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PREVALENCE OF TOOTH-SQUEEZE OR BARODONTALGIA AMONG THE MILITARY AND COMMERCIAL PILOTS AND AIRCREW MEMBERS IN AN OPERATIONAL AND INTERNATIONAL AIRPORT OF A COSMOPOLITAN CITY OF PAKISTAN

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ABSTRACT

Barodontalgia: Changes in ambient pressure occur during flying, diving, or hyperbaric oxygen therapy and can cause different types of pathophysiological conditions and pain including toothache.[1] Barodontalgia also called as aerodontalgia refers to pain in the soft tissues resulting from disequilibrium in the air-filled spaces around a tooth caused by ascent and decent into places with differential barometric pressure.[1] It is commonly known as tooth squeeze, flyers tooth and aerodontalgia.[1] In general, barodontalgia is defined as pain that occurs in the region of the teeth after pressure change.[2] In some instances, Barodontalgia has been identified as the only cause of an aircrew member suddenly becoming incapacitated, thus hazardously compromising the safety of the affected person as well as others.[2] The incidence of barodontalgia in aircrew has been reported to vary. There is plethora of variation of in-flight barodontalgia cases in literature and most of the current epidemic logical data on barodontalgia has been computed from Military Aircrew and Commercial Pilots. The aim of the study was to evaluate the prevalence of barodontalgia in Pakistan Military and Civilian Aircrew Members of a third world country such as Pakistan. **Methods:** A cross sectional study was conducted on Military and Civilian Pilots at an operational airbase and civil international airport in Pakistan. A standardized self-reporting anonymous questionnaire was distributed among 350 subjects, with questions, regarding gender, age, type of flying (commercial/fighters), the in-flight pain, type of pain, and recurrence of pain. Informed consent was taken and participants were informed that their confidentiality will be maintained and kept anonymous by excluding their names and other identification marks. **Results:** 350 subjects were selected. Out of 350 subjects, 179 responded (response rate 52%) with mean age 30.31+/- 5.634 year. Among military zero (0) cases of barodontalgia was reported and 17% from Commercial Pilot reported the cases of barodontalgia once in life. None of subject from Military and Commercial Pilot experienced the recurrence of barodontalgia pain. **Conclusion:** Barodontalgia was only reported in civil airline pilots and commercial aircrew and none of the military pilots reported any incidence of barodontalgia.

KEYWORDS: Aerodontalgia, tooth squeeze, barodontalgia, aviators' toothache.

INTRODUCTION

The term AERODONTALGIA was first coined during the era of World War II. It was the tooth pain experienced by air crew during flight, however as this tooth related pain was also observed in divers a more appropriate term, barodontalgia was subsequent given to this phenomenon.[3] The phenomenon can be explained on the basis of Boyle's Law which states that ''*at given temperature, the volume of gas is inversely proportional to the ambient pressure''*.[4] At high attitude, during air travel, the outside pressure decreases, the volume of the gases increases. This creates a problem in tooth chambers and canals since gases cannot expand or contract in a manner needed to adjust the internal pressure to match the external pressure.[5] Clinically barodontalgia is defined as symptom (dental pain) rather than a specific disease. It usually occurs as a flare-up of an underlying subclinical pathological situation. All the most frequent dental diseases including cavities, defective crown restorations, peri-apical diseases, periodontal and jawbone inflammation.[6]

Broadly speaking the main condition for barodontalgia is the change in environmental pressure. Remarkably barodontalgia is always triggered by some pathological cause. All literature on this subject describes cases in which one or several causes could have been associated. Here the main triggers identified are inadequate restorations, secondary caries, inadequate root canal fillings, post-operative lesions, or apical or periodontal

damage.[7] Information in literature clearly deviates regarding heights and depths at which barodontalgia may occur (600-12,000meters/10-40 meters).[7] On average it can be said that barodontalgia occurs at heights of 600 to 1,500 meters and depths of 10 to 25 meters; there is no significant difference of incidence between aviators and divers.[7] At greater heights the phenomenon is evident in aircraft with pressurized and non-pressurized cabins, where pain develops more frequently during ascent.[7] For divers pain occurs most frequently during descent. Deviations in literature possibly arise due to retrospective diagnosis, as many studies attribute their results purely to patient information. Patients affected cannot always fully comprehend the circumstances of the incidences when they occur, even understanding or overstating them retrospectively.[7]

Classification of barodontalgia

The FREJENTSIK and ANKER,[7] barodontalgia classification is a basic reference instrument first published in 1983. This is expressed as spanning from milder form of class I to severe form class IV. (Table 1 and 2).

