Efficacy of first aid treatment of acute apical abscess in an NHS emergency clinic

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Key points

- Shows how to manage acute apical abscess.
- Discusses how best to reduce pain for these patients.
- Aims to reduce antibiotic overprescribing.

Objectives To determine if dentists are successful in reducing pain caused by acute apical abscess (AAA) in an NHS emergency setting and if different treatment strategies result in different levels of pain reduction. **Design** Single centre prospective clinical study. **Setting** Purpose built dental clinic. **Subjects and methods** Patients attending the emergency clinic with suspected AAA were invited to join the study before being seen by a dentist. **Interventions** Patients' management was agreed between the dentist and the patient. Patients were retrospectively grouped into three groups: antibiotic only (N = 12), drainage (N = 19), drainage plus antibiotic (N = 15). **Main outcome measure** Patients completed a modified pain quality assessment scale (PQAS) before and 24 hours after treatment. **Results** Forty-six patients completed the study. There was a significant reduction in pain for all groups of patients. The drainage groups had significantly greater reduction in pain than the antibiotic only group. There was no significant difference between those who had drainage and those who had drainage and an antibiotic. **Conclusions** Dentists can successfully reduce pain caused by AAA in an NHS emergency setting. AAA should be treated by drainage wherever possible. In terms of pain there is no additional benefit in prescribing antibiotics.

Introduction

This study aims to determine how successful dentists are in reducing pain caused by acute apical abscess (AAA) in an NHS emergency setting. AAA is defined[1] as an inflammatory reaction to pulpal infection and necrosis characterised by rapid onset, spontaneous pain, extreme tenderness of the tooth to pressure, pus formation and swelling of associated tissues. It is known from previous research[2] that abscess should be drained, and antibiotics only be prescribed in the event of spreading infection such as pyrexia, lymphadenopathy or cellulitis in addition to drainage. Guidelines for the management of this condition have been published by a number of organisations.[3,4] However, it is known that many patients in NHS emergency dental clinics have not been treated in line with these guidelines.[5] Similarly research from Belgium[6] and Turkey[7] have shown that there is a discrepancy between the recommended management of AAA and that carried out by dentists. Reasons for this may include lack of time, perceived poor remuneration, adherence to outmoded management strategies, or perceived or real patient demand for 'easier' medical rather than surgical management. In this study, we wish to determine if with good support, it is possible to achieve high levels of pain reduction for patients with AAA in an NHS emergency clinic in the UK. There is no previous dental research in an NHS setting which uses the pain quality assessment scale (PQAS)[8] (Online only supplementary appendix 1) which is widely used in the measurement of other pains. Additionally, this study compared the level of pain reduction between different management strategies.

The NHS in the UK is a state sponsored system under whose auspices the majority of dentistry in the UK is carried out.[9] Most patients will pay towards the cost of their treatment. The charge for an emergency appointment including examination and treatment was £18.80 in 2015/16. Children, pregnant women and those on certain means tested state benefits are exempt from this charge. The NHS commissions private companies to organise emergency dental services outside of normal office hours within a geographic area. Access to these emergency dental services outside of normal office hours is via a telephone triage service separately commissioned by the NHS. The funding per patient from the NHS to the dental clinic is significantly greater for out of hours (OOH) clinics than for regular in-hours clinics. The lead author is a clinical director of one such private company.

Methods

Ethical approval for this study was obtained from the from NHS Health Research Authority and was in accordance with the Helsinki declaration.

All participants were recruited between 15 February 2015 and 14 February 2016 at a single clinic in Croydon, London. The patients will have been given an appointment to attend after being assessed on the telephone by an off-site dental care professional (DCP), working to a nationally agreed algorithm, as needing an

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urgent dental appointment. The algorithm is a pre-written list of questions embedded within a computer system which aims to best decide which care pathway a caller should take based on the answers they give (for example, home care, need to see a dentist within 48 hours, need to see a dentist urgently). Dentists working at this clinic are primarily local general dental practitioners who typically work 1–2 sessions per month, while the DCPs are from a smaller pool who typically work 2–15 sessions per month. There is usually one dentist working with two DCPs (one at chairside and another at reception with both sharing duties in the decontamination room). There is an indirect digital radiography system (VistaScan by Durr Dental) and computerised records software (Root 32 by Status Point).

