doi:10.1111/j.1365-2591.2007.01249.x

Accidental ingestion and aspiration of root canal instruments and other dental foreign bodies in a French population

G. Susini[1], L. Pommel[1] & J. Camps[2]

[1]Department of Operative Dentistry and Endodontics, UFR Odontologie, Marseille, France; and [2]Laboratoire IMEB, ERT 30, UFR Odontologie, Marseille, France

Abstract

Susini G, Pommel L, Camps J. Accidental ingestion and aspiration of root canal instruments and other dental foreign bodies in a French population. *International Endodontic Journal*, **40**, 585–589, 2007.

Aim To determine the incidence of aspiration and ingestion of endodontic instruments in France during root canal treatment without using rubber dam.

Methodology Data was provided by two insurance companies representing 24 651 French general dentists over 11 years. The type and number of accidents per year, the number of dental items involved and the percentage of occurrence of either aspiration or ingestion were reported. The incidence of accidental aspiration or ingestion was calculated. The need for hospitalization to remove the endodontic instruments and other dental items was reported and compared using chi square tests.

Results One endodontic instrument was aspirated and 57 were ingested. Forty-three other dental items were aspirated and 409 were ingested. For the endodontic instruments: the incidence of aspiration was 0.001 per 100 000 root canal treatments and the incidence of ingestion was 0.12 per 100 000 root canal treatments. The aspirated endodontic instruments and dental items required statistically more frequent hospitalization than the ingested items ($P < 0.0001$). The endodontic instruments did not require more frequent hospitalization than other dental items when aspirated (ns) and when ingested (ns). No fatal outcome was reported.

Conclusion The incidence of ingestion or aspiration of endodontic instruments was low even thought most general practitioners do not routinely use rubber dam. Use of rubber dam by general practitioners for endodontic procedures should be encouraged by stressing its advantages rather than the fear factor of accidents.

Keywords: aspiration, endodontic file, ingestion, rubber dam.

Received 12 February 2006; accepted 14 December 2006

Introduction

The use of rubber dam for root canal treatment is mandatory (European Society of Endodontology 1994). Undergraduate and postgraduate endodontic students are taught the importance of a rubber dam and how to place it (Carrotte 2004) under even the most difficult clinical conditions such as crownless or cone-shaped teeth (Greene *et al.* 1984). Alternatives to using rubber dam have been reported for patients allergic to latex (Patterson 1989, Kleier & Shibilski 1999, Kosti & Lambrianidis 2002). Given the bacterial origin of periradicular lesions (Kakehashi *et al.* 1965), it is important to prevent salivary contamination of the root canal space during treatment. Another important advantage of using rubber dam is protecting patients from ingesting (Taintor & Biesterfeld 1978, Govila 1979, Lambrianidis & Beltes 1996) or aspirating (Israel & Leban 1984) not only solvents and irrigants, but also endodontic or other dental instruments.

Correspondence: Doctor Jean Camps, Faculté d'Odontologie, 27 boulevard Jean Moulin, 13385 Marseille Cedex 5, France (Tel.: 33490564528; fax: 33490560918; e-mail: jcamps2035@aol.com).

Surveys undertaken in various countries report that most general practitioners do not use rubber dam when performing routine endodontic treatment: UK (Marshall & Page 1990, Whitworth *et al.* 2000, Jenkins *et al.* 2001), Denmark (Bjorndal & Reit 2005), Belgium (Slaus & Bottenberg 2002, Hommez *et al.* 2003), Sudan (Ahmed *et al.* 2000) and New-Zealand (Koshy & Chandler 2002). However, in a hospital environment where the present authors are asked to help physicians remove aspirated and ingested dental items under general anaesthesia, only a small number of endodontic instruments are encountered (Fig. 1). This experience corroborates the results of another study reporting on 62 patients requiring bronchoscopic removal of foreign bodies (Debeljak *et al.* 1999).

While undergoing dental treatment, patients have swallowed or inhaled endodontic instruments, crowns, burs and copper bands. Although there are published reports describing swallowing and aspirating dental items, none gave the incidence of these types of accidents. The purpose of this study is to report on the incidence of swallowing and aspirating endodontic instruments that occurred during root canal treatment carried out by general practitioners in France.

