The operational dental officer in the ADF

Wing Commander Gregory D Mahoney, BDSc, GradDipClinDent, MSc(Dent)

Abstract

The role of the operational dental officer in the Australian Defence Force (ADF) has been unchallenged until recent times. Now, largely due to workforce and economic constraints, the need for uniformed dental officers has come under scrutiny. Therefore, it is timely to:

- review dental casualty rates in various operational situations
- examine the nature of these dental casualties and whether they affect the operational capabilities of the deployed force
- establish that operational (field) dentistry can effectively treat dental casualties and debate whether this is best done by the operational dental officer.

ADF Health 2003; 4: 40-44

DENTAL PROBLEMS associated with troops in the field have long been recognised as a problem in combat readiness.[1-3] By the end of World War I, 130 Australian dentists were serving abroad. But the patterns of dental disease have changed from the conflicts of the last century. Dentistry has moved towards conserving the natural dentition, and hence there is an increase in diagnostic, preventive, endodontic and fixed prosthodontic dentistry.

The Joint Public Accounts Committee (JPAC), taking into account the Auditor-General's report on the provision of health services in the Australian Defence Force (ADF),[4] considered that the cost of ADF dentistry was far too high compared with the community standard and recommended that the ADF's permanent dental services be abolished. A follow-up audit only recommended a reduction in the number of uniformed dental officers.[5]

For the uniformed dental officer to have a role in the ADF there has to be a need for dentistry in the field to maintain the combat effectiveness of the deployed force. To demonstrate this need, four fundamental questions have to be addressed:

- What are the expected dental casualty rates?
- Do these rates affect combat effectiveness or work performance?
- Are these rates high enough and their treatment time consuming enough to warrant an operational role for dental officers?
- Can operational dental officers treat dental casualties effectively?

Expected dental casualty rates

Several studies have been reported that measure dental casualty rates as the annualised incidence rate (AIR: number of casualties per 1000 per year).[6] The most recent study examined past conflicts, peacekeeping deployments and exercises to project the expected dental casualty AIR for a variety of troop deployments (Box 1).[7]

The literature stresses that these rates are dependent on dental maintenance in the field, and without such maintenance these rates would rise.

Wing Commander Greg Mahoney is in private dental practice in Manly, Brisbane. He joined the RAAF Active Reserve in 1984 and served as a dental officer, transferring to the Specialist Reserve in 1999 after seven years as the Operational Health Support Flight Commander, 23 Squadron. He completed his GradDipClinDent (Pain Control and Sedation) in 1997 and a Master of Science in Dentistry in 2001.

Correspondence: Wing Commander Gregory D Mahoney, BDSc, GradDipClinDent, MSc(Dent), Suite 9, 188 Stratton Terrace, Manly, QLD 4179. mahoney@uq.net.au

In 1999, an ADF-led multinational force under the auspices of the United Nations was deployed to East Timor. The deployment to East Timor had two distinct phases. The first phase, Operation Warden, was to stabilise the situation in East Timor. This was the largest involvement of the ADF (4500 ground personnel) since World War II. The second phase, Operation Tanager, is an ongoing peacekeeping operation and involves between 1500 and 2000 ground personnel.

Based on the literature, the expected AIR for these operations would be in the range 150–260. However, the actual AIR (calculated from Dental Encounter Form Returns) for Operation Warden was 453, and for Operation Tanager 269 (in 2000) and 265 (in 2001). While the Operation Tanager figures were at the upper limit of the expected range of casualties, the dental casualty rates during Operation Warden were twice the expected rate. This could be due to a number of factors:

- *Fluctuations in the ADF population in East Timor*. Some ADF members on short detachments had a lower standard of dental fitness.
- *Inherent problems within the dental fitness classification system*. There is a degree of discretion in determining whether a soldier is dentally fit, which is highly dependent on the skill and experience of the examining dentist.
- *Commanders accepting troops for deployment when dentally unfit*. For operational reasons commanders have sometimes accepted dentally unfit soldiers, and the short notice to deploy would have made it difficult to finish treatment.
- *Field conditions*. Within the first weeks of deployment the living conditions and rations were hard. Anecdotally, the survival biscuits were said to be useful for housing reconstruction and breaking teeth.

The data from Operation Warden suggest that it would be prudent to plan for a deployment at short notice involving reservists to have a dental casualty AIR of 260–450. Most recent deployments by the ADF have fitted this description.

Do these rates affect combat effectiveness?