Training was provided to all dentists and DCPs who worked at the emergency dental clinic from which study participants were recruited. In order to standardise diagnosis, management and note keeping, dentists and DCPs were invited to a seminar entitled 'Diagnosis and Management of Dental Pain' which featured presentations from the lead researcher and a specialist endodontist. They were also sent guidance reminding them that all dentists need to standardise diagnosis, management, and note keeping both within and outside of this study.

They were reminded of the standardised protocol for diagnosis and note keeping which is described by the American Association of Endodontists (AAE) as follows:

1. Medical history
2. Dental history relevant to the complaint
3. Chief complaint
4. Clinical exam
5. Clinical testing for example, percussion, palpation, pocket depths, cold testing
6. Radiographic analysis by means of a long cone parallel radiograph (Rinn XCP by Dentsply)
7. Additional tests if carried out: for example, selective anaesthesia, test cavity.

The dentists were reminded that a pre-operative radiograph is essential for endodontic diagnosis.[10] Additionally, the dentists were sent guidance on endodontic diagnosis from the AAE.[1]

For DCPs there was a face to face meeting with the lead researcher. This included training in how to define patients who might/might not have AAA based on information received from the call triage service. As the DCPs were directly responsible for recruiting patients to the study they were given guidance in how to go through the PQAS questionnaire with the patients in a way that respected the patients' confidentiality and right to decline to participate in the study. Clear guidance was given that the pre-operative questionnaire could only be carried out before the patient had any contact with the dentist.

The dentists and the DCPs were able to contact the lead researcher with any questions or issues throughout the study period.

On arrival at the clinic, patients were given written and verbal information about the

Table 1 Mean score for each pain characteristic for each group at T1 (pre-op) and T2 (24 hours post-op)

Pain characteristic	Group A T1 Abs only	Group B T1 drainage only	Group C T1 Abs + Drainage	Group A T24 abs only	Group B T2 drainage only	Group C T2 abs + drainage	P value
Intensity	6.5	7.6	8.2	4.5	2.6	3.0	<0.001***
Sharp	5.3	7.4	7.7	1.9	2.6	2.3	<0.001***
Hot	4.3	6.7	6.5	1.9	1.4	1.7	<0.001***
Dull	3.3	5.2	7.9	2.5	1.8	3.7	<0.001***
Cold	0.6	2.8	2.4	0.7	0.6	0.4	0.009**
Sensitive	5.1	5.8	3.8	4.6	3.1	3.6	0.001**
Tender	7.5	8.1	8.0	6.3	4.6	4.9	<0.001***
Itchy	1.8	1.7	1.9	0.3	0.2	1.1	0.006**
Shooting	2.8	6.7	6.7	0.6	1.9	2.5	<0.001***
Numb	3.3	2.1	2.6	2.0	0.3	1.9	0.002**
Electrical	2.4	6.5	4.4	0.4	1.4	1.3	<0.001***
Tingling	2.1	3.6	3.8	0.4	1.6	1.3	<0.001***
Cramping	2.7	3.8	4.7	1.4	2.6	3.3	0.011*
Radiating	5.8	6.4	6.8	2.2	1.8	2.6	<0.001***
Throbbing	6.3	7.3	8.7	2.4	2.1	2.7	<0.001***
Aching	6.9	7.5	8.3	4.0	2.1	3.9	<0.001***
Heavy	5.8	7.2	7.6	2.6	2.7	3.4	<0.001***
Unpleasant	7.3	7.9	8.5	4.1	3.6	3.7	<0.001***
Intense deep	7.3	8.1	8.1	3.8	2.2	3.5	<0.001***
Intense surface	5.7	6.9	7.6	2.2	2.7	3.3	<0.001***

*P <0.05; **P <0.01; ***P <0.001

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Table 2 Mean pain reduction from pre-op to post-op (on a scale of 0–10 with 10 being most pain) and ATS scores

