CLINICAL

Barodontalgia Among Flyers: A Review of Seven Cases

Roman E. Hołowatyj, CD, DDS

ABSTRACT

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 can develop in conjunction with sinusitis, and in teeth experiencing pulpitis after restorative treatment, new and recurrent caries, intra-treatment endodontic symptoms, dental and periodontal cysts, or abscesses. Although the causal 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.

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.

By employing a classification system to document cases of barodontalgia, dentists will be better prepared to provide appropriate and successful treatment.

Seven case reports of barodontalgia are presented and compared to previously documented cases. The author also reviews the reasons why military flyers are more likely to develop barodontalgia than others, although the passengers and crews of commercial airliners may also suffer from this condition.

SOMMAIRE

Jadis appelée le mal de dents des aviateurs, la barodontalgie est définie comme une douleur dentaire due à des variations de pression atmosphérique. Elle se manifeste ordinairement chez les personnes qui vont en avion ou font de la plongée. Elle peut se développer conjointement avec une sinusite et dans des dents atteintes de pulpite après un traitement de restauration, de caries nouvelles ou récidivantes, de symptômes endodontiques durant un traitement, de kystes dentaires ou parodontaux, ou d'abcès. Bien qu'on ne comprenne pas bien le processus de causalité de la barodontalgie, on pense qu'il est lié à une hypérémie pulpaire ou à des gaz retenus dans les dents après un traitement radiculaire incomplet.

Aussi convient-il d'inciter les patients souvent exposés à des variations de pression atmosphérique à prendre de bonnes habitudes d'hygiène buccodentaire, à visiter le dentiste pour des examens de rappel réguliers et à accepter en temps opportun l'achèvement de leurs traitements de restauration afin de minimiser les risques d'avoir une barodontalgie.

En utilisant un système de classification pour documenter les cas de barodontalgie, les dentistes seront mieux préparés pour offrir un traitement qui convienne et qui soit couronné de succès.

Dans cet article, on présente sept rapports de cas de barodontalgie et on les compare à des cas antérieurement documentés. De plus, on repasse les raisons pour lesquelles les aviateurs de l'armée sont plus susceptibles que les autres personnes de développer une barodontalgie, même si les passagers et les équipages des avions de ligne commerciaux peuvent également souffrir de cette affection.

Introduction

Although flyer's toothache, also called aerodontalgia, was first noted during the Second World War, it was renamed barodontalgia — tooth pain occurring with changes in ambient pressure — after it was observed that tooth pain could also occur during diving.[1-3]

Aircrew stationed at Canadian Forces Base Moose Jaw, Saskatchewan occasionally present to the base dental clinic complaining of barodontalgia. Not all of the patients in question are pilots. Barodontalgia can also affect flight engineers and other crew members. Therefore, for medical and dental purposes, the term "active aircrew" in the Canadian Forces, as used in this paper, includes several occupations in addition to that of pilot and navigator.[4]

CFB Moose Jaw is responsible for training flight instructors, as well as for conducting basic jet flying training. It is also the home of the Canadian Forces Air Demonstration Squadron — the Snowbirds.

Barodontalgia can occur in patients who are exposed to changes in ambient pressure. Seven such cases are presented here.

Case 1

A 24-year-old male jet instructor-pilot reported an incident of transient sharp pain on ascent one month after a moderate-depth occlusal amalgam restoration with a glass ionomer liner had been placed in an upper left molar, as well as more constant moderate pain. He reported that the tooth had been asymptomatic for several weeks following restoration. During this period, his flying was limited to low level flights (under 3,000 feet). However, he experienced moderate pain in the restored tooth during his first flight at a higher altitude.

On clinical and radiographic examination, there were no abnormalities — other than a mild positive reaction to the cold test. The pilot indicated that the moderate pain he experienced during this higher-altitude flight was the only adverse symptom his tooth had demonstrated subsequent to restoration. After a diagnosis of reversible pulpitis, the restoration was replaced with a zinc oxide and eugenol (ZOE) temporary restorative material (IRM). After one month, the temporary restoration was replaced with amalgam, but the ZOE base was retained. The patient did not report any subsequent adverse symptoms.

