

Dental care provision to UK military personnel serving on Operation Herrick in Afghanistan.

Part 2: aetiology and management

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Key points

Shows that molar teeth are responsible for the vast majority of significant dental morbidity in UK Service personnel and that first molars and lower wisdom teeth are responsible for the majority of 'severe' morbidity.

Highlights that UK military dentists and civilian dentists working for the military practise early, definitive, operative/surgically orientated management of irreversible pulpitis, periapical abscess and other conditions, using antibiotics sparingly.

Explains that reducing morbidity – especially that due to third and first molars – and maintaining oral surgical skills are key in military dentistry.

Aims To evaluate the nature of tooth-related morbidity in military personnel deployed on Operation Herrick and to compare the management of dental emergencies to that in non-deployed personnel. **Method** Data were collected prospectively for UK Service personnel on Operation Herrick (OpH) during an 18-month period and measured against prospectively collected 'home base' (HB) control data. **Results** Molar teeth were responsible for 64.1% (2,089/3,259) of presentations on OpH and 69.5% (323/467) at HB, causing 81.4% (622/764) of cases of pain lasting for >60 minutes and/or waking the patient on OpH and 86.0% (129/150) at HB. Third molars were responsible for 48.3% and 43.3% of such cases, respectively, and first molars 20.7% and 26.7%. The ratio of temporary to definitive restorations was 0.42 at HB compared with 0.18 on OpH ($P < 0.001$). Antibiotics were prescribed in 5.7% of all cases of pulpitis /periapical infection on OpH and 7.9% at HB. A third molar causing pericoronitis was 2.4 times more likely to be extracted on OpH than at HB (27.4% cf 11.6%). **Conclusions** A more definitive approach to management is evident on deployment, reflecting the effort to conclusively treat immediately. To maintain this standard of care it is vital that military dental surgeons continue to be skilled in minor oral surgery.

Introduction

The 2010 Comptroller and Auditor General's report entitled *Treating injury and illness arising on military operations* stated that the Ministry of Defence (MoD) should 'analyse available data to identify and understand the cause of long-term trends in disease and minor injury.'¹ This 'disease and minor injury' included dental disease.

Rates and causes of dental morbidity on military operational deployments have been well researched and documented, yet dental morbidity persists, even in a 'well prepared' or 'dentally fit' force.²⁻¹⁰ This was also the case on Operation Herrick (OpH), the UK

mission in Southern Afghanistan, as documented in the first paper of this series.¹¹ A previous study demonstrated a higher level of morbidity associated with wisdom teeth and pulpitic teeth.⁵ However, the aim of this service evaluation was to acquire a detailed understanding of the teeth and conditions most likely to cause significant morbidity, as well as the type of treatment used to manage emergency dental attendances.

Materials and methods

This service evaluation prospectively collected data for all UK Service personnel deployed on OpH who attended a UK military dental centre (DC) while deployed for the management of 'dental emergencies' (DE). These findings were compared to the same datasets contemporaneously collected at 'home base' (HB) UK military DCs as a control group. A DE was considered to be anyone seeking help or advice for a dentally-related problem.

OpH group

Contemporaneous, standardised datasets were recorded by UK military dental officers for each UK Service person deployed on OpH in Southern Afghanistan who attended as a DE from May 2011-October 2012 onto a specifically designed Microsoft Excel spreadsheet. Data gathered included pain history, the tooth or area involved and the diagnosis that was annotated using a set of morbidity codes, as well as the treatment modality, if any was provided.

HB group

The same standardised data as gathered on OpH were contemporaneously recorded onto a specifically designed Microsoft Excel spreadsheet for all emergency attendances at all home base UK military DCs during a one-week period in 2012. These data were used for comparison purposes with the data collected within the OpH group.

Statistical analyses were made with the aid of IBM SPSS Statistics for Windows (version

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20.0, IBM Corp, Armonk, NY, USA). The chi square test and Fisher's exact test were used to assess the significance of differences between groups. Probabilities of <0.05 were accepted as significant.

