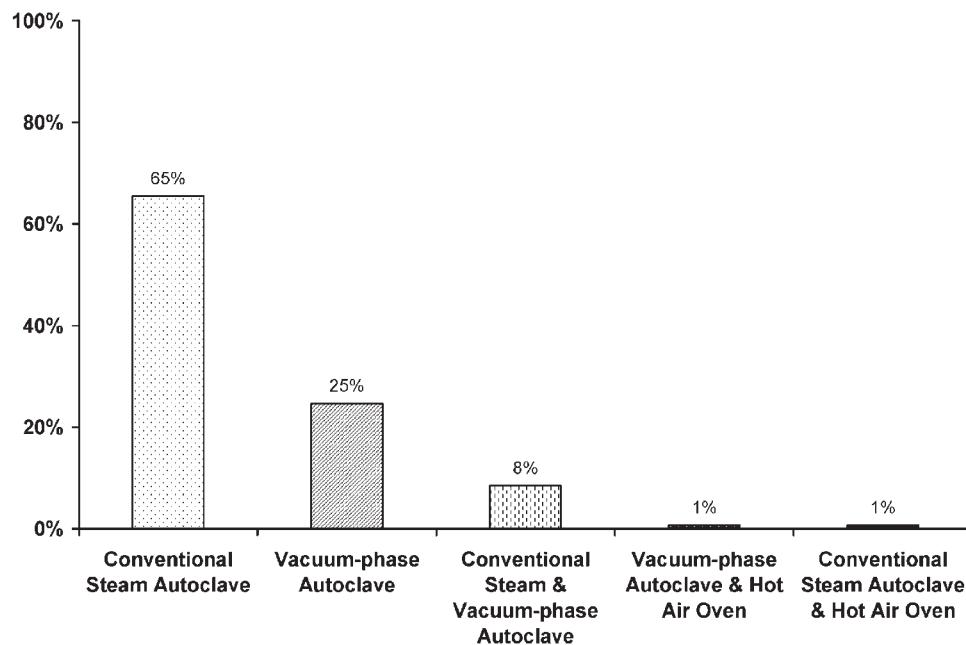


Figure 2 General sterilization methods used by specialist orthodontists for orthodontic instruments (x axis=methods used by respondents; y axis=% respondents)

This was usually from another dental nurse (83%), but 61% responded that their nurses also went on a postgraduate course. Over half of specialists (58%) also reported being involved in cross-infection control training, although only a minority had attended a recent course or meeting concerned with cross-infection control (36%), with an average time lapse of 9.0 months (range 1–36 months).

General decontamination procedures

The reported rate of pre-sterilization cleaning of orthodontic instruments was 92%. Seven individuals (5%) stated that they did not carry out any pre-sterilization cleaning with the remainder not stipulating.

There were a large variety of different methods of pre-sterilization cleaning outlined. The majority of those who carried out a pre-sterilization cleaning were using an ultrasonic cleaner (47%), a washer/disinfector (13%) or a combination of the two (14%). A minority (24%) were relying on a pre-soak or hand washing only.

All the people who responded to the questionnaire were carrying out sterilization of orthodontic instruments, although 5 people gave no response to this question. The methods of sterilization used by the respondents are shown in Figure 2. All respondents were using an acceptable method of sterilization. The commonest method was a conventional steam autoclave (65%), followed by a vacuum-phase autoclave (23%) and

8% stated that they were using a combination of conventional steam autoclave and vacuum-phase autoclave. Hot air ovens are no longer considered a satisfactory method for sterilizing dental instruments and no one in this survey was using a hot air oven alone, however 2 respondents were using the hot air oven in combination with a steam autoclave or a vacuum phase autoclave.

Orthodontic band re-use and decontamination

The majority of respondents (90%) were using bands for molar teeth. Fifteen individuals (10%) reported that they routinely used bonded attachments and were therefore excluded from the rest of the survey.

The majority of clinicians who banded molars routinely re-used the bands after they had been tried-in in the mouth and found to be the wrong size (95%). Six clinicians stated that they discarded the bands, 4 of these individuals worked in the hospital environment with the remaining 2 working in specialist practice. Three respondents reported that they used plain bands without any buccal tube attachments and all discarded these bands. Three respondents also discarded bands with buccal tube attachments after they had been tried-in.

