Aeronautic Dental Practice: A review

Jasdeep Kaur (SCADA), Balwant Rai (MS)

Abstract

The aim of this article is to introduce the concepts of aeronautic dentistry. In aircrews members may be facing numerous adverse effects such as head and facial barotraumas (barotrauma-related headache, external otitic barotrauma, barosinusitis and barotitis-media), dental barotrauma (barometric pressure-related tooth injury), barodontalgia (barometric pressure-related oro-dental pain). Special considerations have to be made when planning restorative, endodontic, prosthodontic and surgical treatment to an aircrew patient. This article reviews why aeronautic dentistry is an important subject.

Key words

Aeronautic dentistry, dental practice, guidelines.

Introduction

Successful and safe journey is the responsibility not only of passengers but also the aircraft company. In-flight sudden incapacitation could jeopardize the flight's safety; thus, an individual's health status is an important part of the aircrew's operative fitness. Shortly after the innovation of modern flight, at the beginning of the twentieth century, in-flight physiologic and pathologic phenomena began to be reported, including those relating to the face and the oral cavity. Since dental and other oral problems were reported as the causes of severe in-flight pain and vertigo, incapacitation, and premature cessation of flights. Most of the previously published guidelines advised using a more interventional/non-conservative approach in treating aircrews than other populations. Currently possess little knowledge on this subject and lack evidence-based guidelines for dental care of aircrew members.

Reprint requests: Dr. Jasdeep Kaur
162, Model Town
Kapurthala-144601, Punjab
Email: raibalwant29@gmail.com

Aims and Objectives

With the increasing number of air passengers as well as airline and leisure pilots and their aircrew, dentists may regularly encounter flight-related oral conditions requiring immediate treatment. Moreover, dentists should prevent the creation of in-flight hazards when treating aircrew members.

Boyle's Law and barotrauma

According to Boyle's Law, the volume of gas at constant temperature varies inversely with the surrounding pressure. The changes in gas volume inside the body's rigid cavities, associated with the changing atmospheric pressure, can cause several adverse effects, known as barotraumas. Head and face barotrauma systems included the entities of external otitic barotrauma, barotitis-media, barosinusitis, barotrauma-related headache, dental barotrauma, and barodontalgia. Barosinusitis (also known as sinus barotrauma) is an acute or chronic inflammation of one or more of the para nasal sinuses, produced by the development of a pressure difference (usually negative) between the air in the sinus cavity and that of the surrounding atmosphere. Normally, there is no air pressure differential between the sinuses and the outside environment. However, when the normal sinus outflow is compromised, as may occur during upper respiratory tract inflammation, a pressure gradient is created resulting in a vacuum effect that may be stressful to the sinus mucosal lining. The vacuum may cause mucosal edema, sero sanguineous exudates, and sub mucosal hematoma, which may consequently cause pain, sometimes abrupt and severe, and possibly epistaxis. Ensuing pain and numbness may occur as a result of pressure on branches of the trigeminal nerve in the maxillary sinus. The incidence of barosinusitis during descent is about double that during ascent.

The dental relevance of non-dental head and face barotraum is as follows:

1. Either barotitis-media or barosinusitis can occur and be manifested as toothache.
2. Relationship exists between dental malocclusion and Eustachian tube dysfunction.

DENTAL BAROTRAUMA

The predisposing factors for in-flight dental fracture, reported in several case reports17, 18 as well as within vitro model,19 are the presence of pre existing leaked restorations and/or latent secondary caries lesions underneath the restoration in the affected tooth prior to exposure to the barometric changes.

Reduction of prosthetic device retention

Pressure changes in micro air bubbles in the cement layer underneath crowns can lead to a significant reduction of the prosthetic device's retention and even to dislodgement, 20 especially if the crown was cemented with zinc phosphate cement. The crowns that were cemented with either zinc phosphate cement or glass ionomer cement had significantly reduced retention (in approximately 90% and 50% of cases, respectively), whereas crowns that were cemented with resin cement did not have reduced retention after pressure cycling. Moreover, micro leakage was detected in the zinc phosphate and glass ionomer cements after pressure cycling, whereas no micro leakage was detected in the resin cement. Reduced barometric pressure can impair the retention of full removal dentures.