This study was approved as a service evaluation by Colonel R. McCormick L/RADC, then Defence Consultant Advisor in Public Health Dentistry and permission to submit for publication was granted by the Director of Research, Royal Centre for Defence Medicine.

Results

On OpH, in the 18-month period studied there were 4,017 attendances by 3,355 individuals. In the HB group, there were 531 emergency attendances by British military personnel at UK military DCs in a one-week period in 2012, of whom 530 had a recorded diagnosis. Further detail on this can be found in the first paper of this series.¹¹

In the OpH group, 16.5% (667/4,040) of patients suffered pain lasting for more than an hour, compared with 28.1% (149/351) at HB ($\chi^2 = 143.63$, dof = 1, $p < 0.001$). 'Pulpitis' or 'periapical abscess' (the terms used in the standardised morbidity codes) were the diagnosis in 14.4% (578/4,025) of attendances on OpH and 16.8% (89/530) at HB but resulted in pain lasting for greater than an hour in 41.7% (278/667) on OpH and 32.2% (48/149) at HB. Similarly, pericoronitis was diagnosed in 11.9% (478/4,025) of attendances on OpH and 13.0% (69/530) at HB but was responsible for 33.6% (224/667) and 32.2% (48/149) of cases of pain lasting for more than one hour respectively.

The corollary is that a fractured tooth/restoration (not caused by trauma) was the diagnosis in 32.6% (1,313/4,025) of all presentations on OpH and 31.5% (167/530) at HB, but only accounted for 1.2% (8/667) and 0.7% (1/149) respectively of cases where pain lasted for more than one hour. Figure 1 details the most common diagnoses by pain duration.

Tooth-related morbidity

Tooth-related morbidity was the reason in 80.7% (3,259/4,040) of attendances on OpH and 87.9% (467/531) at HB. The relative frequency of attendance by tooth in the OpH and HB groups is presented in Figure 2.

Molar teeth were responsible for 64.1% (2,089/3,259) of presentations on OpH and 69.5% (323/467) at HB. Pathology related to lower first molars resulted in most

Fig. 1 OpH and HB groups – emergency cases by diagnosis and pain duration showing percentage of all cases