Table 1: FREJENTSIK and ANKER barodontalgia classification.[7]

Class	Cause	Symptoms
I	Acute pulpitis	Sharp momentary pain on ascent
II	Chronic pulpitis	Dull throbbing pain on ascent
III	Necrotic pulp	Dull throbbing pain on descent
IV	Apical periodontitis, cyst	Severe persistent pain on ascent and descent

Table 2: Dental-related (Direct) Versus Non-Dental-Related (Indirect) Barodontalgia.[7]

Characteristics	Pulp disease-induces (direct) barodontalgia	Periapical disease-induced (direct) barodontalgia	Facial barotauma-induced (indirect) barodontalgia
Cause	Pulp disease	Periapical disease	Barosinusitis, barotitis media
Appearance	During ascent pain usually ceases during descent at the appearance-level	Periapical periodontitis: usually at high altitude (38,000 ft) during ascent or descent	During descent pain usually continues on ground
Symptoms	Non-reversible pulpitis: sudden sharp penetrating pain reversible pulpitis or necrotic pulp: dull beating pain	Continuous intense or dull beating pain swelling	Dental pain in maxillary molar or pre-motor region
Dental history	Recent dental work recent dental thermal sensitivity (e.g. during hot or cold drinking)	Recent dental percussion sensitivity (e.g., during eating)	Present upper respiratory infection past sinusitis illness
Radiological findings	Pulpal caries lesions restoration close to pulp chamber	Pulpal caries lesions restoration close to pulp chamber periapical radiolucency inadequate endodontic obturation	Opacity (fluid) on the maxillary sinus image

METHODS

Subjects

A cross sectional study was conducted in 2018 in a metropolitan city with a international airport facility. The study participants were recruited in one and half month. The participants gave their written informed consent to partake in the study. They were given instructions on a paper sheet and were assured about the confidentiality of their data and names to be kept anonymous. A standardized and anonymous questionnaire was distributed among 350 subjects with questions regarding gender, age, type of flying (commercial/ fighter), experiencing the in-flight pain, type of pain, treatment seeking, performance limitation and recurrence of dental pain from the participants. Informed consent was taken from subjects and participants were reassured about their data confidentiality and medical status. Only those participants were inducted in the study who gave their written informed consent and were willingly joining the research. The ages of the subjects between 20 years to 50 years (20-50) were included and no subjects lesser than 20 years old and above 50 years of age were included. Sum total of 350 questionnaires were distributed among participants and the data was collected. The data was then entered as variables in a computer software. It was then analysed for descriptive analysis using the statistical analysis package SPSS program version 22.

Questionnaire

The standardized questionnaire was distributed among 350 study participants. The self-reporting questionnaire was designed in English. There were multiple questions comprising 2 to 4 possible answers as a Likert scale. Barodontalgia was evaluated and assessed with the questions, ‘‘*Have you ever experienced a dental pain during a flight?’’.* Data recorded included basic biographical data like age and gender of participants, type of pilots (civilian/ military), any dental treatment received and its type and recurrence of pain. All data were kept anonymous.

RESULTS

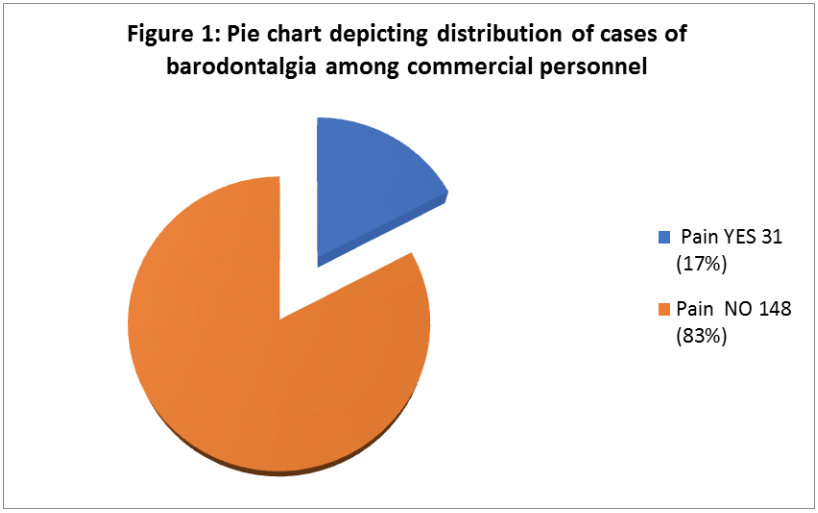
The response rate was 52% among which military aviators were 39% and commercial flights pilots and air crew were 61%. Response rate was described as follows. Subjects from the age group 20-30 years who responded were 62.56%. Subjects from 31-40 years were 35% and 61% belonged to the age group 41-50 years. Among military zero (0) case of barodontalgia was reported and 17% from the commercial pilots, reported the case of barodontalgia once in their life time (table 3). No one from military and commercial pilots experienced the recurrence of barodontalgia pain.