Pain characteristic	Ab only group A	Drainage only group B	Ab + drainage group C	A vs B	A vs C	B vs C
Intensity	2.0	5.0	5.2	0.022*	0.007**	0.864
Sharp	3.3	5.8	5.3	NS	NS	NS
Hot	2.4	3.3	4.7	NS	NS	NS
Dull	0.8	3.3	4.2	0.013*	0.009***	0.477
Cold	+0.1	2.2	2.0	NS	NS	NS
Sensitive	0.5	2.7	0.6	NS	NS	NS
Tender	1.2	4.5	3.2	<0.001***	0.020*	0.187
Itchy	1.4	1.5	0.8	NS	NS	NS
Shooting	2.2	4.8	4.7	NS	NS	NS
Numb	1.3	1.7	+0.4	NS	NS	NS
Electrical	2.2	5.2	3.1	NS	NS	NS
Tingling	1.2	2.5	2.4	NS	NS	NS
Cramping	2.1	2.9	2.6	NS	NS	NS
Radiating	3.6	4.6	4.2	NS	NS	NS
Throbbing	4.2	5.2	5.9	NS	NS	NS
Aching	2.9	5.4	4.4	NS	NS	NS
Heavy	3.2	4.5	4.2	NS	NS	NS
Unpleasant	3.2	4.3	3.8	NS	NS	NS
Intense deep	3.4	5.9	4.7	NS	NS	NS
Intense surface	1.8	5.0	4.9	0.019*	0.009**	0.956

*P <0.05; **P <0.01; ***P <0.001. NS = non-significant. + = mean increase in pain

study, asked if they wished to participate in the study and advised that they were free to consent, or not to join the study and that a refusal would have no effect on the treatment they received. They also received this in writing and were informed that they could withdraw their consent to participate at any point. All adult patients (aged 18 or above) attending were invited to participate except:

- Where the reason for attendance (which is sent from the call triage service) was definitely, in the opinion of the DCP, not endodontic in origin
- Where the patient was unable to speak a reasonable level of English
- When there was insufficient time before the patient's consultation.

The DCP read to the patient the PQAS questionnaire and recorded their responses in a private room.

Once the dentist had examined the patient and made a diagnosis, patients who had been diagnosed with AAA were advised that they would be contacted the next day and two days later (that is, at 72 hours) for post-operative PQAS questionnaires. Those patients who were diagnosed with a condition other than AAA were informed that they would not be contacted further. The diagnosis of AAA was made by the attending dentist and confirmed using the clinical notes and radiographs by the lead researcher according to the protocol of the American Association of Endodontists.

A DCP then telephoned the patient by phone the next day and again two days later for the post-operative PQAS questionnaires. Patients were offered the choice of filling out the post-operative questionnaire online but there was very little take up of this service. Patients were seen between 18.30 and 22.30. Calls to patients were made between 17.00 and 21.30. DCPs tried to call the patient up to three times if they didn't get through initially. In the early stages of the study a decision was made to focus on obtaining responses at the 24 hours rather than the 72 hours post-operative time point. Permission to do this was obtained from the ethics committee. Online responses were accepted for inclusion if they were received between 14.00 and 24.00. In addition to the standard PQAS questionnaire, patients were asked if they had seen another dentist or doctor since the care provided at this clinic and if so what was done by this second clinician.

The lead researcher later checked the study participants' clinical notes and radiographs to confirm the diagnosis of AAA. If there was doubt as to the diagnosis, the participant's data was excluded from the study. This was done with the lead researcher being blind to the participants' PQAS responses.

Results

Statistical analysis was carried out by Juan Luis Gomez Martinez of St Halley statistics, Valencia, Spain. Prior to commencement of data collection, it was calculated that in order to show a medium effect with 80% power at 95% confidence limit, a minimum sample size of 34 was required.

A total of 159 people agreed to participate in the study. Of these, 102 were diagnosed with AAA and the clinical notes provided enough information for the lead researcher to agree with this diagnosis. They reported level of pain by means of PQAS questionnaire before being seen by the dentist (T1). They were managed according to the judgement of the dentist and the wishes of the patient. It should be noted that dentists working at this clinic have been advised by the management of the service on multiple occasions to follow the FGDP guidelines on antibiotic prescribing. Furthermore, dentists who disagreed with these guidelines were stopped from working at this clinic long before this study commenced. However, in primary care, dentists do not always follow guidelines to the letter, or at all. It is the authors hope that increasing the body of research in primary care will encourage more dentists to follow these guidelines. Due to the presence of existing best practice guidelines,[3,4] it would not be ethical to randomise which management group patients were assigned to. There was an element of indirect randomisation in that some patients requested antibiotics rather than the drainage proposed by the dentist. Patients were subsequently grouped into one of three management groups for the purpose of this study: only antibiotic (group A), only drainage (group B) or drainage and antibiotic (group C). Forty-one patients provided a second PQAS (T2) 24 hours later and five more did so at 72 hours. There were 56 patients who did not complete a post-operative PQAS. Taking into account that four patients who had drainage were already taking antibiotics and one patient prescribed antibiotics with drainage never took the antibiotics, there were 12 patients in group A, 19 patients in group B and 15 in group C.