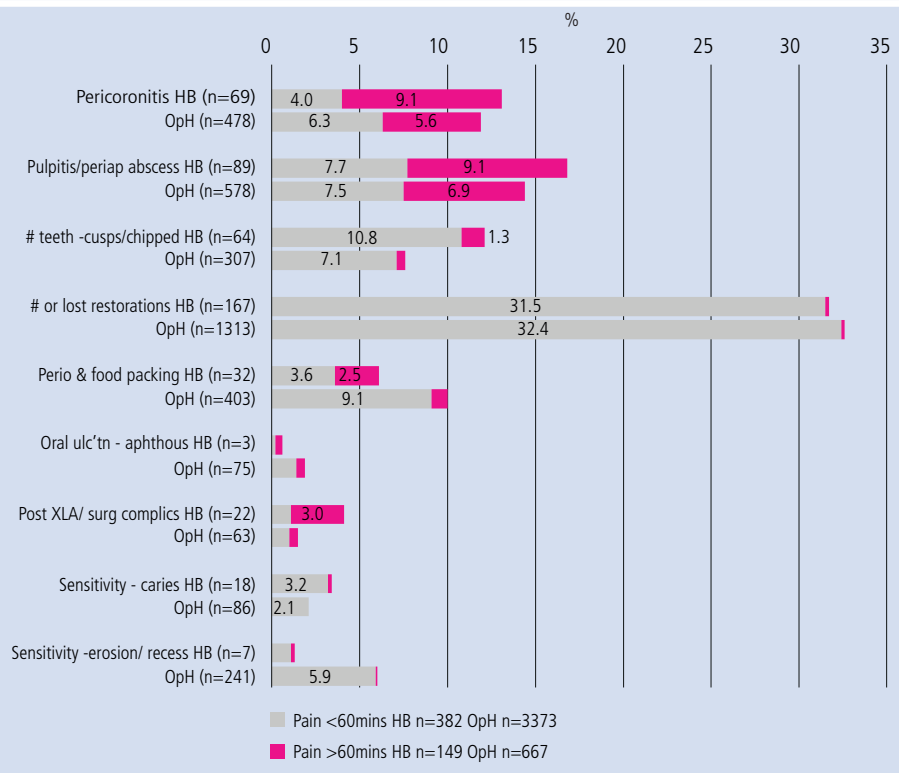


Fig. 2 OpH and HB groups – attendance proportions by tooth and pain caused by tooth for all tooth-related morbidity