Several studies have examined the relationship between dental casualties and combat effectiveness. A US study in 1992 on the impact of dental sick calls on combat effectiveness found that a loss of up to 18 720 man-days per division (10 000 personnel) per year could be expected.[8] Dental sick calls made up about 21% of all sick calls, and this could mean that a soldier could be away from the combat unit for up to five days.

Ludwick et al, in their study of dental emergencies in the Vietnam War among Navy and Marine personnel, also found that dental emergencies lead to significant lost duty time and therefore a reduction in the combat effectiveness of their units, although the loss was difficult to quantify.[9]

Bishop and Donnelly point out that even low grade dental pain can disrupt concentration, sleep, and individual performance. With the sophisticated weapons used in modern warfare, a compromised performance by an individual can not only disrupt a mission but ultimately affect the outcome.[10] Anderson, in a study of British dental casualties during the Gulf War, found that 40% of dental casualties were in pain.[11]

Within the ADF, a study was conducted into work performance and dental emergencies on soldiers and airmen.[12] Some of the findings of this study were that:

- 35% of dental casualties were in sufficient pain to affect their work performance.
- Of the remaining dental casualties, 30% had their lifestyles affected, which could eventually affect their work performance.

Based on an AIR of 260–450 over a six-month deployment, 8.4%–14.6% of a force would have their work performance affected at some time — a figure consistent with the British experience in the Gulf War.[11] Clearly, dental casualties compromise the operational effectiveness of individuals and occur at such a rate that they can degrade the operational effectiveness of the deployed force.

Are these rates high enough to warrant an operational role for the dentist?

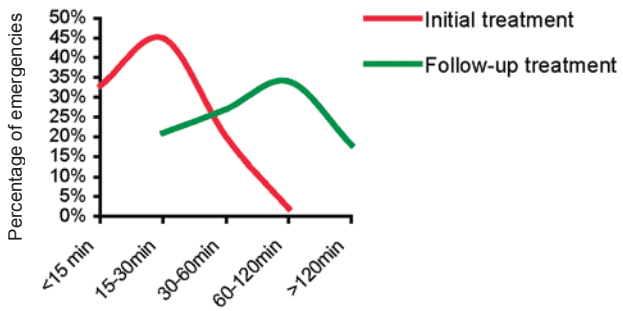
For military operational purposes the usual measure for the need for dentists has been the dental emergency AIR, which ranges, according to the type of deployment, from 150 to 750.[6] However, the rate of emergencies does not give a clear indication of the workload on the dental officer. A low dental emergency rate relies on a high level of dental fitness, which must be maintained in the field, especially for extended deployments.

A number of factors determine the need for a dental officer:

1: Expected annualised incidence rate (AIR) per thousand troops per year of dental casualties

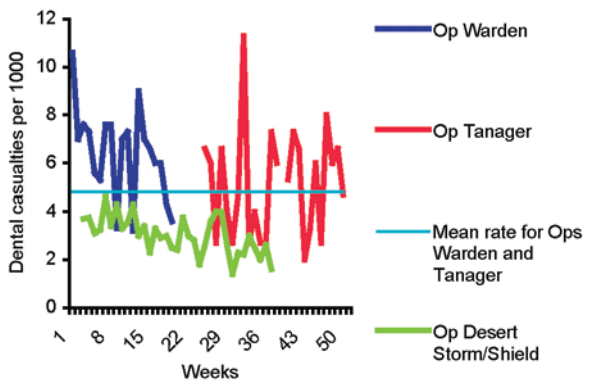
Type of force on deployment	AIR
Well prepared all-volunteer force	150–200
Reserve forces	150–260
Other troops with lower dental fitness standard	750
Ill prepared forces	750

2: Time taken to treat dental emergencies



- *Length of deployment.* On all but very brief deployments, an increase in the dental casualty AIR can be expected if routine preventive examinations and treatment are not undertaken.
- *The expected rate of dental casualties*. As discussed previously, this depends on who is being supported (eg, ADF, reservists, foreign defence forces, civilians).
- *The type of deployment*. Combat deployments involve an increase in maxillofacial injuries.[13]
- *The time to prepare for deployment*. Deployments at short notice increase the likelihood of deployed personnel being dentally unfit.
- *The time taken to initially treat dental emergencies and the requirement for any follow-up treatment on deployment*. In a survey of garrisoned ADF troops, 54% of all dental emergencies required follow-up treatment.[11] The time taken to treat these dental emergencies is illustrated in Box 2, which shows that follow-up treatment can take considerably longer than initial treatment.
- *The availability of local resources*. In planning any deployment, especially within Australia, the possibility of using local resources should be considered. However, care should be taken not to place an undue burden on the civilian infrastructure.
- *Field factors*. Working in deployed conditions is less efficient than in a fixed facility, and this is compounded by dispersion of the deployed force and difficult field conditions. Efficiency can be halved in the deployed environment, according to US Army experience (as reported by Colonel MJ Carino to the Military Dentistry Section of the FDI World Congress, Paris, 2000).

