

Paediatric dento-facial infections – a potential tool for identifying children at risk of neglect?

J. Schlabe,^{1,2} M. Kabban,³ D. Chapiroau¹ and K. Fan^{*1,4}

Key points

Acute dento-facial/ cervico-facial infection in children may be an indicator of wider neglect.

40.7% of children presenting dento-facial / cervico-facial infection were already known to social services.

More than 50% of children presenting with dento-facial infection were between 5-8 years old, suggesting this group is at greater risk of dental neglect

Introduction Child neglect has a significant impact on children's physical and emotional health and development with lifelong consequences. Dental decay can lead to maxillofacial space infections which can have life-threatening complications and may indicate that a child has suffered dental neglect. **Aims and method** In this retrospective audit, we reviewed children below sixteen years who were admitted under oral and maxillofacial surgery for incision and drainage of a dental/ facial abscess, under general anaesthesia, between January 2015 and January 2017, to understand if they had experienced dental neglect. We also assessed if they were or had been known to Children's Social Services (SS) before hospital admission. **Results** Twenty-seven children were included in the study, eleven children (40%), were known to social services (SS). On average 3.2 teeth were extracted with an average hospital stay of 2.5 days. **Discussion** Our data indicate that a significant number of children admitted for maxillofacial space infection are already known to social services. **Conclusion** Our recommendation is that all children admitted with dental/maxillofacial space infections, where dental neglect may be present, should be discussed with the local safeguarding team.

Introduction

Child abuse and neglect is an important issue and can have major consequences into adulthood. On 31 March 2017, 51,080 children were subject to a child protection plan in England and in 48.1% of these cases neglect was the initial category of abuse.¹

Neglect is defined as the persistent failure to meet a child's basic physical and/or psychological needs, likely to result in the serious impairment of the child's health or development.² Neglect also includes not providing access to healthcare.

Dental neglect has been defined as the persistent failure to meet a child's basic oral health needs, likely to result in the serious impairment of the child's oral or general health or development.^{3,4} A case control study of five-year-old pre-school children in Toronto found that children suffering from neglect were twice as likely to suffer from dental caries.⁵ Untreated dental disease commonly causes pain,⁶ but it also affects children's well-being, body weight and quality of life.⁷ Dental decay in the primary dentition may also lead to higher risk of decay in the permanent teeth.⁸

Dental decay can also lead to maxillofacial space infections. Signs of infection include acute cervicofacial swelling or trismus.⁹ The spread of infection can cause life-threatening complications such as airway obstruction,¹⁰⁻¹² sepsis,¹³ endocarditis, mediastinitis,^{14,15} necrotising fasciitis,^{16,17} cavernous sinus thrombosis,¹⁸ brain abscess,¹⁹ or death.²⁰ Ludwig's angina is a potentially life-threatening disease.²¹ Britt *et al.* published a case series of 29 children with Ludwig's angina, 54% of

which had a dental aetiology. Intubation was required in eight cases, tracheostomy was carried out in two cases. The mortality rate of Ludwig's angina is estimated to be 17%.²²

The leading cause of maxillofacial space infections is considered to be odontogenic in more than 50% of cases.^{22,23} The greatest predictor of dental sepsis is untreated decay.²⁴ In the majority of cases, dental decay has been present for some time before patients present to emergency departments, suggesting a neglect of dental health. Thus, the majority of cases are potentially preventable, especially in children without complex general medical problems.

The statutory guidance for safeguarding children in England is 'Working Together to Safeguard Children' (2015).