Pre-sterilization cleaning of re-used molar bands was carried out by 92% of respondents who reclaimed bands. Once again there was a great diversity of methods (Table 1). The majority of clinicians used an ultrasonic

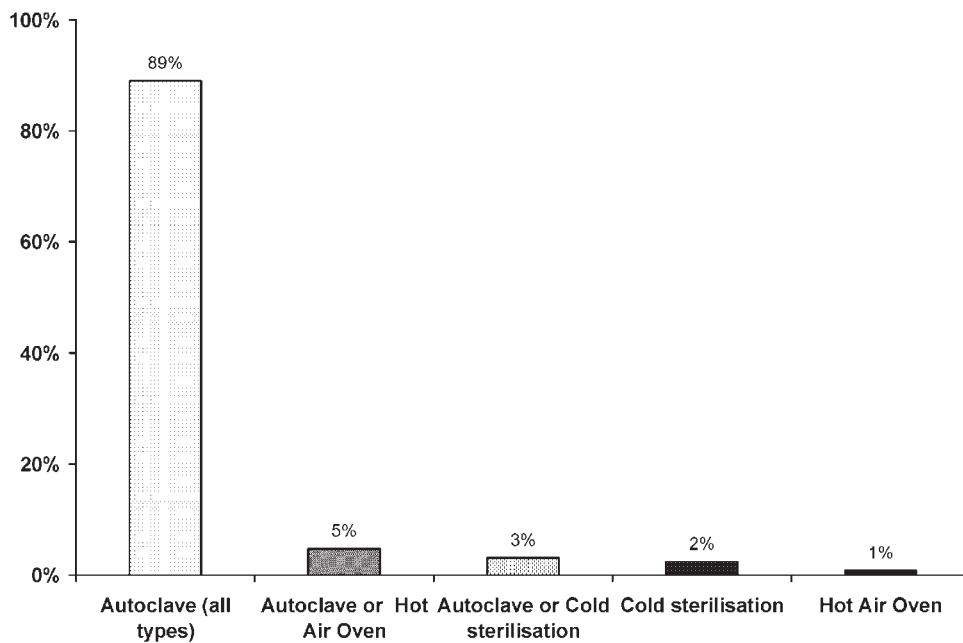


Figure 3 Methods used for sterilizing re-used bands by specialist orthodontists (x axis=methods used by respondents; y axis=% respondents)

cleaner either with/without a pre-soak or hand washing (42%). The next most popular form of pre-sterilization cleaning was a pre-soak or hand wash combination (30%), followed by a washer/disinfector (17%), and 7% used a combination of ultrasonic cleaner and washer disinfecter.

When asked if sterilization was routinely carried out on either plain bands or those with buccal tubes after try-in and before further use, 124 gave a positive response, but 2 individuals stated that this was not

common practice, therefore implying that sterilization was not carried out routinely on tried-in bands.

The majority of respondents were using either a conventional steam or vacuum-phase autoclave (89%) to sterilize their re-used bands (Figure 3); however, the remaining respondents were using sterilization procedures that are no longer recommended for dental instruments.¹

Figure 4 shows the factors determining re-use of tried-in molar bands. The majority of respondents (86%)

Table 1 Diversity of methods used to clean re-used bands before sterilization

Pre-sterilization cleaning method	n	%
Pre-soak only	5	4
Hand cleaning only	16	13
Pre-soak, hand cleaning	15	13
Ultrasonic cleaner only	21	18
Hand cleaning, ultrasonic cleaner	16	13
Pre-soak, hand cleaning, ultrasonic cleaner	13	11
Washer/disinfector only	6	6
Pre-soak, washer/disinfector	4	4
Hand cleaning, washer/disinfector	4	3
Pre-soak, hand cleaning, washer/disinfector	5	4
Ultrasonic cleaner, washer/disinfector	3	3
Hand cleaning, ultrasonic cleaner, washer/disinfector	1	1
Pre-soak, hand cleaning, ultrasonic cleaner, washer/disinfector	3	3
Not stated	5	4
Total	117	100%