3: Comparison of weekly dental casualty rates per 1000 for Operations Warden, Tanager and Desert Storm/Shield



■ *Surge capacity*. Providing dental services on the basis of average dental casualty rates will underestimate the requirement for surges in dental casualties (Box 3). While the average gives the military planner a useful guide, especially for calculating stock requirements, it does not take into account the fluctuations that occur on a weekly basis. It is impracticable to staff to the maximum limit of these fluctuations, and therefore the mean deviation (average of the absolute deviations of data points from their mean) is used as a realistic indication of the surge capacity required. In Operations Warden and Tanager the mean deviation was 30%.

■ *Deployment activities*. Dental officers will spend up to 20% of their time on deployment travelling, setting up and in other deployment-related activity.

A dental officer whose time in the field is poorly utilised is a waste of resources, so it is important to calculate the likely workload before deployment. The overriding principle is to maximise the efficiency and effectiveness of the deployed force. Box 4 gives general methods for calculating operational dental officer requirements for deployments. However, each deployment must be viewed individually to determine the best outcome. A ratio of one dentist per 900 troops in the field appears to be supported by the available Australian data.

Can these operational dental officers treat dental casualties effectively?

The operational dental officer needs to return dental casualties to active duty. If this return to duty occurs at a low level of health support (the closer the casualties are to the front line, the lower the level of health support) then the effectiveness of treatment in the field is enhanced. However, at the lowest level of health support (Level One), the dental emergency kit and the conditions under which it would be used are so restricted that dental treatment would be unusual.[14]

4: Calculations for dental officer requirements in deployments*

Description	Formula
Dental emergencies: Total hours (Ti) taken to initially treat dental emergencies, where x = annualised incidence rate (AIR), n = number of troops divided by 1000, y = number of days of deployment, and the average time taken to initially treat dental emergencies = 0.5 hour.	xn(y/365)0.5 = Ti
Follow-up of dental emergencies: Total hours (Tf) taken to perform follow-up treatment (54% of dental emergencies require follow-up treatment and take on average 1.5 hours to treat).	xn(y/365)0.54 × 1.5 = Tf
Surge capacity: Total hours (Te) after adding 30% (mean deviation of the weekly dental casualty rates)	(Ti + Tf) × 1.3 = Te
Routine dental treatment: (annual dental examinations and follow ups, scale and cleans): Total hours (Ta), where t = number of troops, y = number of days of deployment, and the average time taken for a routine dental treatment = 0.5 hour.	t(y/365)0.5 = Ta
Total dental treatment time converted to work days (Td).	(Te + Ta) ÷ 8 = Td
Field factor: allow for inefficiencies of field conditions to calculate total treatment time in the field (Tc).	Td × 2 = Tc
Deployment activities: allow 20% of deployment days (y) for non-treatment activities of deployed dental officers.	0.2 y = Ty
Total number of dental officer work days required to treat deployed troops.	Tc + Ty

*Assumptions in these calculations are based on the literature and ADF deployment experience, and are discussed in more detail in reference 12.

Level One dental support might include:

- stabilising casualties before evacuation, or managing those within equipment limitations
- basic humanitarian support to a disadvantaged civil population, but only for short periods without resupply
- so-called "tailgate" treatment, provided by a dental section in transit.

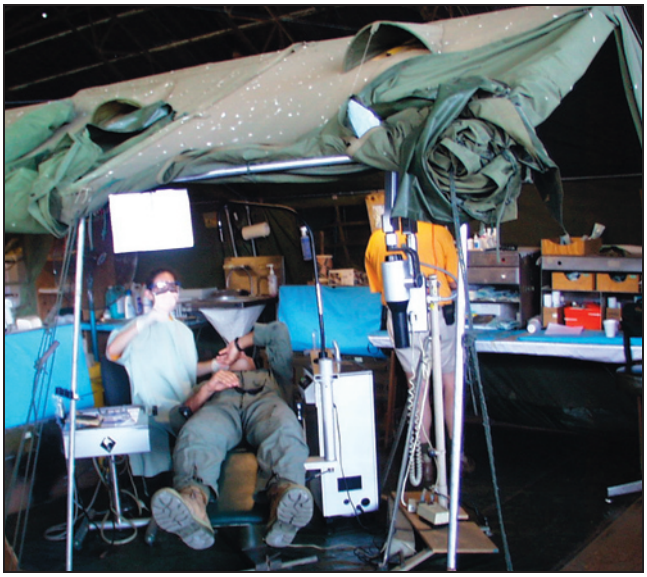
Level Two dental care includes most routine dental treatment. In an area of operations, the Level Two dental section has complete standard dental equipment and is self-contained, small, and mobile. It may be deployed directly to the unit, ship or area it is to support, or collocated with a similar-level medical facility.