In this, safeguarding is defined as:²⁵

- Protecting children from maltreatment
- Preventing impairment of children's health and development
- Ensuring that children grow up in circumstances consistent with the provision of safe and effective care

¹Department of Oral and Maxillofacial Surgery, King's College Hospital, Denmark Hill, London, SE5 9RW, UK; ²Guy's and St Thomas NHS Trust, Great Maze Pond, London, SE1 9RT, UK; ³King's College Dental Institute, Bessemer Rd, Camberwell, London, SE5 9RW, UK; ⁴King's College London, School of Tissue Engineering & Biophotonics Dental Institute

*Correspondence to: Kathleen Fan
Email: kathy.fan@kcl.ac.uk

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Table 1 Paediatric cases of dental infections from Jan 2015 to Jan 2017 at King's College Hospital

Age group (years)	Patient	Gender	Age y (years) m (months)	Source	Surgical drainage	Initial presented	Length of stay (days)	Number of teeth extracted	Known to social service	Discussed with local safeguarding team	New referral to social service
0 to 4	A	m	2y 3m	LR D	I+D	ED	3	1	no	no	no
	B	f	4y 8m	LR D/E	I+D	DentH	1	6	yes	no	no
	C	m	4y 9m	LR D/E	I+D	ED	2	4	no	no	no
	D	m	4y 10m	LL D	I+D	ED	3	1	yes	no	no
	E	f	4y 11m	LR D/E	I+D	Dentist	1	4	yes	no	no
	F	m	5y 3m	UL D	I+D	ED	1	1	yes	no	no
	G	m	5y 4m	UR D/E	I+D	ED	1	10	no	no	no
	H	m	5y 7m	LL D	I+D	DentH	2	1	no	no	no
	I	f	6y 1m	UL D/E	I+D	DentH	3	4	no	no	no
5 to 8	J	f	6y 11m	LR 6	I+D	ED	3	1	no	no	No
	K	m	7y 1m	UL D/E	I+D	Dentist	3	2	no	no	No
	L	f	7y 2m	UL D/E	I+D	Dentist	3	6	yes	no	no
	M	f	7y 3m	LL D	I+D	ED	4	8	no	yes	yes
	N	m	7y 7m	UR D	I+D	Dentist	3	1	unknown	no	no
	O	f	8y	LR D	I+D	Dentist	2	9	yes	no	no
	P	f	8y 8m	LL 6	I+D	DentH	2	11	no	no	no
	Q	m	8y 9m	LR 6	I+D	Dentist	3	1	no	no	no
	R	f	9y 2m	UR E	I+D	Dentist	4	1	unknown	no	no
9 to 12	S	m	9y 10m	LL E/6	I+D	Dentist	2	2	yes	no	no
	T	f	9y 11m	LR 6	I+D	DentH	4	6	yes	yes	yes
	U	m	10y 4m	LR D/E	I+D	Dentist	1	3	no	no	no
	V	f	10y 9m	LL 6	I+D e.o.	ED	4	4	yes	yes	yes
	W	m	10y 10m	LR 6	I+D	ED	3	6	no	no	no
	X	f	11y 9m	Cor.LL7	I+D	ED	2	0	unknown	no	no
13 to 16	Y	m	13y 10m	LL 6	I+D	Dentist	3	2	yes	yes	yes
	Z	f	14y 8m	LR 6	I+D e.o.	Dentist	3	1	unknown	yes	no
	AA	m	15y 9m	LR 7	I+D e.o.	DentH	1	1	yes	no	no

- Taking action to enable all children to have the best outcomes.

As such, every employee should participate in safeguarding training and take steps to identify and protect children from neglect. Medical and dental health professionals also have access to advice and support from safeguarding children advisors.²⁶

Aims

In this retrospective audit, we reviewed the records of all children under the age

of sixteen years, who were admitted as an emergency under oral and maxillofacial surgery at King's College Hospital between January 2015 and January 2017 and required incision and drainage of a dental/maxillofacial space infection under general anaesthesia, of odontogenic cause.

The aims were to:

- Assess what proportion were already known to social services (SS) for neglect
- Support the development of a local safeguarding referral protocol for children with dental neglect admitted under oral and maxillofacial surgery.

Material and methods

This audit was registered with our Trust's clinical audit team. All children below the age of sixteen years, who presented with dental/maxillofacial space infection requiring incision and drainage under general anaesthesia, between January 2015 and January 2017, were included. Patients were identified from our operations database. Electronic records were utilised to obtain demographic data including gender, age at presentation, length of inpatient stay and number of teeth extracted or decayed. The route of referral (dentist, dental hospital

[DentH] or emergency department [ED]) was obtained from the medical records.