Case 2

A 32-year-old male jet student-pilot had two shallow Class II amalgam restorations placed in teeth 46 and 47. He presented to the dental clinic 10 days later complaining of pain on ascent both earlier that day and the day before. The pain generally occurred as he ascended through 7,000 to 8,000 feet, increased slightly, and then dissipated.

At ground level, the post-restoration sensitivity of the teeth to cold had gradually decreased, and the teeth were asymptomatic in low-level flying during the eight days following the operative procedure. On resuming flying at higher altitudes, he began to experience mild pain. Both the radiographic appearance of the teeth and their reaction to the heat test were within normal limits, but one tooth demonstrated a mild positive reaction to the cold test. Cold sensitivity is not unusual 10 days after restoration. The patient declined to have this restoration temporarily replaced with ZOE, since he expected to continue low-level flying during the following week. However, he stated that he would seek treatment if the barodontalgia recurred. He did not return.

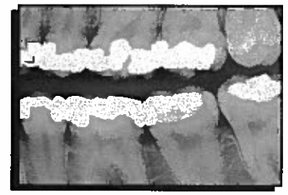

***Fig. 1: Case 4**, bitewing radiograph taken three months before the episode of barodontalgia. Tooth 27 demonstrates a mesio-occlusal restoration and a diffuse radiolucency near the distal part of the restoration. On clinical examination, this tooth displayed extensive buccal and distal caries and was the source of the painful episode during flight.*

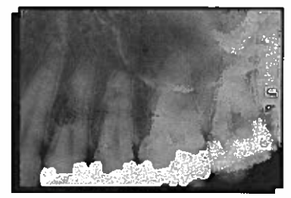

***Fig. 2: Case 4**, two weeks after restoration with "IMR" tooth 27 became acutely painful. The radiograph shows the extreme depth of the restoration.*

Case 3

A 32-year-old male patient who had been trained on fighter aircraft and had served in several capacities as an air demonstration pilot reported a history of spontaneous pain in the area of tooth number 26. The pain occurred on ascent while flying. On clinical examination, the tooth appeared to have a hairline fracture of a marginal ridge. The tooth was restored. Five months post-restoration, the patient presented to the dental clinic complaining that he experienced a loud "pop" in the region of the restored tooth while flying. This was accompanied by a sharp, lingering pain of an intensity that caused his eyes to water. Since the restored tooth was still painful and showed a deep cuspal fracture adjacent to the restoration, a diagnosis of irreversible pulpitis was made. The tooth was treated by root canal therapy and all symptoms disappeared. Had the patient been flying a challenging aerobatic or combat mission, his incapacitation could have had serious flight safety ramifications.

The patient's posttreatment experience is noteworthy because of its effects on his flight performance. For several months after his acutely painful in-flight episode, every time the patient ascended through the altitude at which he had experienced the barodontalgia, he underwent tremendous fear and angst. Fortunately, he was eventually able to resume his normal flying duties with no after thoughts related to this adversity.

Case 4

The morning after he experienced an episode of pain in an upper left molar, a 23-year-old male student-pilot presented to the dental clinic. During flight, the pilot's instructor directed him to put his aircraft into a steep dive from 31,000 feet. He immediately began to experience dental pain. The intensity of the pain increased to an unbearable level during the vertical descent. Although he had no previous history of pain in any teeth, the student admitted that he had experienced occasional sensitivity to sweets in the symptomatic area.

In general, this patient was in a very poor state of dental health and had multiple carious lesions. This was his first visit to the base dental clinic. As a recent military enrollee, he had been transferred several times before beginning flight training at CFB Moose Jaw and had been unavailable for den-

tal treatment. Although the periapical area of the symptomatic, previously-restored tooth appeared normal, a radiographic examination revealed that the tooth had large buccal caries, extending under a shallow mesio-occlusal restoration. It was subsequently restored with a large five-surface ZOE filling as an interim measure (**Figs. 1** and **2**). However, the sudden onset of intense pain in the same tooth two weeks later necessitated the initiation of endodontic treatment. Following completion of the endodontic treatment, the tooth was restored with two paraposts, an amalgam core, and a five-surface amalgam restoration.