Materials and methods

The data was provided by two insurance companies representing 24 651 French general dentists over 11 years. For confidentiality reasons, the data only included the following information:

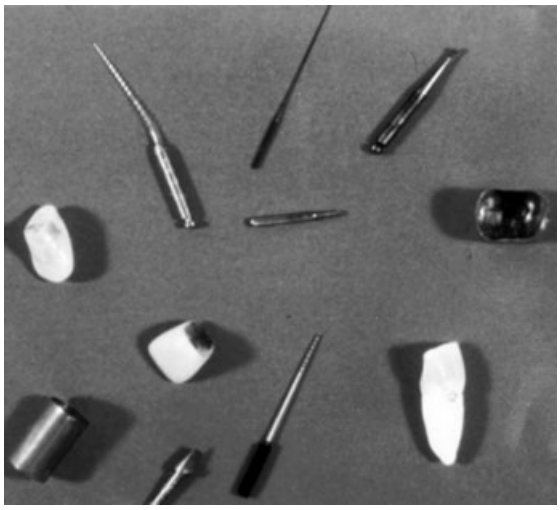

Figure 1 Pieces actually aspired or ingested and removed at the hospital.

(1) year of accident;
(2) type of incident (aspiration or ingestion);
(3) description of the dental item involved;
(4) duration of hospitalization when appropriate and treatment;
(5) possible sequelae.

For this study, the following data were recorded for both aspiration and ingestion:
(1) The number of cases of aspiration and ingestion per year.
(2) The number of endodontic instruments or other dental items involved and the incidence of either aspiration or ingestion.
(3) The need for hospitalization. A chi-square test was used to compare aspiration and ingestion to determine whether aspiration required more frequent hospitalization. Further chi-square tests (one for aspiration and one for ingestion) compared endodontic versus non-endodontic items to determine whether endodontic instruments required hospitalization more frequently than other dental items. The significance level was set at 5%.
(4) The number of fatal outcomes.

Results

(1) The type and number of incidents per year is given in Table 1. It ranged from 32 cases in 2005 to 61 cases in 1994. Generally speaking, there was no reduction of this type of incident over time, for example, 34 cases were reported in 1999 but 51 in 2001.
(2) The number of endodontic instruments or dental items involved and the occurrence of either aspiration or ingestion is given in Table 2. The percentage of endodontic files and broaches aspirated was 2.2% (one case in 44). Endodontic items represented 18% (84 cases of 464) of all ingested items, whereas burs and the prosthesis represented respectively 27% and 29% of the ingested items.
(3) The number of cases requiring hospitalization is given in Table 3. There was a statistically significant difference between aspiration and ingestion ($P < 0.0001$): all aspiration cases (100%) required hospitalization compared to 36% for ingestion (166 cases of 464). This means that any ingested dental item, endodontic instrument or not, led to hospitalization in 36% of cases, but that all aspiration cases required hospitalization. There was no statistically significant difference between hospitalization related to ingestion or aspiration of endodontic instruments

Table 1 Number of cases of aspiration and ingestion per year

	Aspiration	Ingestion
1994	6	55
1995	5	39
1996	4	54
1997	3	56
1998	1	40
1999	2	32
2000	4	44
2001	7	44
2002	4	31
2003	5	40
2004	3	29
Total	44	464

Table 2 Number of endodontic instruments or dental items involved in either aspiration or ingestion

	Aspiration	Ingestion
Endodontic file	1	57
Barbed broach		27
Bur		125
Temporary crown	5	15
Prosthesis	27	136
Matrix band		14
Piece of amalgam	2	17
Screw post	3	9
Extracted tooth		7
Orthodontic bracket		8
Inlay core	7	49
Total	44	464

compared with nonendodontic items (ns). In other words, any ingested or aspirated dental item, endodontic instrument or not, led to the same risk.

(4) No fatal outcome was reported.