In line with safeguarding guidelines, the child's local authority was contacted to find out if the child was known to SS, currently or in the past.

Data for the specific boroughs of London were obtained in regard to poverty, demographics and parental education from London datastore²⁷ and Trust for London.²⁸

Results

A total of 27 children treated between January 2015 and January 2017 were included. Thirteen were female, and 14 were male. The youngest child was two years and three months; the oldest child was 15 years and nine months. The mean age was eight years and three months (Table 1).

Table 2 illustrates the number of children according to their age. In total, eleven children were already known to SS prior to their hospital admission, (40.7%). In four cases (4/27) data could not be obtained, in three of these cases the authority would not provide information due to confidentiality (Fig. 1).

Ten children (37%) presented directly to the emergency department, six children (22%) were referred by the dental hospital and eleven children (41%) presented initially to their dentist or an emergency dentist (Table 3).

The average number of extracted teeth was 3.2. The range of tooth extraction was 0–11 (pericoronitis from an unerupted permanent tooth).

The average length of hospital stay was 2.5 days (range 1–4 days, Table 1).

Five patients (5/27) were discussed with our Trust's safeguarding team during their hospital stay, of these five patients one new referral to social services was made and three cases were re-referred due to new safeguarding concerns (Table 1).

Table 4 illustrates the specific boroughs of London with regard to poverty, demographics, parental education, the number of patients from these boroughs and the number of patients already known to SS (Table 4).

Discussion

In general, dental decay in children is a preventable disease. Despite wide access to NHS dental services and free dental care for children, dental caries remains a significant public health issue. Dental decay in children

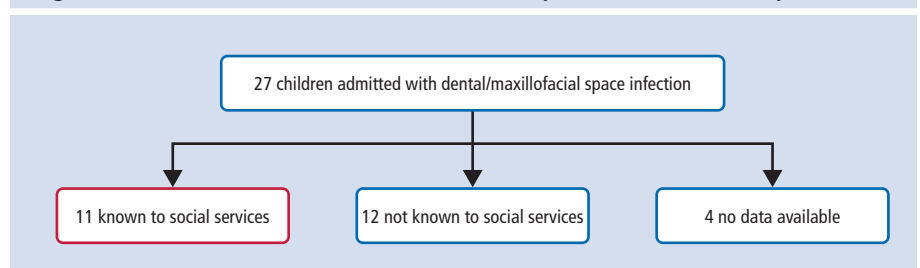
Table 2 Patients admitted with dentofacial infection according to their age and SS input (see also Table 1)

Age	n	Known to SS
0–4 years	1	0
5–8 years	14	6 (43%)
9–12 years	9	3 (33%)
13–16 years	3	2 (66%)
Total	27	11

Table 3 Route of admission and known to social services (See also Table 1)

Route of presentation	n	Known to SS
ED	10	3 (30%)
Dental hospital	6	3 (50%)
Dentist	11	5 (45%)
Total	27	11

Fig. 1 Children admitted with dental/maxillofacial space infection and SS input



has a significant impact on their general health and development, and untreated dental disease further disadvantages children,²⁹ due to physical suffering, disruption in eating, sleeping and attendance at nursery and school. Hospital admission and undergoing a surgical procedure under general anaesthesia may well be distressing for a child, in addition to causing significant costs to the NHS. A retrospective study from the USA estimated the mean overall costs for a hospital admission due to odontogenic cellulitis, with an average hospital stay of 2.08 days, to be \$4166 per case.³⁰

Studies on child neglect show that adversity in childhood can cast a long shadow with negative outcomes for children in regard to educational achievement and physical and psychological well-being. Studies show an association between exposure to child physical abuse, emotional abuse, neglect and adverse health outcomes.^{31–34} This can also include the development of significant issues such as mental ill-health and substance misuse.³⁵

Our study found, that 40% of children who presented with potential life-threatening

dental/maxillofacial space infections were already known to SS. More than 50% of these children were between five and eight years old, suggesting this group are at greater risk of harm and highlighting a potential coincidence of dental neglect and broader global neglect. Four children (15%) were referred to SS due to fresh raised concerns during their hospital stay and one was a new referral.

