

Patient safety: reducing the risk of wrong tooth extraction

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In brief

Raises awareness of the factors increasing the risk of wrong tooth extraction.

Provides a summary of processes that can be implemented to minimise risk of wrong tooth extraction.

Highlights the incidence of wrong tooth extraction.

Over recent years there has been an increased emphasis on improving patient safety in all branches of medicine, with reducing wrong tooth extraction being a priority in dentistry. The true incidence of wrong tooth extraction is unknown but it is considered an avoidable harm and is a significant source of dental litigation. Interventions to reduce wrong tooth extraction include educational programmes encompassing human factor training, patient assisted identification, the use of checklists, marking of surgical sites and implementation of patient safety guidelines. Identified risk factors which make wrong tooth extraction more likely include; suboptimal checks and/or cross checking of relevant clinical information, unclear diagnosis, unclear documentation, ambiguity regarding notation of molar teeth, orthodontic extractions, and extractions where there are multiple carious teeth and extractions in the mixed dentition. Accurate and timely reporting of wrong tooth extraction incidents followed by analysis and sharing of findings together with implementation of improved practice will help to minimise risks of wrong tooth extraction.

Introduction

All forms of wrong site surgery should be preventable including wrong tooth extraction but we know that it continues to take place. Over recent years there has been an increased emphasis on improving patient safety in all branches of medicine and dentistry and reducing the risk of wrong tooth extraction is a clear priority within dentistry.¹ Alongside this emphasis on patient safety however, a number of recent high profile reports have highlighted significant failures in patient safety within NHS organisations, including the Mid-Staffordshire NHS Foundation Trust.² The subsequent Berwick report produced in response to the Francis report, was given the remit of looking at how to improve patient safety.³ The Berwick report's overall recommendation was that:

*'The most important single change in the NHS in response to this report would be for it to become, more than ever before, a system devoted to continual learning and improvement of patient care, top to bottom and end to end.'*³

The NHS has been focusing on reducing the risk of wrong site surgery by encouraging reporting and learning from patient safety incidents (PSI); the most serious of which is a Never Event and is defined as a 'serious, largely preventable patient safety incident that should not occur if the available preventative measures have been implemented by health-care providers.'⁴ The most recent revision of the Never Events Policy and Framework (published April 2015) included 'wrong tooth' in the definition of wrong site surgery; 'a surgical intervention performed on the wrong patient or wrong site and detected at any time after the start of the procedure.'⁵ This policy extends to all patients receiving NHS funded care. Therefore, for multiple reasons, minimising the occurrence of erroneous tooth extraction has never been more pertinent.

The true incidence of wrong tooth extraction is difficult to accurately ascertain but claims for erroneous extraction are significant. In 2013 the Dental Defence Union (DDU)

reported a threefold increase in received claims between 2006 and 2011.⁶ On average, each claim that was settled cost £7,300 plus legal fees. In 2016 it was stated that the DDU received one to two reports of wrong site tooth extraction in a primary care setting each week.⁷ The authors of the paper extrapolated the figures to make an estimate of over 300 cases of wrong tooth extraction in primary care each year in the UK. The same paper confirmed that significant levels of wrong tooth extraction also occurs in secondary care in the UK, with 51 claims for wrong tooth extraction being reported to the NHS Litigation Authority (NHS LA) by NHS Trusts in England between 2004 and 2014 at a total cost of £341,363.35. In addition, national data from reports of 'never events' in England show that 82 reports of wrong tooth/teeth extraction were reported between April 2012 and September 2015.⁸

In the UK in 2003, the National Patient Safety Agency (NPSA) implemented a voluntary national reporting and learning system (NRLS) to capture patient safety incidents. During 2009, the incidence of wrong site extraction was documented as 2% (36 erroneous tooth extractions out of a total of 2,012 patient safety incidents reported). Of these, 22 (61%) were

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carried out on adults and the remaining 14 (39%) on paediatric patients, of which four were on orthodontic patients.⁹ In Norway, a cohort study retrospectively examining 1000 patient records showed a single occurrence of wrong tooth extraction.¹⁰ While this may reassure dentists that wrong site surgery is rare, it is more likely that the low incidence represents under-reporting of incidents, particularly in primary care where there may be a lack of knowledge regarding incident reporting mechanisms and possible anxiety due to the perceived risk of damage to reputation and livelihood.^{9,11–15}

The implications of wrong tooth extraction are numerous and include the physical and psychological impact on the patient, complaints to an organisation, stress to a clinician and the economic impact of further procedures and compensation.⁹ This paper aims to increase awareness regarding wrong site surgery and draws together known factors that can increase the risk of wrong tooth extraction, highlights mechanisms that can reduce the incidence and suggests how this knowledge can be put into use in practice.