The sample is of 46 adult patients (well above the minimum sample size needed): 25 males (54.3%) and 21 females (45.7), with a mean age 40.6 ± 14.2 years and a range from 20 to 68. Fourteen patients (30.4%) were exempt from NHS charges and the other 32 (69.6%) paid NHS charges. A Kruskal-Wallis test concluded that the groups were quite homogenous although more males were in the drainage and antibiotic group.

Six people (13.1%) visited other professionals (dentist or general doctor) in the 24 hours after the emergency appointment (that is, between T1 and T2). The proportion is similar between the different groups.

Table 1 shows the mean score for each pain characteristic for each group at each time. Twenty Brunner-Langer models[11] (one per pain characteristic) were carried out to assess if pain reduced from T1 to T2. Table 1 also shows that for all pain characteristics there was significant reduction from T1 to T2.

A non-parametric Brunner-Langer model for longitudinal data was performed to test for differences in control of pain between treatment groups. This method was chosen as the overall sample size was moderate (N = 46) and small within each group (N = 12, 19, 15) and the primary variable (pain score) was ordinal (0–10). This method assessed changes during the follow-up and effect of treatment by means of an ANOVA-type test (ATS) score. It allows us to answer the important question of whether there is a difference in pain reduction between the different management strategies. Table 2 shows mean pain reduction from pre-op to post-op (on a scale of 0–10 with 10 being most pain) together with an ATS score comparing the different groups.

There was a statistically significant additional reduction in the tenderness, intensity, dullness and intensity at the surface characteristics in the drainage groups compared to the antibiotic only group. Aching was close to statistical significance with a P value of 0.084. There was no statistical significance in the pain reduction between those who received antibiotics in addition to drainage and those who received only drainage. This research shows that these pain characteristics; intensity, dullness, tenderness and surface intensity drainage, resulted in greater pain reduction for patients with AAA than antibiotics alone and that there are no differences between drainage alone and drainage with antibiotics.

Discussion

The AAE defines the pain of AAA as extreme tenderness. In this study, this aspect of pain was most significantly reduced by drainage compared to antibiotics only.

The first objective of this study was to determine if dentists are successful in reducing pain caused by AAA in an NHS emergency setting. While this study proved that the dentists are successful in this clinic, attention needs to be drawn to this clinic not being typical of all dental clinics providing NHS treatment. Compared to other clinics in the UK providing in-hours or out-of-hours emergency dental care, this clinic is well staffed and well equipped. There is always a nurse and separate receptionist assisting the dentist. Digital radiography allows the dentist to correctly treat these patients in less time than if radiographs need to be developed conventionally. Although it is stocked in the clinic, rubber dam is rarely used. Funding for out-of-hours clinics is typically greater than that provided to in-hours NHS dentistry. The maximum number of patients in this clinic is 12 in 3.5 hours. This equates to only 17.5 minutes per patient but as often there are less than 12 patients and some patients have more minor problems the dentist will nearly always have more time than this to manage a patient with AAA. Personal communication with dentists who work at this and similar clinics shows that the majority of dentists feel an average of 30 minutes is required to correctly treat a typical patient with AAA.

The second objective of the study was to determine if different treatment strategies result in different levels of pain reduction. The study clearly shows that there was significant pain reduction in the patients who did not receive drainage. However, it also shows that there is significantly greater pain reduction in patients who did receive drainage. The placebo effect is well known in that patients will get better in some way even with sham medicines and treatments. It could also be suggested that any intervention by a dentist who is perceived as caring and competent by the patient will lower their perception of pain. This study is silent as to the significance of the placebo effect. It would be unethical to carry out a study into the effectiveness of a sham antibiotic against a genuine antibiotic for AAA especially since even a genuine antibiotic is not considered the correct management.

There were no significant differences in any pain characteristic between groups B and C. On the basis of this study there is no benefit, in terms of pain relief, in prescribing antibiotics to a patient with AAA where adequate drainage has been established.