Statistical analysis

The data collected was entered as variables and then evaluated for descriptive analysis with the help of the SPSS program version 22. Figures and tables were reported by the software.

Table 3 Statistical outcomes and results.

Variables	Military (n=70)	Commercial (n=109)	Total
Gender			
Male	70	80	150
Female	0	29	29
Age group			
20-30	56	56	112
31-40	21	42	63
41-50	0	10	10
History of past dental treatment			
Yes	31	70	101
No	39	39	78
Barodontalgia (Figure 1)			
Yes	0	31	31
No	70	78	148
Recurrence of pain			
Yes	00	00	00
No	70	109	179



DISCUSSION

Pakistan has one of the preeminent air forces and commercial airlines set up. Barodontalgia in Pakistan is a lesser studied and researched upon area. The purpose of this study was to determine and document the prevalence of barodontalgia among civilians and forces pilots in Pakistan at a functional airbase and a commercial international airport of a cosmopolitan city of Pakistan.

Since the aetiology of barodontalgia is still not completely understood, current dental treatment recommendations, for flying and diving personnel are often based on statistical data.[8] We have shown that percentage of barodontalgia among military members was zero and around 17% from commercial flights reported the case of barodontalgia. This result was consistent with some previous studies.[15]

In our study, no case of barodontalgia was reported among military pilots, which is in accordance with the study of French researchers.[14] In another study by Kollman et al.[8] recorded incidence of 0.26% in German air force crew whereas in a research conducted by Gonzelez et al.[9] among Spanish in-flight personnel who underwent the obligatory official examination at the Straits Air Command Hospital estimated 0.3-2.6% prevalence of barodontalgia. Cumhar Sipahi and colleagues has reported 0.003% prevalence among four air base pilots of the Turkish air force.[10] The results were divergent from other studies done by Wadha Al-Hajri and Ebtissam Al-Mad who computed it to be 49.6% among pilots in Saudi Arabia and Kuwait.[11] Khawalde M.A figured that 10.49% of the Jordanian air force pilots had experienced barodontalgia at least once during their activities.[13]

The incongruities between the studies may be due to the definition of barodontalgia used in questionnaires, sample size variation, genetics, differences in inclusion and exclusion criteria, and differences in cultural and ethics backgrounds. Kollman et al,[8] has advocated for greater incidence than that actually estimated since there are patients who do not report small incidence of barotraumas for fear of refusal of flying certificates and compromises in career. Although during the present study it was noted that all pilots undergo routine pre-flights checks, and regular dental screenings. The real difference in groups is in relation with performance of dental prevention programs in pilots and air crew members. This would also concur with fact that the military aviators have more stringent and regular dental check-ups and a strict fitness criteria thereby having healthier oral health. These regular and stringent dental check-ups in services aviators reflect the least occurrence of tooth squeeze reported. The incidence of barodontalgia (17%) reported in commercial aviators most likely reflect the fact that patients affected cannot always fully comprehend the circumstances of the incidences when they occur, even understanding or overstating them retrospectively.

CONCLUSION

The military pilots who responded with the questionnaire did not report any incidence of barodontalgia. All age groups of services pilots investigated for the adverse events responded in NO, when asked about barodontalgic pain. The civilian and commercial pilots and air crew however did report around 17% of occurrence of barodontalgia once in their life time. The pain subsequently was treated and the flight missions resumed after treatment of the dental pathology.

RECOMMENDATIONS

Following recommendations are put forth after conducting this study for the competent authorities of the civil aviation company.

- Regular examination of commercial aviators with radiological safeguarding techniques and vitality tests to be carried out.
- Promotion of oral hygiene.
- Counselling of aviators and aircrew for treatment and management of adverse event in time for pain and pathology of oral cavity.
- Following the Standard Operating Procedures (SOP's) for air and equipment safety amongst pilot and air crew.
- Availability of more emergency medicines and dentist at flight facilities e.g. individualized mouth pieces to minimize para-functional oral habits and pressure induced gas infusion.

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