The prevalence of Barodontalgia among Jordanian Military Pilots

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ABSTRACT

Objectives: To determine the prevalence of Barodontalgia among Jordanian military male pilots and its impact on their performance during and after flight.

Methods: The study was conducted at the Royal Jordanian Air Force (RAF) headquarters and its peripheral air bases between January 2013 and July 2013. A two page questionnaire was developed by the authors in Arabic inspired from different studies and sent to all active pilots in service in RAF, pilots were asked about their personal and professional data in the form of multiple choice questions and were asked about their experience regarding barodontalgia. This included when and if any treatment was done and if the incident reported or not to the dental officer available at their base. All the participants were asked to fill the questionnaire and return it either by hand or email. Inquiries contained in the questionnaire included personal data, professional data and date related to possible dental pain during flight

Results: A total of 305 responses were obtained of the 500 handed out or emailed for a (61%) response rate. The age of the pilots ranged between 20 and 59 years where the mean age was 26 years. This study showed that 10.49% of the sample had experienced barodontalgia at least once during their activities

Conclusions: Barodontalgia is not a rare dental pain that occurs during flight and may have serious consequences on military pilot's performance. Though, a proper dental follow-up on regular basis may reduce the incidence and subsequent complications.

Key words: Barodontalgia, Pilots.

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Introduction

During World War II, tooth pain experienced by air crew in flight was given the name aerodontalgia. However, as this tooth-related pain was also observed in divers, a broader, more appropriate term, barodontalgia, was subsequently given to this phenomenon.[1]

Barodontalgias are defined as toothache that arises when there are changes in ambient pressure.

They result from a combination of two basic factors, on the one hand the change in

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pressure(whether positive or negative), and on the other hand the particular anatomical characteristics of the pulp chamber, in which there is richly innervated tissue surrounded by hard, rigid walls.
If there is an increase or decrease in pressure, the pulp is unable to adapt and, in combination with other additional factors, this will cause pain, which is sometimes so intense that it can lead to loss of consciousness.

Therefore a better definition of barodontalgia would be dental pain resulting from the inability of the pulp chamber to balance its internal pressure after changes have occurred in the ambient pressure.[2, 3]
This pathology has been known for centuries and has been widely studied and discussed. Numerous theories have been elaborated in unsuccessful attempts to explain itsetiopathogenesis, which still remains obscure.[4]
Barodontalgia was reported to occur during flying at altitudes of 600-1500 meters and during diving at depths of 10–25 meters.The prevalence of barodontalgia in aircrew has been reported to vary from 0.26% to 8 %.[5]
A classification of barodontalgia was developed by Ferjentsik and Aker [6] and is primarily based on the underlying causes and clinical symptoms (Table I). Pain during ascent can indicate the presence of a disease of vital pulp tissue (pulpitis). Pain during descent can be indicative of pulp necrosis or facial barotraumas.[7]

Barotrauma is defined as pressure-induced damage that can occur both at high and low pressures, the pathology of barotrauma is directly related to Boyle's law, which states that, if temperature remains constant, the volume of a fixed mass of an ideal gas is inversely proportional to the pressure of the gas.

When a gas-filled cavity in the human body cannot communicate with the exterior and pressure cannot be equalized, pressure differences occur which can lead to pain, edema, or vascular gas embolism.[8] This often occurs in the lungs, the middle ear, or the maxillary sinus (barosinusitis).[9, 10]
Head and face barotraumas include the entities of external otitic barotrauma, barotitis-media, barosinusitis, barotrauma-related headache, dental barotrauma, and barodontalgia.[5]
The dental relevance of non-dental head and face barotraumas follows:
Either barotitis-media or barosinusitis can occur and be manifested as toothache (indirect barodontalgia).[11] Thus, they should appear in the differential diagnosis list of dental pain that is evoked during changes in barometric pressure.
Several reports claimed that a relationship exists between dental malocclusion and Eustachian tube dysfunction.[12] Dental splint was offered as a preventive and/or therapeutic measure for Barotitis- media.[13] Currently, Barotitis-media is usually not an indication of the need for a dental splint.
Treatment of barodontalgia is not different from this rendered for pain occurred at ground level, but the prevention of such insults remains the core of management in dental practice.[14,15]
The aim of this study was to determine the prevalence of barodontalgia among male pilots serving at the Royal Air Force of Jordan who are totally males and it's possible impact on their performance.

