

Pain in Plane: A Case Report and Review on Barodontalgia

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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. Barodontalgia is one of the important clinical entities which present with such overlapping signs and symptoms, that in normal clinical setup the pain due to barodontalgia goes unnoticed. Also the literature available in textbooks is also less informative and revealing of the nature of pain caused due to barodontalgia. 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. We report the case of a patient with severe pain in the region of his mandibular left first molar, which had clinically a fractured restoration with secondary caries. Pain occurred during an airplane flight and persisted after landing. Radiology revealed a periapical radiolucency in the region of the distal root apex. Pain relief was achieved only after endodontic treatment. On the basis of this paper, we also present the review regarding the etiology and management aspect of barodontalgia.

Key words: Barodontalgia, Barotrauma, Odontocrexsis, Barosinusitis, Aerodontalgia,

INTRODUCTION

Barodontalgia, a barometric pressure-related oral (dental or other) pain, has remain of considerable concern among aviation physicians and dentists during the 1940s and quite forgotten later.¹ Barodontalgia often goes unnoticed in a normal

clinical setup, as it was almost neglected in Dental Education in the first half of the 20th century and there was less knowledge among the clinicians regarding it.² In this article, we present a case of Barodontalgia and review the existing

literature obtained from researches which gathered to draw an updated image of this pain entity during the past decades.

CASE REPORT:

A 25 year-old male patient reported to the Department of Oral Medicine and Radiology with the chief complaint of pain in the left Lower back tooth region since five days. He gave history that the pain had occurred when he had been flying in an airplane and had appeared suddenly.

When asked to describe the intensity of pain using a 0 (no pain) to 10 (worst pain) numerical rating scale (NRS), he rated his pain as 8. At ground level, the patient had been free of pain for approximately three hours. His pain had then increased again to a score of 6 to 7 and he described it as a localized intermittent dull throbbing ache.

Upon intra-oral examination, the mandibular left first molar (tooth 36), showed clinically a fractured restoration, which was tender to percussion. A periodontal examination of the left mandible was unremarkable. A vitality test of the mandibular left first molar indicated that the tooth was nonvital. A radiographic examination showed a restored dentition with secondary caries in the left mandible in relation to 36, associated with widening of periodontal ligament space and diffuse periapical radiolucency in the region of the distal root of 36(Figure I).

Following the administration of local anesthesia and the application of a dental rubber dam, endodontic treatment of tooth 36 was instituted. After access cavity preparation, pulp was removed and three root canals were exposed. During the procedure, severe bleeding from both mesial root canal orifices was noted however the distal root canal showed in particular gangrenous decomposition of pulp tissue. The root canals were prepared in crown down motion with Protaper Next (Dentsply). After root canal preparation Calcium hydroxide-iodoform paste (Metapex) was used as intracanal medicament for

one week. Tooth was then obturated using Protaper Next gutta percha points and then was sealed.

The presence or absence of cracks was assessed optically using magnifying glasses and a blue-light lamp before and after staining (Mira-2-Ton, Hager and Werken, Duisburg, Germany). No fractures were detected. After the root canal filling was completed, an intraoral periapical radiograph was taken which showed a complete obturation, further the course of treatment was unremarkable (Figure II).

DISCUSSION

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.³ In the diving environment, this pain is commonly called “tooth squeeze,” and by the name “aerodontalgia,” regarding its feature in flight.² Although rare, “in-diving” or “in-flight” barodontalgia has been recognized as a potential cause of diver or aircrew-member vertigo and sudden incapacitation, which could jeopardize the safety of diving or flight.¹

Typically Barodontalgia is only experienced in teeth which have pre-existing issues, making it more of a symptom rather than a pathological condition.⁴ Most of the common oral pathologies have been reported as possible sources of barodontalgia including new and recurrent dental caries, intra treatment endodontic symptoms, dental and periodontal cysts or abscesses, defective tooth restoration, pulpitis, pulp necrosis, apical periodontitis, periodontal pockets, impacted teeth, and mucous retention cysts and a history of recent surgery.^{2,4,5} The latter is of particular concern for people wearing oxygen regulators when diving using self-contained underwater breathing apparatus (scuba) or when wearing oxygen masks during high performance aircraft flights due to the risk of air being pushed into the tissues.⁵

In four exceptions, barodontalgia is not a symptom of a preexisting disease but of a pressure change-induced (new) pathologic conditions referred to as facial barotraumas.⁴ The term facial barotraumas generally refers to barometric-related trauma to facial cavities, including barotitis media (middle ear barotrauma), external otitic barotrauma, barosinusitis (sinus barotrauma), and dental barotrauma.⁴ Barotitis media is a traumatic inflammation in the middle ear space produced by a pressure differential between the air in the tympanic cavity and that of the surrounding atmosphere. ⁴External otitic barotraumas is caused by injury to the lining mucosa of the external ear canal because of the airtight space between an object in the outer ear canal and the eardrum. Barosinusitis is an inflammation of one or more of the paranasal sinuses produced by the development of a pressure difference (usually negative) between the air in the sinus cavity and that of the surrounding atmosphere. Referred pain from extraoral facial barotrauma (barotitis media, external otitic barotraumas, and barosinusitis) can be manifested as a toothache and should therefore appear in the differential diagnosis list of barodontalgia.⁴