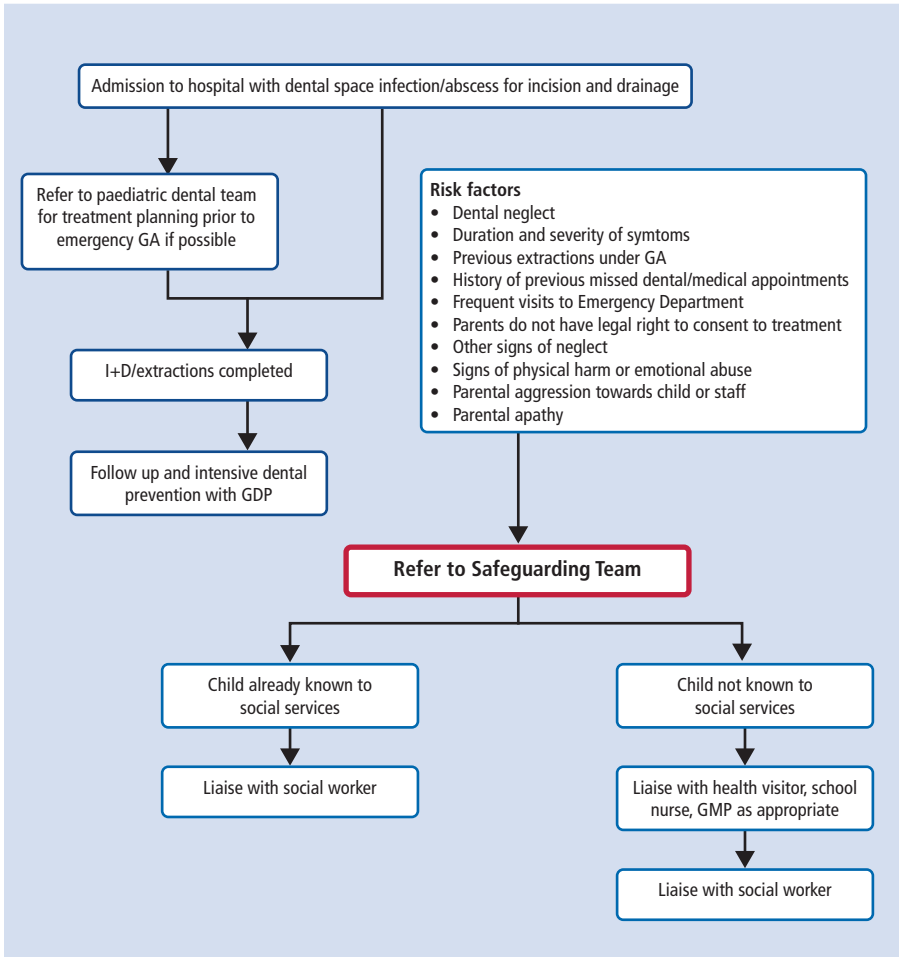
Our study did not find any other indicators of risk such as socio-economic deprivation, but this may be due to our small sample size. In the UK, dental care is free at the point of delivery for all children under the NHS. A study in France by Azogui-Lévy *et al.* (2003) similarly showed that even when 100% reimbursement was given for dental treatment, most children in need of dental care did not receive it.³⁶

Public health nurses in Scotland play a major role in child protection by supporting families in the community. Bradbury-Jones *et al.* (2013) highlighted, that healthcare professionals without a dental background rarely assess children's oral and dental status.³⁷ There is a

Table 4 Demographic and socio-economic data of London boroughs involved. The data was collected from London datastore²⁷ and Trust for London²⁸

