Use of safety syringes for administration of local anaesthesia among a sample of UK primary care dental professionals

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Abstract

Background: Safer sharps devices (SSDs) are commercially available and their use is mandated through UK legislation. **Aim:** To identify the current usage of SSDs in UK primary care dentistry. **Method:** A cross-sectional survey was administered to delegates at the 2017 British Dental Association (BDA) Conference and Exhibition in Manchester, and at the 2017 BDA Scottish Conference and Exhibition in Glasgow. The survey covered a range of questions relating to sharps injuries and utilisation of traditional and safety syringes for delivery of local anaesthesia. Statistical analyses were conducted using SPSS Version 22 (IBM Corp., 2013) and included chi-square and Fisher's exact tests. **Results:** 796 delegates participated, of whom 396 (49.7%) were using safety syringes for delivery of local anaesthesia. Of the 166 participants who had experienced a sharps injury in the past year, 76 (46%) worked in facilities that most commonly used SSDs for delivery of local anaesthesia. **Conclusion:** Our results indicate that a significant number of dental practices in our sample have not adopted SSDs and suggest sharps injuries are still being sustained in some practices using SSDs. Further epidemiological research is required to provide strong evidence for effectiveness of SSDs and reasons why SSDs have not been fully adopted in UK primary dental care.

Introduction

Sharps injuries represent a significant occupational hazard for healthcare workers (HCW), with the attendant risk of acquiring a blood borne viral infection such as hepatitis B, hepatitis C or HIV[1, 2]. These incidents can engender severe stress and anxiety for the HCW[3] as well as significant financial costs to the employing organisation. There have been previous studies of sharps injuries among dentists,[2, 4, 5] which indicate that they represent one of the groups at particular risk. However, there have been no studies conducted since the introduction of the UK Sharps Injuries in Health Care Regulations in 2013[6] which require employers to assess the risk of injury from sharps devices and substitute traditional, unprotected medical sharps with a 'safer sharp' to minimize workers' blood exposure risk. This legislation applies to dentistry as it does to all other areas of healthcare.[7]

An interesting chronological description of the progressive policy changes in the USA to prevent HCW exposures to blood borne viruses (BBV) is provided by Jagger and colleagues[8] and emphasises the important role of safer sharps devices (SSDs). Use of the latter was mandated in the USA by the OSHA standard released in 1990 and promulgated in 1991,[9] resulting in a surge in adoption of SSDs in 2000 and 2001.[8] More recently, the UK has adopted the EU Directive (2010/32/EU) legislation through the introduction of the 2013 Health and Safety (Sharps Regulations in Healthcare) Regulations, which similarly mandate use of SSDs where it is reasonably practicable to do so.[6, 7]

SSDs for the administration of local anaesthesia in dentistry have been available for more than 25 years.[10, 11] In 1990, Cuny and colleagues evaluated four types of dental safety needles and syringes for clinical acceptability, but none of the devices tested passed their clinical evaluation and the authors concluded that they were no safer than traditional anaesthetic needles.[10] Shortly afterwards, a UK study described the introduction of SSDs into a dental school and demonstrated that when combined with the necessary education, the SSDs reduced the frequency of needle stick injuries.[11] A follow-up survey of UK dental schools published in 2003 suggested a low adoption rate which, at the time, was attributed to lack of education surrounding the ability of SSDs to reduce injuries and how to use them effectively.

Additionally, engineering issues associated with the new safety syringes in relation to differences between SSDs and traditional devices were also attributed to the low adoption rate due to the acceptability to the users.[12]

The aim of this study was to identify the current usage of SSDs among a sample of UK primary care dental professionals, given the requirements of current legislation.

Methods

Study design

A cross-sectional survey, delivered on tablet computers, was administered to delegates at the 2017 British Dental Association (BDA) Conference and Exhibition, which took place on the 25th - 27th May in Manchester, UK and at the 2017 BDA Scottish Conference and Exhibition on the 1st September in Glasgow, UK. Ethical approval was granted by the University of Glasgow College of Medical, Veterinary & Life Sciences Ethics Committee (Project No: 200160085).

Survey design

The survey was designed to ensure that it took no more than five minutes to complete. There were 15 questions, but the number of questions answered was contingent on each individual participant's responses, as not all were relevant in every case. It covered a range of questions relating to sharps injuries and utilisation of a variety of types of syringes for delivery of local anaesthesia in dentistry. For the question relating to the utilisation of syringes, participants were shown images of the types of syringes available and asked to indicate which was most commonly used in their practice. Informed consent was achieved through a question on the first screen of the survey. A summary of survey structure can be viewed in Table 1. This analysis focuses on the use of SSDs and other data are reported in a separate publication.