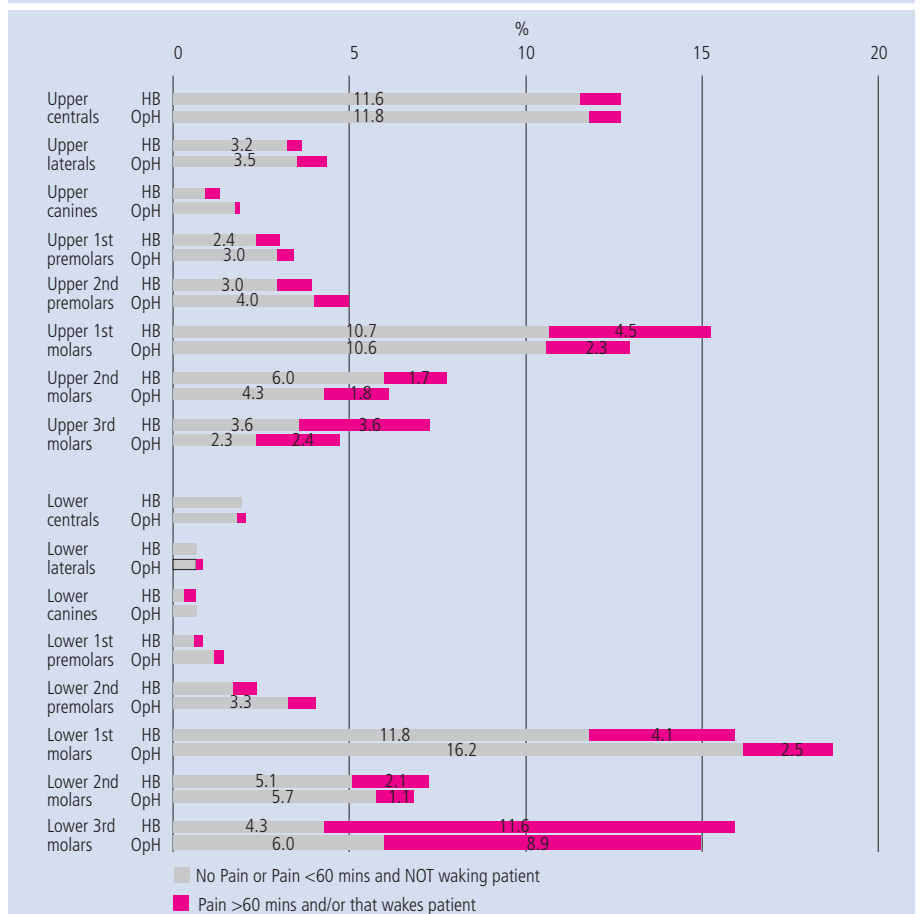


Fig. 3 Overall treatment modalities for HB and OpH groups as a percentage

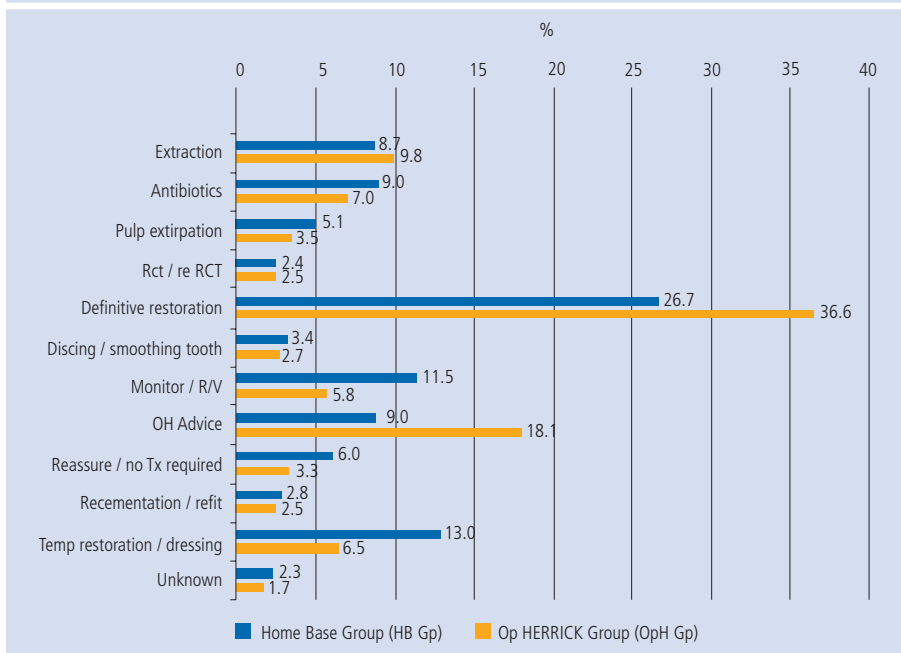
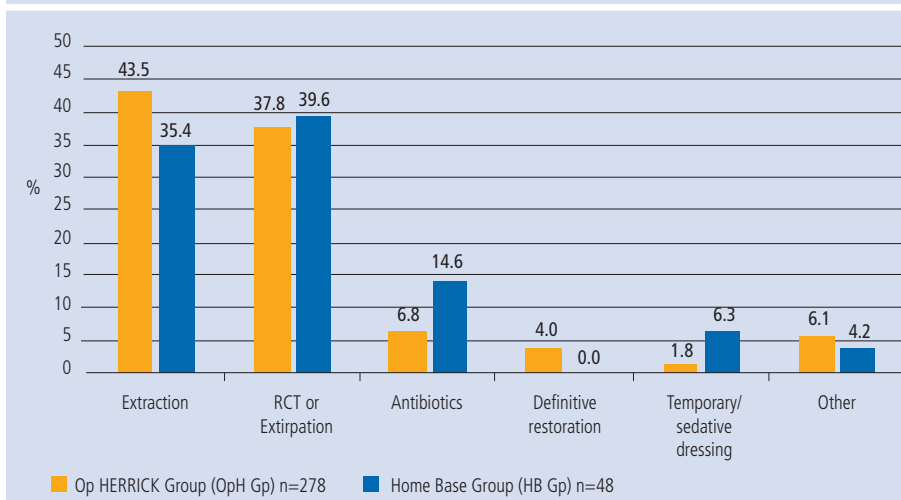


Fig. 4 Treatment of teeth with pulpitis or periapical infection causing pain lasting >60 minutes



presentations (OpH 18.7%, HB 15.9%), followed by lower third molars (OpH 14.9%, HB 15.8%), upper first molars (OpH 12.9%, HB 15.2%) and upper central incisors (12.7% in both groups).

In the OpH group, of the 3,259 patients with tooth-related morbidity, 23.4% (764) of patients experienced pain lasting for >60 minutes and/or pain that woke them, compared with 32.1% (150/467) at HB ($\chi^2 = 16.61$, dof = 1, $p < 0.001$). Molar teeth caused 81.4% (622) of these cases (28.1% upper and 53.3% lower) on OpH and 86.0% (129) of cases at HB (30.7% upper and 55.3% lower) (Fig. 2). Lower third molars caused 38.0% (290/764) and 32.0% (48/150) of these cases on OpH and at HB respectively,

while upper third molars caused 10.3% (79/764) and 11.3% (16/150) respectively. First molars caused 20.7% (158/764) of such cases on OpH, and 26.7% (40/150) at HB.