Methods

This study was conducted at the Headquarters of the Royal Jordanian Air Force (RAF) and its peripheral air bases between January 2013 and July 2013.
Out of the 500 questionnaires sent, a total of 305 respondents were recorded.
Inquiries contained in the questionnaire included personal data (age and marital status), professional data (years of experience, weekly flight hours, type of aircraft and years of experience). Pilots were also asked to report their dental pain experience while flying with more details regarding the nature of pain, its effect on the pilot during flying, the altitude at which the pain occurred, was it during ascent or descent and what was the

professional dental diagnosis and treatment based on their medical and dental records in their medical facility.

The collected data was analyzed using the Statistical Package for Social Sciences (SPSS) program version 16. Descriptive statistics were performed and Chi square test was used to determine the relationship of pain among pilots.

Results

A total of 305 responses were obtained of the 500 handed out or emailed and that is a (61%) response rate. The age of the pilots ranged between 20 and 59 years where the mean age was 26 years. This study showed that 10.49% of the sample had experienced barodontalgia at least once during their activities. It was also noticed that 57.7% of pilots were at the age group of 20-29 years and 59.4% of which had a dental pain while flying (Table II).

The highest percentage of tooth pain (26.67%) was reported at 4000 ft of altitude which is statistically significant ($P < 0.05$), with a higher percentage of pilots recording pain during both ascent and descent (Fig.1). Pain was reported by the pilots according to their pain experience. No data was collected from the Air Force Safety Facility therefore we have no data whether all incidents have been reported in or not.

Taking the platforms into consideration, 64.9% were helicopter pilots of which 37.5% reported an incident of barodontalgia while of the fighter pilots which represented 20.7% of the study sample, 34.4% reported barodontalgia, The difference between the two groups of pilots was statistically significant ($P<0.05$) (Fig. 2) and (Table III).

As for the effect of pain on pilots during their activities (i.e.headache ,loss of vision..etc) it was found that 46.67% suffered loss of concentration during flight and 30% suffered from headache (Fig. 3).

All pilots were referred for professional dental care (at RAF base dental officers and dental specialist at RAF medical facility) after the incident and 34.48% of cases were diagnosed with old faulty restorations which needed re-treatment. Restorative treatment was carried out by conservative specialist for most cases either for changing the old faulty restoration, treating the caries present or treatment of periapical pathologies (Fig. 4).

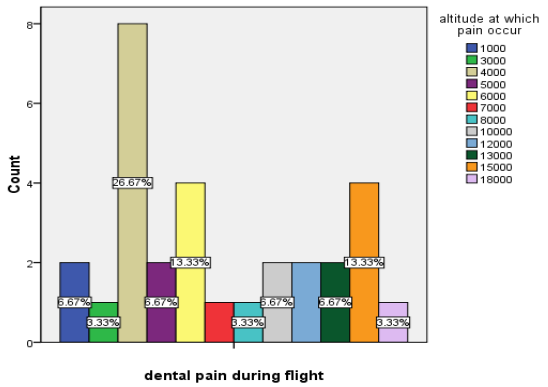

Fig. 1: Altitude at which the dental pain occurred.