Why incidents occur

Procedures to identify a correct tooth for removal need to appreciate that dental surgery is unique; while other forms of surgery identify an anatomical structure (for example, appendix) a dentist needs to go one step further to correctly identify a specific structure (for example, upper right second premolar tooth).¹⁶ It has been appreciated that errors are rarely due to negligence or misconduct of an individual and most likely attributable to system failure.¹⁷ Dentists generally feel that their practicing environment is a safe one and this is supported by Mettes *et al.*¹⁰ who reported an absence of major harm to patients in a primary care-based study in the Netherlands. A number of self-reports by dentists have identified contributing factors associated with wrong tooth extraction; these include heavy workload, presence of multiple condemned teeth, miscommunication, as well as cognitive failure.¹⁸

Recent research into patient safety incidents has focused on failures within a system context. Active failures encompass unsafe acts that can be directly linked to an accident (for example, dentist error due to distraction); and latent failures which can be identified as contributory factors that may lie dormant for a long period of time before contributing to an actual patient safety incident (for example, use of different systems of dental notation by different dentists,

Box 1 Minimising risk of wrong tooth extraction⁶

Use one form of tooth notation throughout clinical records. Consider longhand documentation in referral letters. If there is doubt over which tooth is causing pain, then manage the pain rather than embarking on an irreversible dental extraction.

Communicate alternative options and risks of treatment and document these clearly in the clinical records.

Ask the patient which tooth they believe is to be treated and cross reference with clinical records, referral letters and radiographs to ensure all information is consistent.

If treatment is planned with conscious sedation or general anaesthetic then ensure the treatment plan has been confirmed before commencing. Relevant documentation (records, consent form, radiographs) should be available.

Where a patient is being treated on referral, the treating dentist must be confident the treatment plan is reasonable and that treatment is in the patient's best interest. If there is doubt then clarify the treatment plan.

the patient being seen by multiple clinicians, unclear diagnosis).¹⁹ The recognition of the importance of latent failures contributing to wrong site surgery encourages a focus on improving the systems of delivering care and not blaming individuals; dentists themselves have identified that errors are likely to occur 'probably due to a culmination in a lot of little misunderstandings'.^{214,17}

Incident reporting systems

At present there seems to be no reliable system for accurately monitoring PSI in dentistry. In the UK, incident reporting is more commonplace in secondary care when compared to primary care. In England, patient safety incidents in hospitals are reported into local risk management systems which automatically report into the NHS Improvement monitoring systems. Wrong tooth extractions in hospital are reported as never events, however, reports appear to rarely emerge from primary care, where the complexity of existing reporting systems is likely to act as a disincentive.^{8,15,20} Currently, understanding of the prevalence of patient safety incidents is based on self-reporting, local audit of wrong tooth extraction or by extrapolating statistics from the literature based on random selection of patient records.^{10,21} A more targeted approach to identifying patient safety incidents could be to use 'triggers' associated with adverse incidents. This directed approach may be more successful at identifying adverse incidents than a random model.²² Encouraging timely and accurate reporting of wrong tooth extraction and additionally a 'near miss,' where a wrong tooth extraction was prevented, will create valuable epidemiological safety data. Analysis of such robust incident reporting data will allow a better understanding of the underlying patient safety risks and should ultimately allow

the development of risk reducing interventions. The DDU has issued guidance on how to reduce the risk of wrong tooth extraction, (Box 1) but what more can be done?

Interventions

Educational programme

An educational programme to prevent wrong tooth extraction has been developed in a university institution in Taiwan.²³ Incidents of wrong tooth extraction over a three year period were explored and learning points were incorporated into a training session, which included dissemination of newly developed clinical guidelines, delivered to dentists at an early post-qualification training grade level. The intervention resulted in no further wrong tooth extraction during the follow up period. The intervention embraced the suggestion that staff involved in incidents should receive feedback and that the sharing of incidents can promote learning. Caution could be exercised however in the generalisation and applicability of these results; the study was performed within a teaching institution in Taiwan and the culture within this environment may differ from other countries and clinical environments.¹⁶ Additionally, the intervention appeared to involve only the junior staff in the training programme suggesting that the authors feel senior clinicians were more immune to human factors resulting in harm. Other studies suggest that patient safety education recommendations should be given to all dental staff including those involved in undergraduate and postgraduate curricula.^{17,24} In one additional study, an educational module based on adverse events was delivered to fourth year undergraduate dental students and increased their knowledge of the key concepts involved in incidents occurring.²⁵