On OpH, tooth or restoration fracture was the diagnosis in 59.8% (365/610) of lower first molar and 54.7% (231/422) of upper first molar presentations, accounting for 30.6% (496/1,620) of all such diagnoses. First molar teeth were responsible for 35.3% (204/578) of pulpitis or periapical abscess cases on OpH and 39.3% (35/89) at HB.

For lower third molars, pericoronitis was the diagnosis in 81.6% of cases (390/487) on OpH and 70.3% (52/74) at HB. For upper third molars pericoronitis occurred in 45.8%

(70/153) on OpH and 38.2% (13/34) at HB, with 24.3% (37/153) and 29.4% (10/34) respectively having pulpitis or a periapical abscess. For those individuals diagnosed as suffering from pericoronitis, 42% (29/69) at HB and 43.7% (209/478) on OpH had experienced prior symptoms, with 18.8% (13/69) and 22.4% (107/478) respectively having had two or more previous episodes.

In the HB group 33.5% (178/531) of patients had experienced previous symptoms from the tooth or area that led them to report sick compared with 21.1% (854/4,040) from the OpH group ($\chi^2 = 41.17$, dof = 1, $p < 0.001$). For those experiencing pain duration of greater than 60 minutes, the figures were HB 38.9% (58/149) compared with OpH 37.2% (248/667).

The relative frequency of treatments used for emergency attendees in both the OpH and HB groups is summarised in Figure 3. On OpH 83.8% (332/396) of the teeth that were extracted were molars; 48.2% (191) were third molars (87 upper, 104 lower), 20.7% (82) first molars (38 upper, 44 lower) and 14.9% (59) second molars (31 upper, 28 lower). 33.2% (81/244) of all pulp extirpations/root canal treatments were performed on first molar teeth (45 upper, 36 lower). Of the 1741 teeth that had permanent or temporary restorations or dressings placed, 37.6% (655) were first molars (249 upper, 406 lower), more than twice as many as the next most commonly restored teeth (central incisors – 15.2%).

Of all antibiotic prescriptions on OpH, 64.9% (183/282) were for pericoronitis, compared with 54.2% (26/48) at HB ($\chi^2 = 2.032$, dof = 1, $p = 0.154$). 38.3% (183/478) of all patients with pericoronitis received antibiotics on OpH, compared with 37.7% (26/69) at HB ($\chi^2 = 0.009$, dof = 1, $p = 0.923$). In the OpH group 27.4% (131/478) of patients with pericoronitis had an extraction compared with 11.6% (8/69) in the HB group ($\chi^2 = 7.953$, dof = 1, $p = 0.05$). The ratio of temporary restorations or dressings applied to teeth compared with placement of definitive restorations was 0.42 (60:142) at HB compared with 0.18 (262:1,472) on OpH ($\chi^2 = 27.788$, dof = 1, $p < 0.001$).

For all teeth with pulpitis or periapical infection, regardless of pain status, extirpation or root canal treatment was carried out in 37.5% (217/578) on OpH and 38.2% (34/89) at HB ($\chi^2 = 0.014$, dof = 1, $p = 0.905$), while the rate of extraction was 29.9% (173/578) in the OpH group and 27.0% (24/89) in the HB group ($\chi^2 = 0.326$, dof = 1, $p = 0.568$). Antibiotics were prescribed in 5.7% (33/578) of all cases

of pulpitis or periapical infection on OpH and 7.9% (7/89) at HB (2-sided Fisher's exact $p = 0.469$).

For teeth diagnosed with pulpitis that caused pain lasting more than 60 minutes, the resulting treatment provided is shown in Fig. 4. Surgical management, in the form of extraction or extirpation/RCT of the pulp/root canal, was the mainstay of treatment with antibiotic usage low in both groups, albeit the rate in the HB group was twice that seen on OpH (14.6% [7/48] cf 6.8% [19/278]; 2-sided Fisher's exact $p = 0.082$).