Complex procedures are not usually undertaken, but most dental casualties can be returned from a Level Two facility to active duty. A major difficulty with a Level Two facility is definitively treating pericoronitis associated with acutely infected wisdom teeth. In the past, pericoronitis was a major problem and a reason for a large number of aeromedical evacuations.[13] Recognising this, the ADF Health Service formulated a policy on managing impacted wisdom teeth,[15] which has led to a significant fall in incidents of pericoronitis. This is demonstrated by the decrease in the proportion of periodontal cases (pericoronitis is a major portion of periodontal cases) in Operations Tanager, Warden and Belisi compared with an ADF garrison survey[12] and the US experience[16] (Box 6).

During Operation Warden it was estimated, based on previous epidemiological studies, that the deployed ADF contingent would have 90–100 cases of pericoronitis presenting at dental sick calls. In fact there were only eight cases. This led to a considerable saving of operationally effective soldiers, with fewer sick days and aeromedical evacuations.

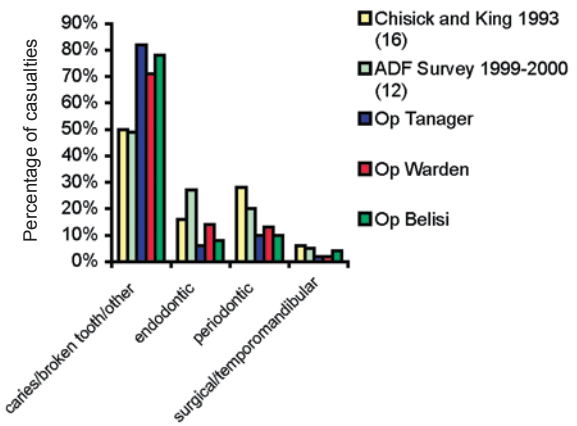
At a **Level Three** facility all dental casualties can be effectively treated and returned to active duty.

5: Level 2 care in Bougainville (Combined Health Element of the Peace Monitoring Group)



6: Comparison of the nature of dental casualties

Proportion of total dental casualties caused by different categories of dental problems in various military populations



Can dentistry in the field be done by other medical personnel?

Australian National Antarctic Research Expeditions deploy personnel in a hostile environment in a manner comparable to military deployments. In the Antarctic, the doctors who manage dental problems are assisted by the group's very high dental fitness before departure, training in dentistry before departure, and a relatively small workload for medical problems.[17]

The experience in Antarctica and other similarly isolated places shows that it is possible to train medical practitioners in basic dental skills and that there may be some value in cross-training military doctors, especially for detachments too small to warrant a dentist. However, for longer and larger deployments, combining the medical and dental workload may compromise the standard of care and lead to more evacuations of dental casualties. Providing dentists for larger deployments allows more efficient diagnosis and treatment of dental emergencies, and also allows dental maintenance work to continue, preventing an increase in dental problems during deployment.

Conclusion

The operational dental officer has a role in the ADF. Dental casualties occur even in a well prepared force. These casualties are such that the effectiveness of the individual is reduced. Field dentistry in the ADF is a highly mobile, self-contained and effective means of maximising the effectiveness of the deployed force.

Acknowledgements

I acknowledge the support and assistance of Dr Malcolm Coombs, Discipline of Oral Diagnosis and Radiology, University of Sydney, and Dr Douglas Stewart, Head of Department, Oral Medicine and Surgical Science, Westmead Centre for Oral Health. The members of ADF Dental Branches have been supportive and, in particular, Lieutenant Colonel Geoff Stacey, Staff Officer 1, Land Headquarters, and Capt Tim Maddern RAN, SA-Den. My thanks also to Dr Peter Sullivan of the Polar Medicine section of the Australian Antarctic Division for providing some most useful information on remote area medicine and dentistry.