[Table 1. Summary of survey structure]

Study population and recruitment

The inclusion criteria for the study were any dental professional who was working solely in primary care, in the UK. Participants were recruited as they passed the investigators' conference stand. Before inviting a delegate to participate, survey assistants ensured that the delegate met the inclusion criteria by asking some preceding filter questions, in particular if they were working in primary care dentistry.

The sampling approach was opportunistic, as participation in the research was voluntary. However, a sample size calculation was carried out to determine the minimum sample size required, which was estimated at 337 delegates. This was based on the assumptions that there would be approximately 4500 primary care dental professionals in the target population (conference attendees), the highest level of variance (50/50 split) for main outcome measures and a 20% response rate; these were based on another research project which also collected survey responses through a stand at a conference.[13]

Data analysis

All statistical analyses were conducted using SPSS Version 22 (IBM Corp., 2013). Descriptive statistics were presented as frequencies, proportions and percentages, as appropriate. Categorical questionnaire responses were cross-tabulated to explore associations, and chi-squared / Fisher's exact tests were used to test the hypotheses that there were no differences in the number of sharps injuries or demographic differences between those respondents who worked in practices which most commonly used SSDs or traditional devices.

Results

A total of 811 delegates completed the survey, of whom 15 were excluded as they did not perform a clinical role, leaving a total of 796 valid responses. Total conference attendees numbered 2698, of whom 2311 (86%) were dental practitioners, 268 (9.9%) were dental nurses and 122 (4.5%) were hygienist/therapists. Thus, the sample represents 28% of the potentially available study population.

Sample demographics

Table 2 describes the demographics of the sample. The majority were dental practitioners (647; 81.3%), followed by dental nurses (112; 14.1%). Most (591; 85%) of the survey respondents practised in England, followed by Scotland (138; 17.3%), Wales (53; 6.7%), and Northern Ireland (n=14; 1.8%). The majority of survey respondents worked in practices which were either NHS only (345; 43.3%) or mostly NHS (195; 24.5%).

[Table 2. Summary of demographics of survey respondents (N=796)]

Use of safer sharps devices

In response to the question on which type of local anaesthetic delivery device was most commonly used in their work place, virtually equal proportions worked in practices where non-safety "traditional" devices (400; 50.3%) and SSDs (396; 49.7%) were the norm.

Table 3 provides a cross-tabulation of some of the key parameters relevant to use of these various types of device. A higher proportion of dental nurses (75; 67%) reported working in practices where SSDs were used most commonly, in contrast to dental practitioners (304; 47%) and dental hygienist / therapists (17; 45.9%). The introduction of SSDs was reported by fewer respondents from Scotland (51; 37%) than from the rest of the UK. Participants working in practices which performed 'mostly NHS' clinical work, were less likely to be using SSDs (146; 42.3%) than respondents working in practices that performed 'mostly private' treatment (49; 63.6%).

[Table 3. Cross-tabulation of type of anaesthetic kit most commonly used in practice by clinical role, area of the UK where respondent practises and structure of dental practice (N=796)]

Sharps injuries experienced by respondents in practices using safety syringes

Of the 166 respondents who had suffered a sharps injury in the past year, 90 (54%) worked in clinical facilities that were most commonly using non-safety local anaesthetic syringes and 76 (46%) in facilities that were most commonly using SSDs

(Table 4). Whilst slightly fewer injuries had occurred in the practices using the safety-engineered syringes, the difference was not statistically significant (p=0.266).

[Table 4. Cross-tabulation of anaesthetic kit most commonly used and number of sharps injuries experienced in the past year. N=166.]

Discussion

To our knowledge this is the first study of the uptake of SSDs for administration of local anaesthesia in primary care dentistry in the UK since the introduction of the Health & Safety Sharps Regulations in 2013. These regulations require employers to manage the risks from sharps injuries using a hierarchy of control measures, including the use of a 'safer sharp' where it is reasonably practicable to do so (Table 5).[6] The main findings were that approximately half of the study respondents were operating in clinics that most commonly used SSD anaesthetic syringes. A second interesting finding was that of the 166 respondents who had sustained a sharps injury in the past year, almost half worked in facilities that most commonly used SSDs. However, these are observations and further research is required to understand why SSDs have not been fully adopted (despite legislation) and the epidemiology of sharps injuries occurring while using SSDs.