Borough	No of patients	Known to social services	Poverty				Demographics			
			Child poverty rate (%)	Adult poverty rate (%)	Unemployed (2015) (%)	Low paid (%)	Adults lacking Level III qualification (%)	Average age 2017	Population born abroad (%)	Children 0-15 (%)
Bexley	4	4(100%)	24.7	15.9	7.6	22.8	48.0	39.0	16.1	20.6
Brent	1	1(100%)	32.0	33.0	7.5	22.8	33.0	35.6	53.9	20.9
Bromley	5	1(20%)	21.4	15.3	5.3	16.4	30.0	40.2	18.3	19.9
Enfield	1	0	34.1	27.0	3.8	29.1	45.0	36.3	35.0	22.8
Lambeth	2	1(50%)	36.1	29.8	5.9	19.5	22.0	34.5	32.2	17.6
Wandsworth	1	0	27.3	21.5	5.7	12.4	17.0	35.0	32.8	17.8
Greenwich	5	2(40%)	33.7	26.3	8.1	22.4	33.0	35.0	35.4	21.9
Lewisham	5	1(20%)	34.7	25.7	5.7	21.3	28.0	35.0	34.9	20.6
Croydon	2	1(50%)	31.2	21.5	4.1	23.6	35.0	37.0	29.4	22.0
Southwark	1	0	36.7	31.0	7.7	20.6	27.0	34.4	38.4	18.6
Greater London			37.0	24.0	6.1	21.0	n.a.	36.0	36.6	13.9

Fig. 2 Referral pathway for children admitted with dental/maxillofacial space infection



general lack in clinical confidence in identifying and referring dental neglect.³⁸

This is compounded by dental neglect in children being poorly and inconsistently understood.³⁹

Where parents or carers repeatedly fail to access dental treatment for a child's tooth decay or leave dental tooth pain untreated, 'alarm bells' should ring for clinicians to consider neglect.⁴⁰

The systematic review by Bhatia *et al.* of data from 1595 children between 0 and 18 years, highlighted the following key features of dental neglect:³⁸

- A failure or delay in seeking treatment for significant dental caries or trauma
- Failure to complete a recommended course of treatment
- Allowing the child's oral health to continue to deteriorate.

Harris *et al.* reported, that 81% of dentists state that they see children with neglected dentitions at least once a week.⁴¹ Although dental neglect may exist in isolation, it can be an indicator or even the first sign of broader child neglect.^{37,41-43}

When children are admitted with dental/maxillofacial space infections, they are likely to have undergone a sustained period of oral health neglect and it is imperative that a full assessment of their care is undertaken.

As a result of our findings, a pathway of care for children admitted with dental/maxillofacial space infections has been developed (Fig. 2). Features of generalised neglect are included in the pathway in addition to features of dental neglect, as reported by Bhatia *et al.*³⁸ Where possible, referral to the paediatric dental team is advised for emergency admissions prior to theatre. Once the initial treatment and extractions are completed, intensive follow up with the dentist should be arranged for a preventive regime in line with 'Delivering Better Oral Health Toolkit'.⁴⁴ Where there is evidence of dental neglect or broader signs of neglect (Fig. 2), referral to the safeguarding team should be made. Awareness and confidence to escalate concerns as well as education of non-dental healthcare workers is required to recognise dental neglect early and arrange treatment to prevent the development of potential dental/maxillofacial space infection.

Conclusion

Dental neglect can lead to children attending with dental/maxillofacial infections requiring surgical intervention under general anaesthesia. Dental neglect can be an indicator of broader neglect. Therefore, all children attending with infection as a result of dental neglect should be discussed with the local safeguarding team and a social services referral considered. A future comparative study to analyse the difference between children undergoing elective extractions of carious teeth under general anaesthesia, with those admitted as an emergency should be carried out to ascertain differences in their likelihood of possible neglect.

