Review Article

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Aviation Dentistry

Dentistry Section

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ABSTRACT

With the rapid expansion of the airline industry in all sectors, dentists should pay special attention to crews and frequent flyers, due to change of pressure in-flight, that cause different types of oro-facial pain. Aviation dentistry deals with evaluation, principles of prevention, treatment of diseases, disorders or conditions which are related to oral cavity and maxillofacial area or adjacent and associated structures and their impact on people who travel or on aircrew members and flight restrictions. Dentists should prevent the creation of in-flight hazards when they treat aircrew members and frequent flyers.

Keywords: Dentistry, Aerospace medicine, Barodontalgia, Odontocrexis, High altitude

INTRODUCTION

Dental practice has changed over the past few years, focusing mostly on prevention. Aviation dentistry deals with oral and dental health statuses of aircrew members and frequent flyers. The prevalence of caries increases in microgravity [1]. There are people who will "rise from the ground" frequently as pilots, flight crew and those who travel frequently for work. With the growing number of air passengers, flight attendants, leisure pilots, as well as military and airline pilots, dentists may increasingly encounter flight-related oral conditions which require treatment. Moreover, dentists should prevent the creation of in-flight hazards when they treat aircrew members [2].

Many cases on breaking of dental restorations, tooth fractures, sharp or diffused pain have been reported. Pain which is observed is caused by the pressure which is exerted on various nerves and their branches. There is change in the atmospheric pressure as a person travels at high altitude, i.e. about 18,000ft. and above [3]. Dental barotrauma is observed among military personnel than in civilian air passengers or flyers [4]. In World War II, numerous dental studies were conducted in altitude-chamber stimulations and during in-flight observations and even a specialty program was offered in aviation dentistry in the US [5]. Proper diagnosis of the pain should be made, to treat barodontalgia at an earlier stage. Several times, barodontalgia goes unnoticed due to negligence [6]. So, there should be better knowledge on aviation dentistry among both dentists and aviators.

DISCUSSION

Head and face barotrauma

Barotrauma is a condition which is experienced by tissues, which is caused by a difference in pressure between a gas space inside the body and the surrounding fluid. Barotrauma can occur during flying, diving, or hyperbaric oxygen therapy. So, in this case, it is the atmospheric pressure which is lowered as a person travels at high altitudes. It involves conditions like external otitic barotrauma, barotitis-media, barosinusitis, barotrauma-related headaches, dental barotrauma, and barodontalgia [2]. Barotitis and barosinusitis occur during descents made from high altitudes. A partial vacuum develops, which is manifested by a retracted tympanic membrane. Haemorrhages may occur as a consequence of the vacuum [7]. Pressure-volume changes which are associated with changing atmospheric pressure precipitate acute inflammation of the sinus and middle ear cavities, which is known collectively as barotrauma [7]. Barosinusitis is an inflammatory condition of the paranasal air sinuses. Due to the difference in air pressure, a vacuum is created. This vacuum leads to mucosal oedema, submucosal haematoma, etc. which can lead to dizziness, headache and anoxia [8]. Vacuum which is created is stressful for the mucosal linings of sinuses. Ensuing pain and numbness can occur due to pressure exerted on branches of trigeminal nerve [2].

Barodontalgia

It is a condition in which barometric pressure changes in the external environment, which can cause dental pain. This problem can occur, owing to a miniature void which is created within a filled tooth or in a root canal treated tooth. Barodontalgia is a symptom. Common oral defects which cause barodontalgia are dental caries, defective tooth restorations, pulpitis, pulp necrosis, apical periodontitis, periodontal pockets, impacted teeth and mucous retention cysts [8]. It can be caused by two ways- either due to creation of pressure changes in the tooth, caused by carious activities or because of defects in it. It can also occur during ascent, as the pressure reduces, leading to dissolution of gases in the blood vessels, due to which bubbles enter the pulp. Treatment involves removing the void space by carefully replacing the offending restoration, repeating the endodontic treatment or removing the tooth [8].

The classification of barodontalgia is based on pulp / periapical condition and symptoms: pulp/ periapical-related 'direct' barodontalgia and barotitis/ barosinusitis-induced 'indirect' barodontalgia [6].

Pulpitis and barotrauma

In a survey which was conducted on Israeli air force, the following results were seen [9,10]:

Out of 331 participants, 27 reported at least one event of barodontalgia: which included fighter, transport and helicopter aircrews. Dental diseases were the major causative pathology, which were responsible for 67% of the cases: pulpitis constituted 40.7% of the cases, pulp necrosis/apical periodontitis constituted 18.5% of the cases, vertical root fractures constituted 3.7% cases and impacted teeth constituted 3.7% cases. 18.5% of the barodontalgia cases were caused by barosinusitis. None of subjects reported premature mission cessations caused by dental pain.