After the dental rehabilitation of this patient, barodontalgia did not recur. Curiously, he denied having any adverse symptoms in his teeth during the high altitude indoctrination (HAI) course (see appendix) that he was given just a few months prior to his first flight.

Case 5

During the hyporbaric chamber portion of a HAI course, a 23-year-old male aircraft technician experienced moderate pain during a simulated ascent to 25,000 feet. The pain dissipated on return to ground level. It did not recur during the final exercise in the hyporbaric chamber, which involves explosive decompression. Two weeks prior to his HAI course, the patient had begun endodontic therapy on an upper molar. One week later, he experienced a mild toothache, which he self-treated with analgesics. However, the patient did not recount his experiences until some time after the conclusion of the course, during an appointment to complete his endodontic treatment. Some residual pulpal debris from the apical area of the root canal system was removed at that time. The patient is fully recovered.

Case 6

A 26-year-old aircraft technician reported some discomfort on inhalation on cold winter days (the outside temperature at that time of year was -30°C). In addition, he complained that he had experienced mild pain in two maxillary anterior teeth during his HAI course. This occurred during a simulated air ascent in the hypobaric chamber.

An endodontic cold test produced a mild positive reaction in tooth 22, and there was radiographic evidence of some recurrent caries in teeth 11 and 22. These teeth were restored, and the patient did not report any further incidents of barodontalgia.

Case 7

A 33-year-old male patient described an episode of very intense "eye-watering" and continuous pain in his left infra-orbital area. The pain, which also involved teeth 23 to 26, occurred as he was gradually descending from 35,000 feet. He was flying in a Tutor jet trainer on a flight that did not include any aerobatics. The intense pain continued for most of the descent and only dissipated near ground level. The patient also reported a similar occurrence when he was a passenger on a commercial airline flight from Toronto to Saskatoon, although the pain was not as intense. Since he had no detectable caries, no other adverse symptoms in any teeth, no abnormal clinical conditions, and admitted to having mild congestion in his left maxillary sinus, the condition was determined to be consistent with barosinusitis, with pain referred to the maxillary teeth. The patient declined any treatment, as he felt his congestion was improving, and did not return.

Barodontalgia As a Dental Pathological Phenomenon

In each of these cases, the patients' barodontalgia was related to an underlying dental or antral pathosis. The change in ambient pressure was not the cause of the symptoms, but a contributing factor.

The mechanism by which dental pain occurs in conjunction with changes in ambient pressure is still unclear. Although the causative process is not well understood, it may be related to pulpal hyperemia, gasses trapped in teeth following incomplete root canal treatment, or abscesses.[5-7]

The clinical contexts of barodontalgia that have been reported in the literature include: periapical infection, periapical abscesses, caries, deep restorations, residual dental cysts, sinusitis, and postsurgical interruptions in the mucosa.[6] Postsurgical interruptions are of concern in divers, as some SCUBA oxygen regulators produce positive oral pressure and thereby force air into the interrupted tissues.[2,6,8] Similarly, the oxygen systems (which include masks) in high-performance military aircraft provide oxygen under pressure at altitudes above 37,000 feet.[9-12] Below that altitude, they provide oxygen on demand, diluted with cabin air.[10]

Early reports hypothesized that air, which had been trapped under dental fillings, caused barodontalgia. Now, however, the dental literature states that "pain occurring at simulated high altitudes is associated with the nearness of caries to the pulpal tissue, and that changes in altitude are more important than the degree of altitude."[6] It is abundantly clear that the presence of air bubbles under fillings does not result in barodontalgia,[5] and that teeth with deep, restored cavities may have chronic pulpitis, whether or not they have exposed pulps under the restorations. These teeth are likely to demonstrate barodontalgia, particularly after cavity preparation. However, this would not necessarily imply that every tooth with chronic pulpitis will always demonstrate barodontalgia in hypobaric situations.[5]