There are a number of caveats to consider before discussing the implications of these findings. The participants included are a small proportion of the total number of dental professionals practising in primary care in the UK. Additionally, they were all attending a national dental conference and exhibition, demonstrating interest in knowledge enhancement and new products, so their responses may not be representative of dental professionals more widely. Furthermore, the results may not be representative of the UK as a whole as some devolved nations were more fully represented than others; however, collecting data from a conference in Scotland in addition to England may have helped to address this. In addition to representative bias, other potential causes of bias include non-response bias, since those who had experienced a sharps injury may have been more likely to participate, as well as recall bias in relation to history of previous sharps injuries. Thirdly, not all sharps injuries are caused by local anaesthetic needles, so a proportion of those reported

by participants may have had a different aetiology, for example an elevator slipping during an extraction. Nonetheless, there were clear strengths of this study. The recruitment method used was highly effective at generating the required sample size, as our final sample was approximately double what was required to detect a difference in proportion (based on an estimated sample size of 4500, 20% response rate and the highest level of variance (50/50 split). In addition, the recruitment technique also allowed for informal interactions with participants, which provided useful contextual information.

[Table 5. Hierarchy of prevention control measures outlined by the 2013 Sharps Regulations.[6]]

In dentistry, where it is not possible to avoid the use of sharps, employers are legally required to substitute traditional (non-safety) devices with an SSD where it is reasonably practicable to do so (Table 4).[6] Despite this, we found that 50% of respondents worked in practices which more commonly used traditional devices to perform local anaesthesia. This low adoption rate could be attributed to the perceived effectiveness of SSDs preventing injury. . A number of studies have reported apparent effectiveness of such devices in reducing sharps injuries,[14-17]. However, the overall evidence base is not as strong as it appears. In a review of published studies, Tuma and colleagues reported that of 17 studies which reported substantial decreases in percutaneous injuries after SSD adoption, most were uncontrolled before-after trials with little control for confounding factors and other interventions such as training.[18] Their conclusions were recently supported by a Cochrane systematic review which concluded that there was only very low quality evidence that most SSDs prevent needle stick injuries.[19] The review pointed out that many of the studies were subject to significant bias and called for cluster-randomised studies to compare safety devices for effectiveness and cost-effectiveness.[19]

In instances where employers opt to continue to use traditional devices, a documented risk assessment justifying this decision is required and must be reviewed regularly.[6] Furthermore, traditional devices may be preferred to SSDs due to ease of use related to engineering issues[19]. The design of SSDs is critical, and many dentists prefer the robustness of traditional metal local anaesthetic syringes, a

factor described anecdotally by some study respondents. This may, however, be less of an issue for younger generations of dentists, many of whom have been trained in dental schools that have adopted SSDs. Nonetheless, the current design of SSDs is unlikely to be perfect, with room for innovation and improvement, but this will only be achieved through their continued use and feedback from current users.

Other considerations mentioned in discussion with study participants who had not transitioned from traditional devices included the revenue costs associated with adopting SSDs, which are greater than those for traditional syringes. These relate not only to the purchase of the consumables, but also to disposal of the significantly greater volume of clinical waste generated. The latter is an important consideration posing ecological as well as local logistical challenges. However, it is also important to consider these costs in the context of the potential costs associated with sharps injuries in the work place.[20]

It is important to acknowledge that SSDs alone will not eliminate all sharps injuries, and rigorous adherence to Standard Operating Procedures on all aspects of infection control, supported by ongoing staff training and audit, are essential. We found that even in practices which most commonly used SSDs for local anaesthesia, sharps injuries still occurred. A caveat to this result is that it is possible that these injuries were sustained from traditional devices, as many respondents explained that both types of equipment were available in their practice for use. Further research is required to understand the context of injuries which are sustained from SSDs. For example, what type of injury occurred, and did the injury occur pre- or post-procedure? These are important questions, since SSDs are primarily designed to prevent injuries post-procedure, as they incorporate mechanical mechanisms that recap or eliminate the sharp point after use.[21] Another important area of research to consider is whether the HCW who sustained the injury had received the appropriate training. The issue of training is especially important for dental safety syringes,[11] since the safety features of the available devices require activation by the user and are therefore subject to operator error [20].

Thus, further research is essential before the true effectiveness of SSDs at preventing injuries becomes clear. This also highlights the importance of reporting

sharps injuries, which not only ensures that the HCW is appropriately followed up and managed, but also enables a proportionate investigation of the incident, to reduce the risk of similar incidents occurring in future. Finally, the investigation and collation of the context of injuries sustained from SSDs could lead to improved and more acceptable devices on the market.