Discussion

Reducing dental morbidity and subsequent treatment plays an important role in maintaining optimum fitness to fight capability. Despite rigorous efforts to promote dental fitness and high 'dental fitness' state, various nations have found that a level of emergency dental treatment is still required in both home based and deployed military forces.²⁻⁷ This study is the first to provide detailed information on the specific teeth and associated diagnoses that cause morbidity on operational deployment. It indicates that the breakdown of presenting problems on operational duty has many similarities to that of UK home-based personnel. However, as detailed and explored in the first paper of this two-part series,¹¹ the proportion attending with pain lasting more than an hour was 70% greater at HB than on OpH. Could diagnosis and management of the original problem have been better – almost two out of five of the patients suffering pain lasting more than an hour at HB and on OpH had experienced symptoms from the same tooth or area previously?

An attempt has been made to compare the findings relating to dental emergency attendances in an operational environment (OpH) with those in troops in the non-deployed setting (HB). It is a limitation of this study that the HB (control) group is considerably smaller than the OpH sample. More validity in comparison would have been added by increasing the duration of data collection in the control group. The data collection was limited to one week in the HB cohort to minimise additional time pressure on clinical teams who were also conducting routine treatment, unlike on OpH.

Fractured or chipped teeth/restorations represented the commonest diagnosis, in-keeping with other studies of deployed service personnel.^{2,5,12} However, these types of problem only caused

1.2% (OpH) and 0.7% (HB) of cases of pain lasting more than 60 minutes. While treatment is required for these teeth to prevent significant symptoms occurring, it is prevention of the cause of long-duration pain or pain that wakes the patient that is of paramount importance; such pain cases accounted for almost a quarter of cases on OpH and one third at HB. Molar teeth were implicated in over 80% of these cases both on OpH and at HB – showing where the focus of attention needs to be. Pericoronitis associated with third molars was seen in 11.8% (OpH) and 13.0% (HB) which lies within the range of 10 to 20% reported in previous studies.^{2-4,7,12,13}

The findings presented within this paper provide additional support to the 2008/9 study that found pericoronitis occurs *de novo* in an operational setting in more than 50% of cases.¹⁴ Patients enduring single (21.3%) and two or more (22.4%) previous episodes of pericoronitis have not changed substantially from the 2008/9 study (22.7% and 23.8%, respectively). Although it is challenging to predict third molar pericoronitis, the frequency of multiple prior presentations, suggests that more should be done to encourage extraction of at-risk teeth. The importance of appropriate management of third molars is clear from the fact that 48.3% of all cases of tooth-related pain lasting more than an hour or waking the patient on OpH were the result of third molar related morbidity, not just pericoronitis.

Second only to third molars as a cause of long-duration pain, or pain that wakes, were first molars. These four teeth were the commonest reason for presentation – 31.6% on OpH and 31.1% at HB – and were responsible for 35.3% and 39.3% of cases of pulpitis/periapical abscess on OpH and at HB respectively. The treatment burden for these teeth on OpH was high – requiring 33.2% of all pulp extirpations/ root canal treatments, 37.6% of all restorations/ dressings and 20.7% of all extractions. This suggests that it may be difficult to predict and prevent morbidity related to first molar teeth, perhaps because many are more heavily restored than other teeth.

Previous research on UK military personnel has shown that missing a lower first molar on joining the military and being under 20 years old resulted in a relative risk reduction for pericoronitis in the ipsilateral third molar of 82%.¹⁵ The high incidence of first molar related morbidity found in this study suggests that observational research is required in a wider population to evaluate further the natural history of first molars, exact reasons for associated morbidity

and the effect of the loss of a first molar at different ages on rates of pericoronitis.