To examine patients demonstrating barodontalgia in a hypobaric chamber, Kollman[5,7] studied German Air Force aircrew members who regularly received scheduled training in such a facility. The training is very similar to the Canadian Forces HAI course, which exposes participants to a series of reduced air pressures similar to those that could occur during flight. Kollman describes the "flight" profiles in detail. He found that many of the subjects who demonstrated barodontalgia had recurrent caries, either under or adjacent to restorations. Some subjects required simple restorative treatment, while others needed root canal therapy to restore the teeth and prevent further symptoms.

A high proportion of the patients receiving dental treatment at the CFB Moose Jaw dental clinic also fly (250 pilots alone). This may explain why barodontalgia is observed in the clinic at a relatively high frequency (an estimated five to six cases yearly) relative to the civilian environment. Many "civilian" dentists may never see a case of barodontalgia in their practice.

Canadian Forces' aircrew are forbidden to fly for 12 hours, minimum, after the injection of local anesthetics. The restriction period is even longer if they have undergone surgical procedures or taken any drugs. In both cases, an affected aircrew member can only be "ungrounded" by an authorized flight surgeon.[4,9,13] Therefore, neither the administration of drugs nor the proximity of dental treatment to the commencement of flying appears to be a predisposing factor in the onset of barodontalgia.

Subclinical dental pathoses can become significantly symptomatic at altitude.[6] It is also known that the degree of change in air pressure may be more important than the ambient pressure itself in contributing to barodontalgia.[5] An examination of various aircraft pressurization systems may therefore reveal some interesting findings that could ultimately account for the apparent higher frequency of barodontalgia in military flyers.

When aircraft fly at altitudes above 10,000 feet, human physiology requires that both pilots and crew must either have supplemental oxygen delivered through a face mask or, alternatively, the aircraft cabin must be pressurized to permit unaided breathing.[10]

In a commercial airliner, the cabin air is condensed or pressurized, yielding a cabin "altitude" that is different from the actual aircraft altitude. For example, in today's state-of-the-art Boeing 757 passenger airliner, the cabin air pressure is gradually increased as the aircraft ascends, so that at an actual altitude of 42,000 feet, the cabin altitude is just 8,000 feet[14-16] (**Table I**). Basically, the thin outside air at 42,000 feet is brought into the aircraft and then condensed or pressurized to create a higher inside air pressure (lower cabin altitude). This allows unaided breathing. Passengers experience a pressure change from ground level to only 8,000 feet, and not the actual 42,000 feet through which the aircraft ascends. However, because the aircraft cabin pressure can vary to this degree, or more, depending on the aircraft, a passenger or crew member could still develop barodontalgia in susceptible teeth.

Table I

A Comparison of Cabin Pressures at Various Aircraft Altitudes[14-19]

Aircraft Altitude*	Cabin Altitude (Pressure)*			
	Boeing 757	Dash 8**	CT-114 Tutor	CF-5/CF-18
10	1.0	2.5	8.0	8.0
20	2.2	5.0	11.0	8.0
30	4.0	—	18.0	13.0
40	7.0	—	24.5	16.0

**In thousands of feet.*

***One version of the DeHavilland Canada Dash 8 twin-engine turboprop aircraft with a ceiling of 25,000 feet is used as a 50-passenger carrier by many regional commuter airlines.*

In contrast to commercial airliners, the cockpit of the Tutor jet trainer and CF-5/CF-18 fighter aircraft does not pressurize at all until the aircraft has reached an altitude of 8,000 feet.[17] This is significant, as atomospheric pressure changes the most between 0 and 5,000 feet. As the Tutor climbs to 17,500 feet, the cabin altitude stays at a constant 8,000 feet, then slowly rises to 24,500 as the aircraft nears 40,000 feet.