Patient assisted identification

Engagement of the patient has been suggested as an additional measure to preventing wrong tooth extraction; where a patient is informed of the reason for extraction, the tooth is verified verbally before extraction and the patient is encouraged to communicate at any point during the procedure in the hope that wrong tooth extraction can be minimised.¹¹ This additional check has been formally implemented in some UK dental hospitals, and is encouraged by the DDU, where the patient is requested to point to the tooth they are expecting to be extracted.^{6,13,21} However, it must be appreciated that in the stressful environment of a hospital or dental surgery, an anxious patient can be as much in error as a clinician. It is important to stress that patient confirmation is only part of the pre extraction checks. Various studies looking at patient assisted identification in surgical practice have produced surprising results. For example, in one study, 200 patients undergoing orthopaedic surgery were asked to pre-operatively mark the surgical site with a 'Yes'; only 68.2% correctly identified the surgical site.²⁶

Correct site surgery checklists

In 2009, the World Health Organisation (WHO) developed a surgical checklist to reduce patient safety incidents which was shown to lead to a reduction in surgical complications.^{27,28} The NPSA adapted the checklist for use in England and Wales with the recommendation that it could be adapted locally or for specific specialties subject to clinical governance procedures.²⁹ Prior to the WHO Surgical Safety Checklist being introduced, the concept of a pre-operative checklist to reduce wrong tooth extraction had been identified.¹⁷ In 2009, the University Dental Hospital of Manchester introduced an oral surgery specialty specific correct site surgery checklist.³⁰ Other checklists relevant to wrong tooth extraction have also been suggested.³¹ A checklist aims to draw the attention of the dental team to specific areas where errors can occur. Implementation of the checklist has focused on education, leadership, communication and behaviour change.^{17,30} A recent systematic review demonstrated that the only interventions in dentistry that have reasonable evidence that they can reduce or minimise adverse events are surgical safety checklists.³² The introduction of correct site surgery checklists into primary dental care has been explored with general dental practitioners who are aware that wrong tooth extraction does occur and that implementing a system based on checklists used in secondary care would be feasible.¹⁴

Marking to identify structures

An integral step to the WHO Surgical Safety Checklist is adequate marking of the surgical site, however, there is no simple or reliable way of directly marking every tooth intended for extraction. An oral and maxillofacial unit in Gloucester Royal Hospital, UK, have introduced a novel way to help identify teeth to be removed.³³ They describe marking a horizontal line on the skin of the cheek (thereby dividing the face into four quadrants) and writing dental notation on the skin in the appropriate quadrant to identify which teeth need removal. The intervention is reported as being acceptable to both patients and clinicians.³³

Methods to specifically and directly mark teeth before extraction have been considered. While the American Dental Association encouraged this protocol, the Joint Commission on Accreditation of Healthcare Organisations in the USA postulated that there was no practical way for this to be achieved; permanent markers and marking with a dental burr were not deemed appropriate.³⁴ One UK dental hospital has adopted a tooth marking policy before extraction using a red wax marker.²¹

Clinical guidelines

A number of interventions to prevent wrong tooth extraction have focused on the introduction of guidelines.^{18,23} In the educational programme introduced in Taiwan the reduction in wrong tooth extraction cannot be ascribed to whether the change was due to education or the development of clinical guidelines that were simultaneously introduced.²³ Guidelines to prevent wrong tooth extraction are a means of documenting an expected standard that should be achieved in a procedure and will promote a uniform patient safety culture.²³ However, written guidelines do not address behaviour change and therefore errors and harm may still occur. In a Nigerian hospital department guidelines were introduced in an attempt to reduce wrong tooth extraction, however, only 25% of dentists were aware of the universal protocol.¹⁸ Evidence from Scandinavia suggests that guidelines may also be utilised differently across primary and secondary care with hospital dentists more likely to refer to them.²⁴

Human factors awareness

Technical skill is paramount to proficient completion of a procedure, however there is increasing recognition of the role of non-technical skills or 'human factors' in preventing wrong tooth extraction. Most of the errors

that occur during surgery can be attributed to failures in non-technical skills such as situation awareness, fatigue, working conditions, decision making, communication, teamwork and leadership.³⁵ Even an experienced, motivated individual can make a mistake in a complex healthcare system because errors usually occur when systems and technology are mismatched with human characteristics.³⁵ By accepting the role of human factors in complex procedure based healthcare systems, the analysis of patient safety incidents is able to progress beyond the obvious process failures and give insight into the broader 'human' aspect of patient safety incidents. Dentists should be aware of how human factors can affect their performance and situations in which it is likely to lead to patient safety incidents.