BARODONTALGIA

The possibility is evident considering the duration of a space flight to Mars and back could require up to more than five years. The dental concerns of a space mission are only a small part of a much larger team effort; however, it is one not to be overlooked. Recently in India (Balwant Rai), aeronautic dentistry is evolving: Barodontalgia. Flight surgeons and dentists should be aware of this phenomenon and use preventive measures to minimize its incidence and severity. Once referred to as "flyer's toothache," barodontalgia is defined as tooth pain occurring with changes in ambient pressure. It usually occurs in people who fly or dive. It may be due to sinusitis, and in teeth experiencing pulpitis after restorative treatment, new and recurrent caries, intra-treatment endodontic symptoms, dental and periodontal cysts, or abscesses. It has been reported that the most common cause of the barodontalgia in space due to chronic pulpitis, maxillary sinusitis, No pathogenesis etc. The pulpitis was treated by root filling or replacing a deep filling, subsequent exposure to low pressure caused no pain. Root fillings placed using cold lateral condensation of gutta-percha to within 2 mm of the radiographic apex of the tooth were associated with the best outcome. Although the actual process of barodontalgia is not well understood, it may be related to pulpal hyperemia, or to gases that are trapped in the teeth following incomplete root canal treatment. Moreover, sensory and non sensory aspects of pain experience may be differentially influenced by exercise stress. Patients who are frequently exposed to changes in ambient pressure should be encouraged to follow good oral health practices, attend regularly-scheduled dental recall examinations and accept the timely completion of restorative treatment to minimize the possibility of developing barodontalgia.

PREVENTION

Currently it seems that the incidences of in-flight dental manifestations of pressure changes are relatively low (compared with the reported incidences from the first half of the twentieth century), owing to the current inside pressurization of airplane chambers, the high quality dental care, and the enhancement of oral health in the second half of the twentieth century. Special attention must be devoted to prevention of dental problems and to oral health maintenance. Dentists have the responsibility to educate their patients about the importance of a healthy diet and motivate them toward maintaining meticulous oral hygiene.

PERIODIC EXAMINATIONS

Similarly, early diagnosis of initial visible and occult oral disease is of a special importance for aircrews. However, a comparison of several air forces worldwide revealed non uniformity in the frequency and extent of periodic dental examination. Currently there is no evidence-based guideline or any consensuses regarding

the frequency and extent of periodic aircrews' dental examinations.

SUMMARY

Aircrew patients as well as air passengers often challenge the dentist in treating several flight-related conditions. This overview article described conditions and provided the dentists with some useful tools and guidelines.

References

1. Bierman H R, Brickman I W. The relationship of dental malocclusion to vacuum-otitis media and the use of dental splints during descent from altitudes. Ann Otol Rhinol Laryngol 1946; 55: 5-12.
2. Sognnaes R F. Further studies of aviation dentistry.Acta Odontol Scand 1946; 7: 165-173.
3. Zadik Y, Einy S, Pokroy R, Bar Dayan Y, GoldsteinL. Dental fractures on acute exposure to high altitude.Aviat Space Environ Med 2006; 77: 654-657.
4. Calder I M, Ramsey J D. Ondontecrexis – the effects of rapid decompression on restored teeth.J Dent 1983; 11: 318-323.
5. Jagger R G, Jackson S J, Jagger D C. In at the deepend - an insight into scuba diving and related dental problems for the GDP. Br Dent J 1997;183: 380-382.
6. Musajo F, Passi P, Girardello G B, Rusca F. The influence of environmental pressure on retentiveness of prosthetic crowns: an experimental study. Quintessence Int 1992; 23: 367-369.
7. Lyons K M, Rodda J C, Hood J A. The effect ofenvironmental pressure changes during diving on the retentive strength of different luting agentsfor full cast crowns. J Prosthet Dent 1997;78: 522-527.
8. Lyons K M, Rodda J C, Hood J A. Barodontalgia:a review, and the infl uence of simulated diving on microleakage and on the retention of full cast crowns. Mil Med 1999; 164: 221-227.
9. Snyder F C, Kimball H D, Bunch W B, Beaton J H.Effect of reduced atmospheric pressure uponretention of dentures. J Am Dent Assoc 1945;32: 445-450.
10. Kollmann W. Incidence and possible causes ofdental pain during simulated high altitude fl ights.J Endod 1993; 19: 154-159.
11. Sipahi C, Kar M S, Durmaz C, Dikicier E, Bengi U.Türk Hava Kuvvetleri uçucu personelinde görülenbarodontalji prevalansý. Gülhane Týp Dergisi 2007;49: 1-4.
12. Gonzalez Santiago Mdel M, Martinez-SahuquilloMarquez A, Bullon-Fernandez P. Incidence of barodontalgias and their relation to oral/dental condition in personnel with responsibility inmilitary fl ight. Med Oral 2004; 9: 98-105.
13. B. Rai : Barodontalgia . The Internet Journal of Dental Science. 2009 Volume 6 Number 2.
14. B. Rai : Effects of Microgravity on Teeth and Periodontium: Aeronautic Dentistry . The Internet Journal of Dental Science. 2007 Volume 5 Number 2.
15. B. Rai : Aeronautic Dentistry: A New Specialized branch and its Curriculum Guidelines . The Internet Journal of Dental Science. 2007 Volume 5 Number 1