References

1. Wright NT. The genesis of the Royal Australian Army Dental Corps. *Army Journal* May 1974: 24-30.
2. Wright NT. The genesis of the Royal Australian Army Dental Corps – the original six — Part 2. *Aust Dent J* 1977; 22: 251-259.
3. Bullus MHR. Gallipoli: the dental story. *Army Journal* Jan 1973: 41-47.
4. Australian National Audit Office. Australian Defence Force Health Services performance audit. Audit Report No. 34. 1996-97.
5. Australian National Audit Office. Australian Defence Force Health Services follow-up performance audit. Audit Report No. 51. June 2001.
6. Deutsch WM, Simecek JW. Dental emergencies among marines in Operations Desert Shield/Storm. *Mil Med* 1996; 161: 620-623.
7. Mahoney GD, Coombs M. A literature review of dental casualty rates. *Mil Med* 165; 2000: 751-756.
8. Allen FW, Smith BE. Impact of dental sick call on combat effectiveness: the dental fitness class 3 soldier. *Mil Med* 1992; 157: 200-203.
9. Ludwick WE, Gendron EG, Pogas JA, Weldon AL. Dental emergencies occurring among navy-marine personnel serving in Vietnam. *Mil Med* 1974; 139: 121-123.
10. Bishop BG, Donnelly JC. Proposed criteria for classifying potential dental emergencies in Department of Defence military personnel. *Mil Med* 1997; 162: 130-135.
11. Anderson JQ. Op Grandy: a dental overview. *Royal Army Dental Corps Bulletin* 1992; 3: 4-6.
12. Mahoney GD. The role and need for the operational dental officer in the Australian Defence Force. Master of Science in Dentistry thesis. University of Sydney, 2001.
13. Tinder LE, Osbon DB, Lilly GE, et al. Maxillo-facial injuries sustained in the Vietnam conflict. *Mil Med* 1974; 139: 668-672.
14. Australian Defence Force Publication No. 53. Manual of Health Support. 2nd ed. 1998.
15. Health Policy Directive No. 404. Indications for the removal of third molars in the Australian Defence Force. Nov 1994.
16. Chisick MC, King JE. Dental epidemiology of military operations. *Mil Med* 1993; 158: 581-585.
17. Flether LD. Dental observations at Australian Antarctic stations. *Aust Dent J* 1983; 28: 281-285.

(Received 12 Jul 2002, accepted 1 Aug 2002) ❑

Malaria Update

Malaria in the ADF, July–December 2002

NOTIFICATIONS OF MALARIA to the Central Malaria Register (CMR) at the Australian Army Malaria Institute (AMI) appear to have stabilised, with 14 notifications during the July to December 2002 reporting period, similar to the 13 notifications in the first six months of the year. This compares to 245 notifications for the first six months and 144 for the last six months of the year 2000, coinciding with the ADF's initial presence in East Timor with INTERFET. Reasons for the reduction in malaria cases were discussed in the previous issue.[1]

The breakdown by malaria species and probable country of origin is detailed in the Table, and shows that East Timor remains the greatest source of malaria for the ADF.

Malaria infection in ADF personnel reported from July to December 2002, categorised by probable geographic source of infection

	P. falciparum	*P. vivax*	*Mixed falciparum/ vivax*
East Timor	1 (in AO)	10 (4 in AO)	1 (in AO)
PNG (Bougainville)	0	2	0
Totals	1	12	1

AO = area of operation. All other cases diagnosed on return to Australia.

Four of the 10 *Plasmodium vivax* malaria cases acquired from East Timor presented in the area of operations and all infected personnel were using doxycycline for prophylaxis. As previously discussed,[1] vivax malaria is usually more likely to present on return to Australia (RTA), and it is unusual for vivax malaria to outnumber infections with *P. falciparum* in the area of operations. Whilst these vivax infections in the area of operations probably indicate a breakdown in compliance and/or a decrease in bioavailability of doxycycline, it is prudent to keep in mind the possibility that *P. vivax* is developing tolerance of doxycycline.

Lieutenant Commander Sonya Bennett

Officer in Charge, Clinical Studies and Surveillance, Army Malaria Institute

1. Malaria in the ADF, January–June 2002. *ADF Health* 2002; 3: 96.

Malaria reporting

All Health Service personnel are encouraged to notify the Central Malaria Register promptly when a malaria casualty is detected. Informal notifications preceding a PM40 can be made by telephone (07 3332 4836) or by email (sonya.bennett@defence.gov.au). ❑