Identifying risk

Documentation

Teeth can be charted in a number of different methods and the use of different tooth numbering systems to annotate teeth can lead to confusion and increased risk of wrong tooth extraction.³⁶ The loss of adjacent teeth and the subsequent drifting of remaining teeth can also make nomenclature more subjective. It has been identified that wrong tooth extraction is more likely to occur in referral practices where the clinician performing the treatment is not the one that constructed the treatment plan.¹¹ This includes situations such as in hospital where the hospital dentist deciding on the treatment plan may be different to the dental practitioner executing that plan, or between an orthodontist and a general dental practitioner. The success of the treatment relies upon a clear understanding of the nomenclature used by both the prescribing and treating dentist.

Molar teeth

Clarification to remove any ambiguity regarding the intended tooth for extraction requires especially clear documentation in the patient's record when only two molar teeth are present. Loss of a first or second molar tooth followed by tooth drifting and the presence of a fully erupted third molar tooth can cause confusion. In this situation, to some dentists, the third molar tooth will look clearly like a third molar due to its morphology, but may appear to be a second molar tooth to other dentists, based on its positioning in the arch (Box 2). The consistent use of 'first standing molar' or 'last standing molar' or 'lone standing molar' in a partially dentate

Box 2 Clinical scenario

A 32-year-old female attended her longstanding family dentist with intermittent toothache from the upper right first standing molar tooth. She had previously had all four first molar teeth (6s) extracted as part of an orthodontic treatment plan in her teenage years. The upper right seven (17) had drifted into the available space with the 18, which had also erupted and drifted forward. The dentist diagnosed decay beneath the restoration of the upper right first standing molar tooth which was documented in the clinical records as the 17; at the time, a decision to describe the first standing molar tooth as the 17 was aided by knowledge of the previous orthodontic extraction of the 16 and the restored adjacent posterior molar having a small clinical crown in keeping with the morphology of a 18. Following discussion it was decided to arrange for extraction of the decayed tooth.

Due to holiday and ill health the appointment for the extraction was significantly delayed, by which time the original dentist had retired from the practice and a new dentist had taken on the patient. On the day of the appointment the dentist was running late and offered to re-book the patient for another appointment but the patient was having toothache and happy to wait. Eventually the patient entered the surgery, the clinical records were briefly reviewed and the dentist extracted the upper right last standing molar thinking this was the 17. Unfortunately, it only became clear after the event that the intended tooth for extraction was the upper right first standing molar tooth.

Box 3 Clinical scenario

A 12-year-old attended the dentist for a new patient assessment and consideration for orthodontic therapy. A treatment plan was constructed which included extraction of the upper deciduous canines to encourage eruption of the permanent canines. The patient did not return for the extractions for a number of months and in the intervening period the upper right deciduous canine had exfoliated, and a diminutive upper right permanent canine had erupted in its place. The dentist extracted the permanent canine before realising their error.

patient is an example of how to clarify a potentially unclear treatment plan in this situation.

Orthodontic extractions

Orthodontics is a speciality where teeth requiring removal are mostly intact and therefore at higher risk of identification error.¹¹ Unlike teeth requiring extraction due to caries, there are usually no 'visual cues' as to which particular tooth requires removal compared to its neighbours. In addition, the decision for extraction is made by the orthodontist, but the extractions are usually executed by another dentist. Extra risks here include documentation error and communication error, both between orthodontist and dentist and between dentists within the same dental practice. To help overcome this issue, the use of two different charting methods to communicate teeth requested for extraction has been suggested for orthodontic extractions to minimise wrong tooth extraction.³⁷ In this scenario the dentist performing the extraction must also satisfy themselves that the treatment plan appears reasonable with clarification from the referring clinician where necessary.⁶

Multiple carious teeth

A risk of erroneous tooth extraction occurs when adjacent teeth and their intention for extraction are confused; for example where multiple carious teeth also are present.¹¹ Here, some of the carious teeth may be intended to be retained and restored however the 'visual

cues' as to which teeth are to be removed are diminished compared to when only one carious tooth in an area is present.

Extractions in the mixed dentition

Extractions in the paediatric patient have been identified at increased risk of wrong tooth extraction; in 13% of cases in a study analysing the root cause analysis of wrong tooth extraction, there was confusion between the intended primary tooth for extraction and the adjacent permanent tooth.¹¹ Additionally, treatment plans stating the need for extraction of a primary tooth can lead to confusion when the deciduous tooth is exfoliated between the treatment plan being constructed and it being executed (Box 3).

Summary

Wrong tooth extraction is an event that should be fully preventable. The true incidence of wrong tooth extraction is unclear, but a review of evidence would indicate that it is more frequent than appreciated. Preventative strategies include increased awareness of the factors that predispose to wrong tooth extraction and implementation of patient safety tools which help reduce the occurrence. Further work is required into monitoring why wrong tooth extraction occurs and how it can be prevented. This will be aided by incident reporting and root cause analysis.

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