Hence, with the theoretical basis in mind and the proof from the scientific literature, it can be concluded that pulp diseases are the

major causative pathology of barodontalgia [9]. They can develop in conjunction with sinusitis, and in teeth which experience pulpitis after restorative treatment, in new and recurrent caries, in intra-treatment endodontic symptoms, in dental and periodontal cysts, or abscesses [11]. A review of seven cases done by Holowatyj RE also concluded that the causative reason for barodontalgia could be pulpal hyperaemia [11].

One clinical benefit of barodontalgia is that it can help dentists locate early caries, leaking restorations and periodontal abnormalities. The placement of a zinc oxide eugenol (ZOE) base was found to prevent barodontalgia when reversible pulpitis was the underlying cause. This was attributed to the well-known sedative effects of ZOE. It was also suggested that when people who were subjected to large pressure changes were treated, it would be best to avoid procedures such as capping of exposed pulp. Rather, an endodontic treatment could be indicated [6].

Other contributing factors include parafunction (bruxism), low temperature, decreased oxygen percentage, acceleration and dryness [4,12].

Odontocrexis

Calder and Ramsey studied tooth fractures caused by a high-altitude environment and they coined the term, "odontecrexis" (Greek for tooth explosion), to describe this physical disruption of teeth with leaking restorations caused by barometric pressure changes [3,13]. The tooth damage was experienced when there were inferior quality restorations and unrestored teeth with and without caries. The damage was caused accidentally due to expansion of gas which was trapped beneath the restorations [14]. Some of the causes were fractures in porcelain fused metal restorations, pressure changes in microtubules of dental cements, which could lead to dislodgement of crowns.

A research which was done on fractures of posterior teeth showed that mesio-occluso-distal restorations were identified as a major predisposing factor to tooth fractures. In this study, mandibular first molar teeth were identified as being at risk; placement of cuspal coverage restorations may be considered to be a justifiable preventative measure [15].

Prosthesis

Retentions of dentures are solely based on atmospheric pressure, adhesion and gravity. This implies for both maxillary and mandibular dentures; among which maxillary dentures totally depend on them. Reduced barometric pressure can impair the retentions of complete dentures [8]. In crowns, pressure changes occur in microtubules of the cement layer, which result in a reduced retention of the crown [11]. Mostly, the cement layers beneath the crowns become weak due to microleakage [16]. A study showed that the retention of full cast crowns to extracted teeth was reduced after pressure cycling, if the crowns were cemented with either zinc phosphate cement or glass ionomer cement. Dentists should consider using resin cement when they cement crowns and fixed partial dentures for patients, such as divers, who are likely to be exposed to pressure cycling [17].

Periodontal defects

In flyers who fly at high altitudes, decrease in oxygen levels can have a deleterious effect on teeth, fillings, gums and the mouth. A common complaint is xerostomia. Due to decrease in saliva content, there is an increase in the risk of periodontal diseases [8]. Predisposing factors of flying personnel include poor oral hygiene, nervousness, flying fatigue.

Oral surgery

When an upper posterior tooth is extracted, the dentist should rule out existence of an oroantral communication. If it is involved, it can lead to sinusitis and it can be adverse if it is exposed to a pressure changing environment. Hence, an oroantral communication should be ruled out [18].

Teeth and jaw bones

Most of the common oral pathologies have been reported as barodontalgia producers, which include dental caries, defective tooth restorations, pulpitis, pulp necrosis, apical periodontitis (jawbone cysts and granulomas), periodontal pockets, impacted teeth, mucous retention cysts, and vertical root fractures.

Flight restriction

Grounding of a patient is required when there is interference with the flight capabilities of the aircrew members [2]. This can be caused by intake of medications, which causes side effects like headache, nausea and dizziness. Due to the intra oral pressure, the blood clot which is formed after the surgical procedure in patient's mouth can come out and it can lead to intra oral bleeding [2]. So, here, flight restriction is needed until the symptoms subside. Restorations which are being done recently have a greater probability for fractures than the old ones. It is the duty of dentists to notify their patients (aircrew members) about the post-operative flight consequences and restrictions [2].

Treatment

Only a proper diagnosis can lead to a proper treatment. Lack of proper examination or lack of proper cooperation can lead to serious problems later, for those aircrew personnel. While extracting the maxillary premolars and molars, dentists have to rule out the existence of an oroantral communication. This communication can lead to sinusitis and consequences can occur upon exposure to a pressure changing environment [8]. To favour the retention of prosthesis, an implant supported prosthesis can be chosen [14].

CONCLUSION

There is an increase in the number of people who travel by air. This leads to an increase in number of aircrew personnel. So, scope of aviation dentistry has increased and it should be given importance, so that proper diagnoses can be made and patients are treated before their conditions lead to serious issues. Special considerations have to be made when restorative, endodontic, prosthodontic and surgical treatments are planned for aircrew patients. Aviators and dentists should embrace all available opportunities for incorporating oral and dental health into aviators' physical standards, to promote their wellness. This article supplies the dental practitioner with some diagnostic tools as well as treatment guidelines. Principles of prevention, periodic examination, dental-related flight restriction (grounding) and dental documentation (for forensic purposes) have been described as well.

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