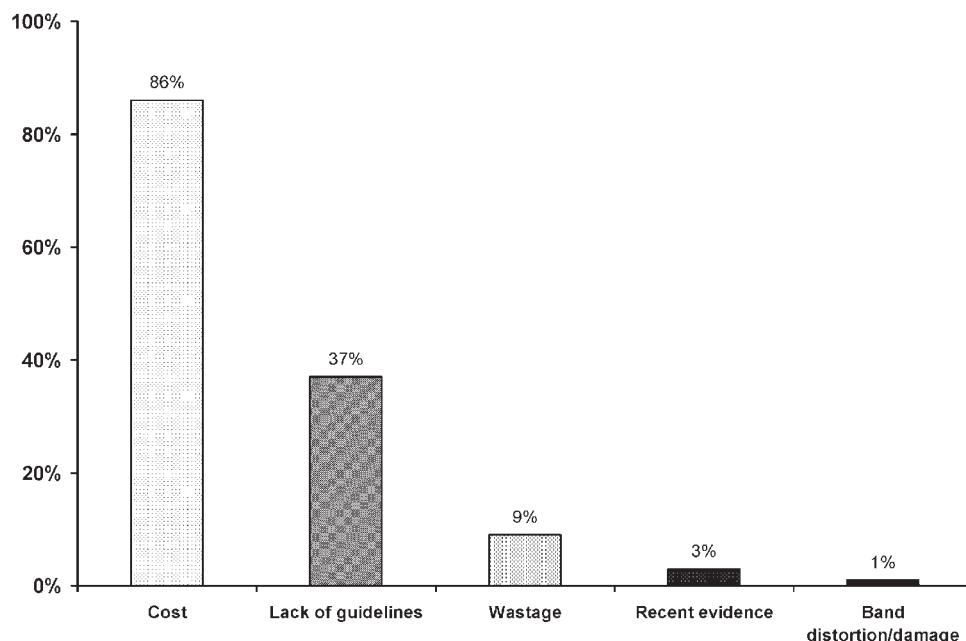


Figure 4 Reasons given by specialists for not discarding orthodontic molar bands after trying them for size (more than one answered allowed) (*x* axis=methods used by respondents; *y* axis=% respondents)

thought cost was an important factor deterring them from discarding bands. The next most important factor was lack of guidelines (37%), followed by wastage (9%), recent evidence suggesting that there is no cross-infection risk (3%) and how distorted/damaged the band was (1%).

Discussion

This survey of British specialist orthodontists has found that most are using and re-using bands for molar teeth. The majority were cleaning and sterilizing their bands according to current guidelines before re-use, but there was a great diversity of methods, showing that there is no consensus on the best way to achieve decontamination.

Compliance with general cross-infection control guidelines was generally good within this group. The reported proportion of members of the dental team wearing gloves for all patients was 97%. This shows that there has been a considerable improvement in glove wearing over 15 years as Evans⁴ found only 21% of British orthodontists wore gloves for all patients and 33% never wore gloves. This figure is also comparable with a recent report that 91% of Scottish general dental practitioners⁷ wore gloves for all procedures.

Compliance with the wearing of masks and eye protection for clinicians, especially dental nursing assistants was lower than with glove wearing, although

eye protection was provided for the majority of patients. McCarthy *et al.*² found that orthodontists in Canada were significantly less likely than general dentists to change gloves after every patient, wear masks and use protective eyewear. They suggest that this was because orthodontists believe that they are less frequently exposed to aerosols and spatter; however, 18% of orthodontists in their survey reported blood splashes to the eyes, nose or mouth in the previous year, indicating the need to wear protection for these areas.

Woo *et al.*⁸ suggest that orthodontists believe they are at a lower risk for infectious disease than other dentists because they treat mainly children and adolescents, who are less likely to be infectious. However, this is contrary to the principle of universal precautions, which perceives all patients to be potentially infectious and, therefore, should be treated in the same way. There is also a change in the profile of patients presenting for orthodontic treatment, with more adults being prepared to wear appliances.

The vast majority of orthodontists provide training in cross-infection control to their staff and many get involved in the training personally. This compares favorably with the 92% of Scottish GPs who provide formal training for their nurses.⁷

The majority of orthodontists in the survey were complying with the decontamination guidelines for their instruments.¹ It is considered essential to remove blood and saliva before placement in an autoclave otherwise

the effectiveness of the sterilization procedure is reduced. Nearly half of respondents were using an ultrasonic cleaner to pre-wash instruments before sterilization. It is of interest that Lowe *et al.*⁷ found no GDCPs in their survey were using the newer and more effective washer disinfectors for pre-sterilization cleaning; however, more than one in 4 orthodontists were using them either alone or with an ultrasonic cleaner. Nearly one-quarter of the respondents were relying on a pre-soak or hand washing to clean the instruments. Ultrasonic cleaners and washer disinfectors are considered more efficient and reduce the risk of needlestick injuries.¹