Similarly, the CF-5 and CF-18 fighters maintain a cabin altitude of 8,000 feet while the airplane ascends to an altitude of 23,000 feet. Above that level, the cabin altitude increases to reach 16,000 feet as the aircraft altitude approaches 40,000 feet.[18,19]

By way of comparison, during a simulated training flight in a hypobaric chamber the subject could experience a full pressure change, from ground level to an altitude of 40,000 feet. Oxygen masks must be worn in this exercise, as the hypobaric chamber essentially duplicates the actual atmospheric pressure that the subject would experience at various altitudes.[5]

Clearly, military pilots and passengers in high performance aircraft undergo a greater ambient pressure change during flight than other flyers. When flying to 40,000 feet, for example, the ambient pressure change experienced by military pilots is two to three times greater than it is for passengers or crew members flying in commercial aircraft. Moreover, this pressure change occurs at a faster rate, particularly when military crew members are engaged in vertical aerobatic or combat flying, as they frequently are. As a result, military flyers may be more susceptible to experiencing barodontalgia in predisposed teeth, both during flight in high performance aircraft and during simulated flights in a hypobaric chamber. Yet, as shown in **Case 7**, and from the author's clinical experience, aircrew and passengers flying in commercial aircraft can still demonstrate barodontalgia if they have a dental predisposition.

Case Discussion

In each of the reported cases, the patient already had some preexisting dental pathology before the episode of barodontalgia occurred. As such, the exposure to changing ambient pressure was not a direct cause of the symptoms, but, rather, a contributing environmental factor.

Cases 1 and **2** confirm that some teeth can demonstrate barodontalgia shortly after restoration. In both cases, the patients' pulpitis was transient and reversible, either with time, or by using ZOE as a

Table II

Proposed System of Classification of Barodontalgia[6]

	Chief Complaint	Clinical Finding	Diagnosis	Treatment
Class I	Sharp momentary pain during ascent (decompression); asymptomatic on descent (compression) and afterward.	Caries or restoration with inadequate base. Tooth is vital. PA shows no periapical pathosis.	Acute pulpitis	Zinc oxide-eugenol temporary followed in two weeks with a well-based permanent restoration. Endodontics, if irreversible.
Class II	Dull throbbing pain during ascent (decompression); asymptomatic on descent (compression) and afterward.	Deep caries or restoration. Tooth is vital/non-vital. PA shows no periapical pathosis.	Chronic pulpitis	Root canal therapy, or Extraction of un-restorable tooth.
Class III	Dull throbbing pain during descent (compression); asymptomatic on ascent (decompression) and afterward.	Caries or restoration. Tooth is non-vital. PA shows periapical pathosis.	Necrotic pulp	Root canal therapy, or Extraction of un-restorable tooth.
Class IV	Severe persistent pain after ascent (decompression) or descent (compression).	Caries or restoration. Tooth is non-vital. PA shows definite periapical pathosis.	Periapical abscess or cyst.	Root canal therapy, and/or surgery, or Extraction of un-restorable tooth.

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sedative restorative material. **Case 1** also reinforces the advisability of placing ZOE bases under deep amalgam restorations.[5]

With the advent of all-etch bonding systems for bonding both composites and amalgam to teeth, it may be possible to decrease or even eliminate barodontalgia. Unfortunately, these materials were not available in our clinic when the first two cases were treated. It would be interesting to know whether the patients' postoperative symptoms would have been present if a bonding system such as Allbond 2, Tenure, Amalgambond or Photobond had been used when their original restorations were placed. In our clinic, teeth treated with Allbond 2 or Amalgambond have shown few or no adverse symptoms. A study into the effectiveness of all-etch bonding systems in decreasing or completely preventing the occurrence of a phenomenon like barodontalgia would likely be beneficial.

Since it is not clear whether the coronal fracture in **Case 3** occurred prior to or during flight, it is impossible to state conclusively if decompression alone can result in the fracture of teeth. However, it may be possible that a pre-existing coronal fracture can be exacerbated on decompression. Dental practitioners should therefore correct even minor hair-line fractures of the teeth, and preclude the development of more serious complications.