Conclusions

In summary, our results suggest that a high proportion of UK dental practices in our sample have not fully adopted SSDs, and there is evidence suggesting that in those which have converted, sharps injuries are still being reported. Furthermore, there is a distinct lack of good quality evidence to support the hypothesis that SSDs are effective in reducing sharps injuries. Research is required to understand their effectiveness, and to encourage their use, an activity that will only be complete if the currently inadequate surveillance and reporting of sharps injuries in dental settings is improved.

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Conflicts of interest

No conflicts of interest.

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Table 1: Summary of survey structure.

Section	Description
1. Introduction/participant information	Participants were required to read this page placed at the start of the survey to provide information about the research.
2. Informed consent	Participants were required to provide informed consent through a survey question, and could not progress with the rest of the survey without answering this question.
3. Demographic information	Demographic questions were related to the area of the UK in which the participant practised, their clinical role and whether they mostly practised for the NHS or privately.
4. Prevalence and management of sharps injuries	Questions were related to their experience of sharps injuries, the procedure they would follow if they sustained an injury (e.g. did they report or seek medical advice, reasons for not reporting, where they sought medical advice and if they had follow up BBV testing)
5. Sharps safety policies, training and access to occupational health	Questions were related to whether their practice had a sharps safety policy, whether training had been received, whether access to occupational health support was available and, finally, the most commonly used device for delivery of local anaesthesia.

Table 2. Summary of demographics of survey respondents (N=796)

Variable	Respondents N (%)
Clinical role	
Dental practitioner	647 (81.3)
Dental nurse	112 (14.1)
Dental therapist/hygienist	37 (4.6)
Total	796 (100)
Area of UK where respondent practises	
England	591 (74.2)
Scotland	138 (17.3)
Wales	53 (6.7)
Northern Ireland	14 (1.8)
Total	796 (100)
Structure of dental practice	
NHS only	345 (43.3)
Mostly NHS	195 (24.5)
Equal amount NHS and private	113 (14.2)
Mostly private	77 (9.7)
Private only	66 (8.3)
Total	796 (100)
Number of sharps injuries experienced in the past year	
0 injuries	630 (79.1)
1 injury	133 (16.7)
≥ 2 injuries	33 (4.1)

Table 3. Cross-tabulation of type of anaesthetic kit most commonly used in practice by clinical role, area of the UK where respondent practises and structure of dental practice (N=796)

	Type of anesthetic kit most commonly used in practice N (%)		P-value
	Non-safety device	SSD	
Clinical role			
Dental practitioner	343 (53)	304 (47)	
Dental nurse	37 (33)	75 (67)	< 0.001
Dental therapist/hygienist	20 (54.1)	17 (45.9)	
Area of the UK where respondent practices			
Scotland	87 (63)	51 (37)	
England	283 (47.9)	308 (52.1)	0.011
Wales	24 (45.3)	29 (54.7)	
Northern Ireland	6 (42.9)	8 (57.1)	
Structure of dental practice			
NHS only	89 (45.6)	106 (54.4)	
Mostly NHS	199 (57.7)	146 (42.3)	
Equal amount NHS and private	53 (46.9)	60 (53.1)	0.003
Mostly private	28 (36.4)	49 (63.6)	
Private only	31 (47)	35 (53)	

Table 4. Cross-tabulation of anaesthetic kit most commonly used and number of sharps injuries experienced in the past year. N=166.

	Type of anaesthetic kit most commonly used in practice N (%)		P-value
	Non-safety device	SSD	
Number of injuries experienced in the past year			
1 injury	70 (52.6)	63 (47.4)	0.266
≥ 2 injuries	20 (60.6)	13 (39.4)	
Total	90 (54.2)	76 (45.8)	

Table 5. Hierarchy of prevention control measures outlined by the 2013 Sharps Regulations.[6]

Health and Safety (Sharps Instruments in Healthcare) Regulations 2013: Hierarchy of prevention control measures of sharps injuries in the work place.

- **Avoid the unnecessary use of sharps**: sharps instruments are only used when they are required. Needle-free equipment is available and should be used where it is reasonably practicable to do so.
- Where the use of sharps is felt to be unavoidable because of the nature of the procedure being undertaken (for example, local anaesthesia or oral surgery), **the employer must substitute traditional unprotected medical sharps with a 'safer sharp'** where it is reasonably practicable to do so.
- Employers should take steps to **prevent the recapping of needles.** Needles must not be recapped after use unless the employer's risk assessment has identified that recapping is itself required to prevent a risk (e.g. to reduce the risk of contamination of sterile preparations).
- In relation to the safe storage and disposal of sharps, employers should **provide prominent labelling of suitable secure containers in close proximity to the point of use.**
- Employers must be able to show they have taken steps to **ensure that all team members have been trained in the management of sharps**, whether those items are already in use or new designs have subsequently been introduced.