All the responders to this survey reported sterilizing their instruments and also declared that they were using either a conventional downward displacement autoclave or the newer vacuum-phase autoclave, which are the methods of choice.¹ None was using a hot air oven, chemical or ultraviolet methods, which are no longer considered acceptable methods for sterilizing dental instruments. The results of this survey compare very favorably with that of McCarthy *et al.*² who found that only 46% of Canadian orthodontists were used an autoclave compared with 72% of general dentists, and the remainder were using either chemical sterilization or disinfection and dry heat. They suggest that orthodontists were reluctant to use a steam autoclave because it can cause rusting and corrosion of orthodontic pliers and dulling of cutting edges.

The majority of respondents were using and re-using bands. Only 5% reported that they threw away bands that had been tried-in the mouth and, therefore, used new bands for every patient. This compares with 7% of GDCPs who used a new matrix band for every patient.⁷ The main barrier to discarding tried-in molar bands was cost, as it was with the GDCPs, who were also concerned about the time it takes to replace matrix bands.

Three clinicians reported that they were using plain bands because of the potential problems of sterilizing the lumen and headgear tube of the bracket. A recent study⁹ has found that there was no bacterial growth from bands that had been tried-in the mouth, cleaned by immersion in an enzymatic disinfectant and sterilized in a bench top steam autoclave. They concluded there was little risk of cross-infection from the re-use of bands that have been adequately cleaned and sterilized. It therefore seems unnecessary to use plain bands or discard tried-in bands.

There was a wide diversity of methods employed for the decontamination of bands, showing a lack of research to enable clear guidance to be provided in this area. It was also found that 7% of respondents were not using an approved method of pre-sterilization all of the

time. The method of pre-sterilization cleaning is important in determining how well the blood and saliva are removed from the band, and therefore how effective the sterilization procedure is. Lowe *et al.*¹⁰ found that following ultrasonic cleaning 6% of matrix bands were found to be contaminated with blood compared with 34% of hand scrubbed matrix bands. More research is required to determine the most effective methods of decontaminating molar bands and to help formulate guidelines for effective practice.

The situation of re-using tried-in molar bands is complicated by the fact that they are marked for single use only. The Medical Devices Agency defines re-use as 'repeated episodes of use of a device in circumstances that make some form of reprocessing necessary'.¹¹ Manufacturers mark orthodontic bands with the CE mark. The initials 'CE' do not stand for anything, but are a declaration by the manufacturer that the product meets all the appropriate provisions of the relevant legislation implementing the European Directive specific to that product. In the case of certain aspects of medical equipment this stipulates that it is for single use only. Trying-in of these bands for sizing purposes may constitute use and the subsequent sterilization and re-use may invalidate the CE mark. Manufacturers are now beginning to address this issue.

Difficulties with investigating the sensitive issues such as cross-infection control may encourage specialist practitioners to provide the perceived ideal response as opposed to report actual true-life practice. Unfortunately, this means that data relating to compliance with existing regulations may be flawed. To ensure that data are more accurate the individuals could be observed in their day-to-day practice. This would be time-consuming, but also might alter practice if the practitioners were aware of the nature of the study. We hope to have addressed this issue by ensuring that all replies have been analysed anonymously.

Conclusion

- The majority of UK specialist orthodontists who responded to the questionnaire are adhering to universal precautions for cross-infection control with regard to the wearing of gloves for the treatment of patients, but not the wearing of masks or eye protection particularly for their dental nurses.
- The majority are re-using orthodontic bands that have been tried-in the mouth, but not used for treatment.
- The majority are carrying out approved decontamination procedures; although the great diversity of procedures performed suggest that more research is

required to provide guidelines into the most effective method of decontamination.

Authors and contributors

Philip Benson was responsible for the original concept and initial literature review. Philip Benson and Paul Dowsing were both responsible for the design of the questionnaire, data analysis, writing of the article, critical revision of the paper and final approval of article. Paul Dowsing was responsible for questionnaire distribution, follow-up and data collection. Philip Benson is the guarantor.

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We would like to express our thanks to all the specialist orthodontic practitioners who completed and returned the questionnaire. A copy of the questionnaire used in this study is available from the authors (p.benson@sheffield.ac.uk).

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