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- Department for Education. Characteristics of children in need: 2015 to 2016. 2016. Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/564620/SFR52-2016_Main_Text.pdf (accessed April 2018).
- Department for Education and Skills. Working together to Safeguard Children: a guide to inter-agency working to safeguard and promote the welfare of children. London DfES, 2006.
- American Academy of Pediatrics Committee on Child Abuse and Neglect, American Academy of Pediatric Dentistry, American Academy of Pediatric Dentistry Council on Clinical Affairs. Guideline on oral and dental aspects of child abuse and neglect. *Pediatr Dent* 2008; **30**(7 Suppl): 86–89.
- Harris J C, Balmer R C, Sidebotham P D. British Society of Paediatric Dentistry: a policy document on dental neglect in children. *Int J Paediatr Dent* 2009; DOI: 10.1111/j.1365-263X.2009.00996.x.
- Valencia-Rojas N, Lawrence H P, Goodman D. Prevalence of early childhood caries in a population of children with history of maltreatment. *J Public Health Dent* 2008; **68**: 94–101.
- Shepherd M A, Nadanovsky P, Sheiham A. The prevalence and impact of dental pain in 8-year-old school children in Harrow, England. *Br Dent J* 1999; **187**: 38–41.
- Sheiham A. Dental caries affects body weight, growth and quality of life in pre-school children. *Br Dent J* 2006; **201**: 625–626.
- Broadbent J M, Thomson W M, Williams S M. Does caries in primary teeth predict enamel defects in permanent teeth? A longitudinal study. *J Dent Res* 2005; **84**: 260–264.
- Ryan P, McMahon G. Severe dental infections in the emergency department. *Eur J Emerg Med* 2012; **19**: 208–213.
- Potter J K, Herford A S, Ellis E, 3rd. Tracheotomy versus endotracheal intubation for airway management in deep neck space infections. *J Oral Maxillofac Surg* 2002; **60**: 349–354; discussion 54–55.
- Branstetter B F, Weissman J L. Infection of the facial area, oral cavity, oropharynx, and retropharynx. *Neuroimaging Clin N Am* 2003; **13**: 393–410, ix.
- Bali R K, Sharma P, Gaba S, Kaur A, Ghanghas P. A review of complications of odontogenic infections. *Natl J Maxillofac Surg* 2015; **6**: 136–143.
- Holmberg P, Hellmich T, Homme J. Pediatric Sepsis Secondary to an Occult Dental Abscess: A Case Report. *J Emerg Med* 2017; **52**: 744–748.
- Sakamoto H, Aoki T, Kise Y, Watanabe D, Sasaki J. Descending necrotizing mediastinitis due to odontogenic infections. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2000; **89**: 412–419.
- Zeitoun I M, Dhanarajani P J. Cervical cellulitis and mediastinitis caused by odontogenic infections: report of two cases and review of literature. *J Oral Maxillofac Surg* 1995; **53**: 203–208.
- Colmenero Ruiz C, Labajo A D, Yanez Vilas I, Paniagua J. Thoracic complications of deeply situated serous neck infections. *J Craniomaxillofac Surg* 1993; **21**: 76–81.
- Tung-Yiu W, Jehn-Shyun H, Ching-Hung C, Hung-An C. Cervical necrotizing fasciitis of odontogenic origin: a report of 11 cases. *J Oral Maxillofac Surg* 2000; **58**: 1347–1352; discussion 53.
- Kiddee W, Preechawai P, Hirunpat S. Bilateral septic cavernous sinus thrombosis following the masticator and parapharyngeal space infection from the odontogenic origin: a case report. *J Med Assoc Thai* 2010; **93**: 1107–1111.
- Li X, Tronstad L, Olsen I. Brain abscesses caused by oral infection. *Endod Dent Traumatol* 1999; **15**: 95–101.
- Wong T Y. A nationwide survey of deaths from oral and maxillofacial infections: the Taiwanese experience. *J Oral Maxillofac Surg* 1999; **57**: 1297–1299; discussion 300.
- Sethi D S, Stanley R E. Deep neck abscesses-changing trends. *J Laryngol Otol* 1994; **108**: 138–143.
- Britt J C, Josephson G D, Gross C W. Ludwig's angina in the pediatric population: report of a case and review of the literature. *Int J Pediatr Otorhinolaryngol* 2000; **52**: 79–87.
- Han X, An J, Zhang Y, Gong X, He Y. Risk Factors for Life-Threatening Complications of Maxillofacial Space Infection. *J Craniofac Surg* 2016; **27**: 385–390.