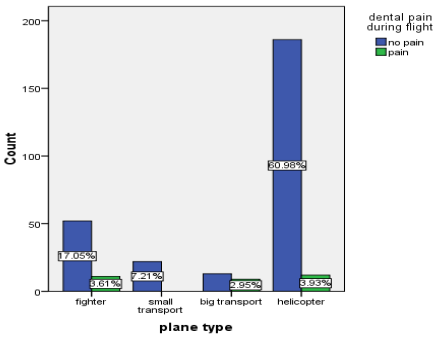

Fig. 2: Association between plane type and dental pain

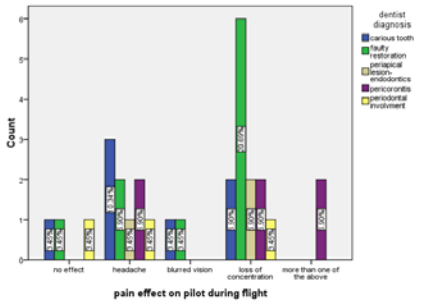

Fig. 3: Pain effect on pilots during flight

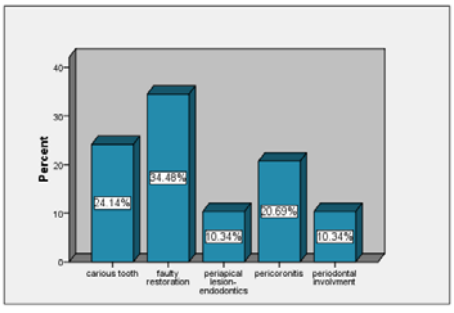

Fig. 4: Dentist diagnosis of barodontalgia insults

Table I: Classification of direct barodontalgia

Class	Pathology	Features
I	Irreversible pulpitis	Sharp transient (momentary) pain on ascent
II	Reversible pulpitis	Dull throbbing pain on ascent
III	Necrotic pulp	Dull throbbing pain on descent
IV	Periapical pathology	Severe persistent pain (on ascent/descent)

Table II: Age group of pilots which experienced dental pain during flight

	Age group	dental pain during flight		
		no pain	pain	Total
20-29	Count	157	19	176
	% within dental pain during flight	57.5%	59.4%	57.7%
30-39	Count	96	12	108
	% within dental pain during flight	35.2%	37.5%	35.4%
40-49	Count	19	1	20
	% within dental pain during flight	7.0%	3.1%	6.6%
50-59	Count	1	0	1
	% within dental pain during flight	.4%	.0%	.3%
Total	Count	273	32	305
	% within dental pain during flight	100.0%	100.0%	100.0%

Table III: The relation between plane type and dental pain during flight

			plane type				
			fighter	**small transport**	**big transport**	**helicopter**	**Total**
dental pain during flight	**No pain**	Count	52	22	13	186	273
		% within dental pain during flight	19.0%	8.1%	4.8%	68.1%	100.0%
		% within plane type	82.5%	100.0%	59.1%	93.9%	89.5%
		% of Total	17.0%	7.2%	4.3%	61.0%	89.5%
	Pain	Count	11	0	9	12	32
		% within dental pain during flight	34.4%	.0%	28.1%	37.5%	100.0%
		% within plane type	17.5%	.0%	40.9%	6.1%	10.5%
		% of Total	3.6%	.0%	3.0%	3.9%	10.5%
		P	0.04			0.03	
Total		Count	63	22	22	198	305
		% within dental pain during flight	20.7%	7.2%	7.2%	64.9%	100.0%
		% within plane type	100.0%	100.0%	100.0%	100.0%	100.0%
		% of Total	20.7%	7.2%	7.2%	64.9%	100.0%

Discussion

Our study was conducted to measure the prevalence of barodontalgia among Jordanian pilots at RAF, based on a questionnaire that was distributed among pilots asking about the incident of barodontalgia, its nature, effect and treatment performed.

Results showed that 10.49% of the study sample experienced barodontalgia, which is lower than what was reported in other studies conducted in the same way; the Saudi – Kuwaiti study showed a prevalence of 49.6% among pilots,[15] the Indian origin pilots conducted in 2010[16] reported 20.6%, the Turkish air force reported a 12% barodontalgia.[17] But comes higher than the reported 8.2% from the Israeli air force study conducted in 2007.[18]

Barodontalgia is a symptom and not pathology by itself, it has been thought of as a flare-up of an already present condition most common of which are dental caries, defective restorations, pulpitis, necrotic pulp, periodontal pockets, periodontitis, pericoronitis and jaw pathologies (cysts, granuloma).[10,19-21] As for pain derived from barotraumas i.e. barotitis media, barosinusitis we could consider it as barodontalgia.[19]

Recently, the most common incidental cause of barodontalgia is deep caries without pulp exposure, which was found to be so in 36% of cases in Kollmann's high altitude chamber simulations series, followed by exposed vital pulp 29% and pulpitis or peri-apical periodontitis 14% .[10]

The main causes for dental pain in the Spanish air force survey were peri-apical periodontitis 39% and defective restorations 23%.[22] Zadik in his study conducted in 2007 at the Israeli air force the most common in-flight pain causes were recently restored teeth 29.6%, barosinusitis 18.5%, and pulp necrosis/periapical periodontitis 18.5%.[18] We found in our study that the main cause of barodontalgia among Jordanian pilots was faulty restorations 34.48% followed by untreated carious teeth 24.14% pericoronitis 20.69%, periodontitis (periodontal pockets) and periapical periodontitis(10.34%).