Most documented cases of barodontalgia involving previously restored teeth have occurred on ascent.[6] **Case 4** is an exception to the rule. It shows that teeth with extensive caries, which are not associated with a restoration, can experience barodontalgia on descent. This may indicate severe chronic pulpitis or an exacerbation of a chronic pulpal state, necessitating root canal therapy. Since the mesio-occlusal restoration on the symptomatic tooth was intact on examination, and the pulpitis likely occurred as a result of the deep buccal caries, it is the author's contention that an un-restored tooth with active deep caries could demonstrate barodontalgia. Canadian Forces aircrew members are generally attentive to their oral health. Furthermore, military dental treatment policies provide for regularly scheduled dental care for all service members, which generally prevents a patient from falling into an undesirable state of dental health. Both these factors may explain why no examples of this condition have been demonstrated previously.[5,6,20]

Case 5 demonstrates that intra-treatment pain from incomplete endodontic therapy can be more intense in hypobaric conditions. However, in the author's clinical experience, if pulpal tissue is thoroughly removed during pulpectomy treatment, the canal is not over-instrumented, and there is no internal suppuration, patients who have undergone endodontic treatment generally have not been symptomatic during their flying activities. This is also borne out by Rauch.[6] Furthermore, patients in our clinic who required endodontic treatment in symptomatic teeth have continued their flying activities, following their first appointment, but prior to the completion of treatment, without reporting any instances of barodontalgia.

Case 6 demonstrates an occurrence of barodontalgia similar to those investigated by Kollman.[5,7] Recurrent caries under or adjacent to restorations can contribute to barodontalgia, particularly when the subject is in a hypobaric chamber. Good dental health is the most important factor in the prevention of barodontalgia, particularly when a patient is exposed to large changes in ambient pressure.

As shown in **Case 7**, sinusitis may be the primary contributing factor in most cases of barodontalgia involving multiple teeth, on descent. Usually, correction of the sinusitis is all that is required to prevent the recurrence of dental pain during flight.

In his extensive literature review on the subject, Rauch[6] proposed a classification system of barodontalgia (**Table II**). This system is similar to the one proposed by Goethe et al,[3] which is recommended by the Fédération Dentaire Internationale (FDI). A comparison of the author's seven case reports against the table shows that when barosinusitis is discounted as a possible cause of the patients' symptoms, the treatment rendered was consistent with Rauch's classification system. This table may prove invaluable to the dentist who normally has little contact with patients who fly, but who must suddenly diagnose and treat a patient who has suffered from barotrauma.

Conclusion

Barodontalgia is defined as tooth pain occurring with changes in ambient pressure. It can develop when pulpitis is present following restorative treatment, or in teeth with new and recurrent caries. In can also occur in conjunction with intra-treatment endodontic symptoms, and with specific pathoses such as dental and periodontal cysts, abscesses, and referred sinus pain. However, the causal mechanism of barodontalgia is not clearly understood.

This review of seven cases shows that barodontalgia is a very painful phenomenon that may occur in the passengers and/or crew of commercial and military aircraft. As such, it can result in serious consequences for pilots who fly high performance jets, particularly during difficult manoeuvres such as formation flying, aerobatics and air combat.[21]

Barodontalgia can be largely avoided by maintaining a high level of oral health, including regularly scheduled dental recall examinations and the timely completion of restorative treatment. Oral health is therefore vitally important to all patients involved in activities that expose them to changes in ambient air pressure.

Dental practitioners who encounter patients complaining of barodontalgia may achieve better results if they employ Rauch's classification system to supplement the diagnostic and restorative sciences.