A number of pain characteristics showed large reductions in groups B and C compared to group A. These were not statistically significant although a larger sample size may have given more refined results. However, as

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some of the pain characteristics show very low initial scores (for example, itchy, cold, numb and tingling) for AAA it may be possible to omit them from a future study into AAA in order to produce a shorter questionnaire for our patients. Alternatively, a future study could look only at the pain characteristics, tenderness, intensity, dullness and intensity at the surface, in which this study showed statistically significant changes. Additionally, a future study could take into account the degree of systemic spreading infection using such means as patient temperature recordings. This study looked only at pain rather than cessation of infection as reduction of pain is a primary motivation of patients seeking emergency dentistry. The NHS defines urgent treatment as 'treatment [that] is provided only to the extent that is necessary to prevent […] significant deterioration or address […] severe pain'.[12] It was outside the scope of this study to consider the final endodontic outcome or long-term prognosis of these teeth.

Antibiotic resistance is an increasingly serious threat to global public health.[13] Dentists should examine their prescribing patterns and only prescribe antibiotics to patients with spreading infection or at serious risk of spreading infection. There are cases where instituting drainage may not be possible due to patient or clinician factors such as an inexperienced clinician faced with a previously root-treated tooth.

Conclusion

Dentists can successfully reduce pain caused by AAA in an NHS emergency setting. It is important to note the details of this clinic as it is not typical of all NHS clinics.

AAA should be treated by drainage wherever possible. Antibiotics without drainage should not be considered as a valid first-line option in the management of AAA. In terms of pain there is no additional benefit in prescribing antibiotics. This study did not consider the effects of antibiotics on spreading infection (that is, pyrexia, lymphadenopathy or cellulitis).

Conflict of Interest
Dr Scott Aaron is a clinical director of Herts Urgent Dental Care which holds contracts with NHS England to provide out-of-hours emergency dentistry.

Ethical Approval
All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Ethical Approval was received from NHS Health Research Authority, NRES Committee London – City & East Bristol Research Ethics Committee Centre, Whitefriars Level 3, Block B Lewins Mead Bristol BS1 2NT. Reference number: 15/LO/0193.

Informed consent
Informed consent was obtained from all individual participants included in the study.
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1. American Association of Endodontists. Endodontics. Colleagues for Excellence, Endodontic Diagnosis, Fall 2013. Available at https://www.aae.org/specialty/wp-content/uploads/sites/2/2017/07/endodonticdiagnosisfall2013.pdf (accessed March 2018).
2. Matthews D C, Sutherland S, Basrani B. Emergency Management of Acute Apical Abscesses in the Permanent dentition: A systematic review of the literature. *J Can Dent Assoc* 2003; **69:** 660.
3. Scottish Dental Clinical Effectiveness Programme. Management of Acute Dental Problems, University of Dundee, March 2013.
4. FGDP. *Antimicrobial Prescribing for General Dental Practitioners,* 2nd ed. Faculty of General Dental Practice, 2012.
5. Dailey Y M, Martin M V. Are antibiotics being used appropriately for emergency dental treatment? *Br Dent J* 1994; **176:** 413–416.
6. Mainjot A, D'Hoore W, Vanheusden A, Van Nieuwenhuysen J P. Antibiotic Prescribing in Dental Practice in Belgium. *Int Endod J* 2009; **42:**1112–1117.
7. Kaptan R F, Haznedaroglu F, Basturk F B, Kayahan M B. Treatment Approaches and Antibiotic Use for Emergency Dental Treatment in Turkey. *Ther Clin Risk Manag* 2013; **9:** 443–449.
8. 8. Galer B S, Gammaitoni A R, Jensen M P. Pain Quality Assessment Scale (PQAS). Mapi Research Trust, 2010. Further information available online at https://eprovide.mapi-trust.org/instruments/pain-quality-assessment-scale-and-revised-pain-quality-assessment-scale (accessed March 2018).
9. LaingBuisson. Dentistry UK Market Report, 2014. Available at https://www.laingbuisson.com/wp-content/uploads/2016/06/Dentistry14_brochure_WEB.pdf (accessed March 2018).
10. FGDP. Selection Criteria for Dental Radiography, 3rd ed. Faculty of General Dental Practice, 2013.
11. Brunner E, Langer F. Nonparametric Analysis of Ordered Categorical Data in Designs with Longitudinal Observations and Small Sample Sizes. *Biom J* 2000; **42:** 663–675.
12. Department of Health. Standard General Dental Services Contract. 2013. Available at https://www.gov.uk/government/publications/standard-general-dental-services-contract-and-personal-dental-services-agreement (accessed March 2018).
13. World Health Organisation. Antimicrobial Resistance Factsheet. 2016. Available at http://www.who.int/mediacentre/factsheets/antibiotic-resistance/en/ (accessed March 2018).