Discussion

The present study was based on data obtained from the two largest insurance companies in France and covers a period of 11 years. Since dental insurance is mandatory in France, the number provided (24 651) should be accurate and can be extrapolated to the 36 000 French dentists because all active practitioners have insurance. In addition, when ingestion or aspiration occurs, it certainly would be reported to the insurance company because failure to do so automatically results in loss of indemnity. Therefore, the reported data and incidence provides an accurate representation of this type of incident in France.

French general practitioners, like many of their European colleagues, do not routinely use rubber dam for root canal treatment (Blachère 1998). A survey showed that most general practitioners perform approximately 250 root canal treatments a year (Blachère 1998). Thus, this study encompasses 250 root canal treatments × 24 651 dentists × 11 years = 67 790 250 root canal treatments. For endodontic instruments, calculations from the data of this survey showed that the incidence for aspiration or ingestion per 100 000 root canal treatments was 0.001 and 0.12, respectively.

Only 18% of the swallowed items were endodontic instruments. For comparison, burs and prosthesis were involved respectively in 26% and 29% of the incidents. These findings are in line with those reported by Tiwana *et al.* (2004) who showed dental appointments involving single-tooth cast or pre-fabricated restorations involving cementation had a higher risk of aspiration. This might be due to the fact that rubber dam is rarely used in prosthodontics compared with endodontics (Al-Rashed 2004). However, there may be other factors to explain the low incidence of aspiration or ingestion of endodontic instruments. It may be that dentists are aware of the risks involved when undertaking a root canal treatment without rubber dam and they may use more caution than with other dental procedures. Other factors may be the use of rotary instruments that are secured in the handpiece, and the fact that the majority of dental procedures do not involve endodontics.

This study showed that the risk of aspirating or ingesting endodontic instruments is low and, when it

Table 3 Number of cases requiring hospitalization

	Aspiration of a non-endodontic item	Aspiration of an endodontic instrument	Ingestion of a non-endodontic item	Ingestion of an endodontic instrument
Without hospital	0	0	237	61
With hospital without intervention	0	0	94	21
With hospital and intervention	43	1	37	14
Subtotal	43	1	368	96
Total	44		464	

occurs, does not require more frequent hospitalization than other dental items. This may explain, by itself, the low percentage of practitioners using rubber dam and why it is difficult to motivate general practitioners since the fear of an incident is not an incentive. The results of the present work indicate that rubber dam promotion based on incident prevention may not be valid.

Endodontists should be united in their efforts to encourage general practitioners to use rubber dam, not only for endodontic procedures but also in operative dentistry. More frequent usage increases the skill of the operator resulting in shorter application times and improved patient compliance (Stewardson & McHugh 2002). Furthermore, a general practitioner using rubber dam for plastic restorations would more likely use it for endodontic procedures.

It is always more attractive and beneficial putting forward the positive aspects of a technique than blaming nonusers. Rather than emphasizing the possibility of incidents when rubber dam is not used, emphasis may be better placed on positive reasons for its use: patient comfort, improved visibility, reduction of the stress from safety concern, time saving, increased medical and hygienic standard of care. A strong incentive would be a higher success rate resulting from infection control and therefore financial advantages. However, most endodontic studies are performed by endodontists who take rubber dam use for granted. A few studies involve general practitioners who, in fact, provide most of endodontic treatments. It remains an open question whether each procedure should be scientifically tested or just accepted as best clinical practice (Hyatt 2002). Unlike for restorative procedures (Smales 1993, Huth *et al.* 2004), there are no retrospective studies comparing the success rate of routine endodontic treatment with or without rubber dam. An increased failure rate without rubber dam would be a strong argument in favour of its use. No other device provides infection control, a major determinant for success, and patient safety at the same time (Carrotte 2004).

It is important to note that the results of this study are only applicable to France, but it is reasonable to surmise that there may be a similarity in many other countries.

Conclusions

This study provides further evidence that
(1) incidence of aspiration or ingestion of endodontic instruments is low;
(2) endodontic instruments represent 2.2% of the aspirated items and 18% of the ingested items;
(3) endodontic instruments did not require more frequent hospitalization than other dental items when aspirated or ingested;
(4) all of the cases of aspiration required hospitalization but only 36% of the cases of ingestion required hospitalization.

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