Defective or faulty restoration when changes in ambient pressure occurred might have forced oral fluids to be sucked from the inner dentin tubules, thus causing sensitivity or pain in the pulp chamber or may cause pulp inflammation, thus causing barodontalgia indirectly. It also has been reported that pressure changes can cause tooth or restoration fracture especially in teeth with caries under the restorations.[23]

In this study, no clinical examination was conducted. Correlation of the information obtained from the questionnaires with clinical findings obtained from examination could have provided us with more specific results in term of incidence and causes of barodontalgia.

Barodontalgia is reported to occur at barometric pressure condition of 2000ft to 5000ft,[10,24] in our study it was found to be at 4000 ft and this gave the explanation why all pilots flying different platforms non-compressed helicopter, as well as compressed jet and transporter crews suffered from barodontalgia since the pressure change conditions in all three aircrafts altitudes existed.

There are various reports on when pain occurred during ascent, descent or both. We found a percentage of 53.33% of the study sample that stated pain at both maneuvers, this confirms other studies [25] and explains that pain is related to the pathology that causes it; thus, in cases where the pain was acute and transient during the ascent, the subsequent diagnosis was of caries, acute pulpitis, restorations marginally filtered or with inadequate cavity bases.[22]

Much concern in our study was given to the effect of barodontalgia on RAF pilots, a good percentage of 46.67% reported loss of concentration upon barodontalgia attack and 30% reported headaches while 6.67% complained of blurred vision and 10% reported no effect at all.

Military aircrews are not only vulnerable to barodontalgia but also to dental fracture in high-altitude conditions,[23] tooth wear,[26] mal-occlusion,[27] and high prevalence of periodontal diseases.[28]

The subject of barodontalgia has brought up a great deal of controversy between authors but not in the field of treatment where all seem to agree! Treatments carried out are as those usually performed in the dental practice for similar conditions.

Immediate treatment consisted of administration of analgesics in those cases where the pain persisted after the descent. Antibiotics and anti-inflammatory drugs were prescribed for patients to control infection and then proceed with endodontic treatment. In cases of caries with no pulp involvement a careful filling was performed.

In cases where the pulp was affected, rigorous endodontics of the root canal was advised. No author recommended any other type of treatment (direct pulp capping or pulpotomy) owing to the enormous risk this involves.[29]

In non-vital teeth, a conservative method is advised, because although there are doubts as to whether the periapical lesions will heal after the root canal treatment, the absence of symptoms in the majority of cases indicate good prognosis. Disappearance of the apical radiolucency will be expected in these cases if they carry out regular checks. After the endodontic treatment, all the patients are recommended to have a metal-porcelain crown with total coverage to be fitted, for protecting the tooth structure that remains. If there is persistence of a vestibular sinus, an apicectomy can be performed to avoid the risk of the patient suffering new painful episodes.[22]

A large number of exodontias were carried out this could be explained due to the intensity of the pain that the patient demands a treatment that ensures its disappearance, it was also carried out for patients who had to re treat a previously endodontic- treated tooth or had an apicectomy done for it with a questionable prognosis. Extractions were also advised for impacted wisdoms owing to the dramatic symptoms, their inclined position and because of the possibility of repeated infections. In addition, there was a high risk that the lower second molars could be damaged. While extracting the maxillary upper premolars and molars dental officers should rule out oroantral communication which could lead to sinusitis and complications can occur upon exposure to pressure change.[30,31]

Prosthesis retention is among the conciderations when treating aviation crew,dental officers should consider using resin cement to cement crowns and fixed partial dentures,implantsupportd prosthesis are now considered best choice for missing teeth replacement.[21,22]

Conclusions

The prevalence of barodontalgia was 10.49% which is lower among Jordanian pilots compared to most reports from other countries. This could be explained that the Dental department at the Royal Air Force Medical Facility follows a restrict program of an annual dental check-up with recommendations for treatment, it also has a well established guidelines for dental and flight surgeons to follow before ,during and after treatment is carried out including Temporary Medical Unfit (TMU) or TMU for flying.

Recommendations

Military aircrews have the potential to experience barodontalgia. Flight surgeons and dentists should, therefore, be aware of this phenomenon and use preventive measures (check-ups, prophylactic scaling and oral hygiene education) among aircrew members in order to reduce its incidence and severity

It is recommended that more studies specific to air flight centers be performed to realize the full extent of the problem, the factors affecting the incidence, preventive measures in the form of increased awareness among pilots to the importance of therapy and maintenance, differential diagnosis and methods of diagnosis and treatment.

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