It is clear that on OpH every effort was made to see and definitively treat emergency patients on the day they attended, serving to reduce unnecessary, risk-laden travel and to maximise operational effectiveness. This is reflected by the fact that individuals were 2.4 times more likely to have a wisdom tooth causing pericoronitis immediately extracted on OpH than at HB (27.4% cf 11.5%). The low ratio of temporary to permanent restorations placed on OpH (0.18) when compared to at HB (0.42) also demonstrates the policy of immediate definitive treatment where possible.

Other than the greater number of permanent restorations placed and less 'monitoring' of patients, overall treatment proportions at HB and on OpH are similar (Fig. 3), suggesting a coherent policy that is adhered to by the dentists treating UK Service personnel. This can be witnessed by the high levels of operative intervention, via root canal therapy (OpH 37.8%, HB 39.6%) or extraction procedures, (OpH 43.5%, HB 35.4%) and low use of antibiotics (OpH 6.8%, HB 14.6%) in the management of pulpitis or periapical infections causing pain lasting more than an hour. Most antibiotic prescriptions in both groups were for the management of pericoronitis (OpH 64.9%, HB 54.2%) but overall only 38.3% and 37.7% (OpH and HB) of all patients with pericoronitis received antibiotics.

Representative comparison to civilian practice is difficult as published studies from the UK essentially relate to out-of-hours clinics or dental hospital emergency attendances, which is not the same setting. However, there are a few reasonable comparisons that can be made. A study of out-of-hours emergency dental clinics in Cheshire published in 2001 found that 69.6% of 533 patients with pulpitis, dentoalveolar infection or periapical abscess were prescribed antibiotics compared with 14.6% (HB) and 6.8% (OpH).¹⁶ In the same study, of those patients diagnosed with pericoronitis, 51.2% (21/41) received antibiotics compared with 37.7% (HB) and 38.3% (OpH). It must be considered that in the 11 years between the two studies antibiotic prescribing habits may have changed. However, in a retrospective analysis of 1167 adult emergency dental care attendances in Merseyside published in 2008 the antibiotic prescription rate was very similar at 72.2% (117/162) for those with pulpitis, periapical periodontitis or periapical abscess.¹⁷ 84.1% (37/44) received antibiotics for pericoronitis

while 12.5% (14/112) of patients who had pain related to an 'acute apical infection' had surgical intervention.¹⁷ In cross-sectional analysis of adults with 'acute dental conditions' conducted in Wales almost contemporaneously with the OpH and HB studies, the proportion of patients with irreversible pulpitis or periapical periodontitis/ abscess who received antibiotics was lower than the Merseyside and Cheshire studies at 54.2% (207/382).¹⁸ However in the same paper the antibiotic usage for those with pericoronitis was greater at 93.1% (67/72).

It could be argued that treatment of UK military personnel is predominantly more operative than their civilian counterparts when managing pulpitis and periapical abscess, with reduced reliance on antibiotic therapy for this and the management of pericoronitis.

Conclusions

This study found that the nature of dental morbidity suffered by UK Service personnel was broadly similar between those serving on operational deployments and those stationed at home bases. Dental emergency treatments provided were predominantly operative and definitive in approach with limited, appropriate reliance on antibiotic therapy, aimed at getting individuals symptom-free and 'fit to fight' rapidly. In order to maintain this standard of care it is vital that patients continue to have access to clinicians skilled in dento-alveolar surgery during future deployments.

Molar teeth are responsible for four out of five cases of significant morbidity – mainly due to pericoronitis, pulpitis and periapical abscess – with previous symptoms occurring in two out of five. These findings should be employed to develop clinical protocols that target preventative management with the aim of reducing deployed dental morbidity. Particular attention should be paid to first and third molars as these teeth presented the greatest frequency and symptom severity. The assiduous application of current guidance regarding third molar extraction in addition to special tests (such as pulp viability or periapical radiographs) to assess heavily restored molars and upper central incisors, with intervention as required, should be trialled. Further research is required into the benefits of early removal of diseased first molars and the subsequent effect that this may have on third molar related pericoronitis. It is believed that the lessons learnt would also be valid within the provision of civilian dental care.

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