Appendix 1

A High Altitude Indoctrination (HAI) course, also called Aero-Medical Training, is a course of several days' duration that is conducted by the Canadian Forces Medical Services (CFMS) for all military aircrew to familiarize them with the physiology of flight, hypoxia and aircraft safety systems. In addition, the CFMS provides a one-day condensed HAI course for non-aircrew members who expect to fly as passengers in high-performance aircraft. This latter version of the course involves a didactic portion of one half-day covering the above subjects. Like the extended course, this is followed by a series of "flights" in a hypobaric (depressurization) chamber: ascent to 5,000 feet and return to ground level; ascent to 25,000 feet (with supplemental oxygen) and individual exercises of removing oxygen masks to experience hypoxia, then a return to ground level; and finally, "explosive" decompression (sudden depressurization in less than one second from zero to 10,000 feet).[11,12]

Kollman[5] described the sequence of training used by the German Air Force in simulated flights in a hypobaric chamber. The "flight profile" is very similar to the Canadian Forces HAI. ■

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Dr. R.E. Holowatyj is a former clinical instructor in the department of oral medicine and pathology, faculty of dentistry, University of Toronto. At the time of writing, he was the dental detachment commander at Canadian Forces Base Moose Jaw, Saskatchewan, and is presently in private practice in Belleville, Ontario.

Reprint requests to: Dr. R.E. Holowatyj, 208 Bridge St. East, Belleville, ON R8N 1N8.

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References

1. Rottman, K. Barodontalgia: A dental consideration for the Scuba Diving patient. *Quintessence Int* 12:979-982, 1981.

2. Klechak, T.L. Dental barotrauma of diving. *Florida Dent J* 10-11, Spring 1987.

3. Goethe, W.H.G., Bater, H. and Laban, C. Barodontalgia and barotrauma in the human teeth: Findings in navy divers, frogmen and submariners of the Federal

Republic of Germany. *Military Med* 154:491-495, 1989.

4. Canadian Forces Dental Orders 22-11. Dental Treatment of Active Aircrew. Department of National Defence, Canada, 1987.

5. Kollman, W. The incidence and causes of dental pain during simulated high altitude flights. *Dent Corps Internat* 4:12-18, 1992.

6. Rauch, J.W. Barodontalgia — dental pain related to ambient pressure changes. *Gen Dent* 33:313-315, 1985.

7. Kollman, W. The incidence and possible causes of dental pain during simulated high altitude flights. *J Endodont* 19:154-159, 1993.

8. Edmonds, C. et al. Diving and subaquatic medicine. *Diving Med Centre*, 1981.

9. Flying Orders. CFP 100. Vol. III. Department of National Defense, Canada. pp. 4-2, 1980.

10. *Van Sicklets Modern Airmanship.* 5th Ed. New York, Van Nostrand Reinhold Co., pp. 327-335, 1981.

11. HAI Course Notes. Aeromedical Training. Defence and Civil Institute of Environmental Medicine. CFB Toronto, September 1990.

12. HAI Course Notes. Aeromedical Training. Canadian Forces School of Aeromedical Training. CFB Edmonton, May 1985.

13. Guidelines for Flight Surgeons — 3/87. Drugs and Aircrew: Canadian Forces Medical Services, October 1989.

14. Boeing 757 Operations Manual. Vol. II, Chap. 6. Technical Manual. Boeing Aircraft Co., Seattle, 1992.

15. Baz, D. Dan's Technicalities: B757 Pressurization, Toronto, 1992.

16. Dash 8 Pilot Training Manual, Chap. 12., Flight Safety Canada Ltd., Downsview, Ont., 1988.

17. Aircraft Operating Instructions CT-114 Tutor. Department of National Defense, Canada, pp. 36, 1987.

18. Aircraft Operating Instructions. CF-18 Hornet. Department of National Defense. Canada, 1-16-2, 1982.

19. Aircraft Operating Instructions. CF-5 Freedom Fighter. Department of National Defense, Canada, 1-16-1, 1990.

20. Calder, I.M. and Ramsey, J.D. Odontocrexis — The effects of rapid decompression on restored teeth. *J Dent* 11:318-323, 1983.

21. Senia, E.S., Cunningham, K.W. and Marx, R.E. The diagnostic dilemma of barodontalgia: Report of two cases. *Oral Surg* 60:212-217, 1985.