- Pine C M, Harris R V, Burnside G, Merrett M C. An investigation of the relationship between untreated decayed teeth and dental sepsis in 5-year-old children. *Br Dent J* 2006; **200**: 45–47; discussion 29.
- Department for Education. Working together to safeguard children: a guide to inter-agency working to safeguard and promote the welfare of children. 2015. Available at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/564620/SFR52-2016_Main_Text.pdf (accessed April 2018).
- Harris J C, Elcock C, Sidebotham P D, Welbury R R. Safeguarding children in dentistry: 1. Child protection training, experience and practice of dental professionals with an interest in paediatric dentistry. *Br Dent J* 2009; **206**: 409–414.
- Greater London Authority: London Borough Profiles and Atlas. 2017. Available at <https://data.london.gov.uk/dataset/london-borough-profiles> (accessed April 2018).
- Tinson A, Ayrton C, Barker K, Born T B, Long O. Trust for London: London's Poverty Profile. 2017. Available at <https://www.trustforlondon.org.uk/data/boroughs/overview-of-london-boroughs/> (accessed April 2018).
- Finucane D. Rationale for restoration of carious primary teeth: a review. *Eur Arch Paediatr Dent* 2012; **13**: 281–292.
- Thikkurissy S, Rawlins J T, Kumar A, Evans E, Casa-massimo P S. Rapid treatment reduces hospitalization for pediatric patients with odontogenic-based cellulitis. *Am J Emerg Med* 2010; **28**: 668–672.
- Gilbert R, Widom C S, Browne K, Fergusson D, Webb E, Janson S. Burden and consequences of child maltreatment in high-income countries. *Lancet* 2009; **373**: 68–81.
- Kessler R C, McLaughlin K A, Green J G *et al.* Childhood adversities and adult psychopathology in the WHO World Mental Health Surveys. *Br J Psychiatry* 2010; **197**: 378–385.
- Brent D A, Silverstein M. Shedding light on the long shadow of childhood adversity. *JAMA* 2013; **309**: 1777–1778.
- Newbury J B, Arseneault L, Moffitt T E *et al.* Measuring childhood maltreatment to predict early-adult psychopathology: Comparison of prospective informant-reports and retrospective self-reports. *J Psychiatr Res* 2018; **96**: 57–64.
- Norman R E, Byambaa M, De R, Butchart A, Scott J, Vos T. The long-term health consequences of child physical abuse, emotional abuse, and neglect: a systematic review and meta-analysis. *PLoS Med* 2012; **9**: e1001349.
- Azogui-Levy S, Lombrail P, Riordan P J *et al.* Evaluation of a dental care program for school beginners in a Paris suburb. *Community Dent Oral Epidemiol* 2003; **31**: 285–291.
- Bradbury-Jones C, Innes N, Evans D, Ballantyne F, Taylor J. Dental neglect as a marker of broader neglect: a qualitative investigation of public health nurses' assessments of oral health in preschool children. *BMC Public Health* 2013; **13**: 370.
- Bhatia S K, Maguire S A, Chadwick B L *et al.* Characteristics of child dental neglect: a systematic review. *J Dent* 2014; **42**: 229–239.
- Noble F, Dickie J, Conway D I. Systematic review highlights difficulty in clearly identifying dental neglect in children. *Evid Based Dent* 2014; **15**: 3–4.
- NICE. Child maltreatment: when to suspect maltreatment in under 18s. National Institute for Health and Clinical Excellence. 2009. Available at <https://www.nice.org.uk/guidance/CG89/chapter/1-Guidance#physical-features> (accessed: April 2018).
- Harris J C, Elcock C, Sidebotham P D, Welbury R R. Safeguarding children in dentistry: 2. Do paediatric dentists neglect child dental neglect? *Br Dent J* 2009; **206**: 465–470.
- Balmer R, Gibson E, Harris J. Understanding child neglect. Current perspectives in dentistry. *Prim Dent Care* 2010; **17**: 105–109.
- Souster G, Innes N. Some clarification of trigger signs for dental neglect. *Evid Based Dent* 2014; **15**: 2–3.
- Public Health England. Delivering better oral health: an evidence-based toolkit for prevention. 2014. Available at <https://www.gov.uk/government/publications/delivering-better-oral-health-an-evidence-based-toolkit-for-prevention> (accessed April 2018).