Barosinusitis is distinguishable from barodontalgia, as the former will always occur on descent, whereas the latter always begins on ascent. Recognizing that symptoms only appear to arise in teeth (or sinuses) affected by some type of pathology, researchers concluded that a pressure gradient is a contributing factor, not the actual cause of the problem.⁵

An explanation of Barodontalgia comes from the Boyle's Law, stating that "at a given temperature, the volume of gas is inversely proportional to the ambient pressure".² When a person is deep below the water surface the pressure put forth by the water increases, which in turn reduces the volume of gases in pulp chamber and root canals of teeth.⁵ Inversely, when a person reaches high altitudes—especially in unpressurized airplane

cabins—the outside pressure decreases, so the volume of the gases increases. This creates a problem in tooth chambers and canals, since the gases cannot expand or contract in a manner needed to adjust the internal pressure to match the external pressure.⁵ Barodontalgia caused by periapical periodontitis or impacted teeth is probably caused by the elevated pressure within the bony lesion or tooth crypt, respectively.⁴

There was no published research regarding the pathogenesis of barodontalgia in the past decade.¹ Despite some theories, most offered in the first half of the 20th century,⁶ the pathogenesis of this unique dental pain remains occult.¹ Kollman refers to 3 important hypotheses to explain this phenomenon.⁷

First, expansion of trapped air bubbles under a root filling or against dentin that activates nociceptors; Second, stimulation of nociceptors in the maxillary sinuses, with pain referred to the teeth; Third, stimulation of nerve endings in a chronically inflamed pulp. He strongly supports the last 2 hypotheses and states that, for the latter, histologic evidence show that chronic pulpal inflammation can still be present even when a thin dentin layer covers the pulp, for example, as in a deep cavity preparation.⁷

Barodontalgia is subgrouped into direct (dental-induced) and indirect (nondental-induced) pain. The currently accepted classification of direct barodontalgia consists of 4 classes according to pulp/periapical condition and symptoms (Table I) as developed by Frejentsik and Aker.^{8,9}

In diving conditions, pain appears at a water depth of ≥ 33 feet,⁴ mostly at depths of 60-80 feet¹⁰ and upper teeth are more affected than lower teeth whereas in flight conditions, upper and lower teeth are affected equally.¹

In their study, Calder and Ramsey¹¹ mentioned that the physical properties of the gas mixture used during deep sea diving may contribute to barodontalgia. In scuba tanks, oxygen's natural diluent gas, nitrogen, is replaced by helium, resulting in a gas of lower viscosity. This gas can

enter tissues, including teeth, and can sometimes become trapped in closed spaces, such as the pulp chamber and root canal. There are 2 mechanisms by which gases can be trapped in spaces: if there is a space between a tooth and its restoration, gas may be forced into it during an increase in pressure; and dissolved gas may diffuse from tissues into spaces as pressure decreases. Consistent with Boyle's Law, trapped gas will expand and the resulting stress may cause tooth fracture. This process has been called Odontecrexis, a Greek word meaning tooth explosion.¹¹

FDI recommends an annual checkup for divers, submariners and pilots, with oral hygiene instructions from dentists familiar with their dental requirements.¹²

When performing multi visit endodontic treatment, the dentist must carefully place the temporary restoration and educate the patient to confirm that the restoration is intact before diving. In a pressure changing environment, open unfilled root canals may cause subcutaneous emphysema, as well as leakage of the intracanal infected content to the periradicular tissues.¹³ Temporary diving restriction after dental and surgical procedures is still a powerful tool for the prevention of postoperative barodontalgia.¹³ Patients should not dive within 24 hours of a restorative treatment requiring anesthetic and within at least 7 days of having surgery.¹² When dealing with patients involved in diving or aviation, clinicians should pay close attention to areas of dentin exposure, caries, fractured cusps, fillings and periapical pathology.⁵

Examination should include an estimate of the age of restorations in the suspected area, screening for caries and poor-quality restorations, a percussion test on suspected teeth, an evaluation of the response to electrical stimulation or heat and cold, as well as a radiographic examination.¹⁴ One clinical benefit of barodontalgia is that it may help a dentist

locate early caries, leaking restorations and periodontal abnormalities.¹⁵ Also of clinical importance, the placement of a zinc oxide eugenol (ZOE) base was found to prevent barodontalgia when reversible pulpitis was the underlying cause³ which is attributed to its well-known sedative effects of ZOE.³ Another study⁷ suggested that when treating people who are subjected to large pressure changes, it is best to avoid procedures such as pulpectomy, pulp capping of an exposed pulp whereas, endodontic treatment is indicated. Lyons and coworkers¹⁴ based on their study suggested that dentist should consider using resin cement when luting fixed prosthesis in patients who will be exposed to significant variations in the pressure. They also stated that barodontalgia may develop as a result of microleakage following a reduction in the lute bond strength during or following pressure cycle.¹⁴

CONCLUSION:

The present article reviewed the updated knowledge regarding barodontalgia.¹ It is evident from the available literature that barodontalgia has been neglected in dental education and research in the recent years.² It appears that controversy still exists as to the exact etiology of barodontalgia and the mechanisms of the pain.¹ Agreement has been reached on 2 factors: the influence of a pressure gradient and some sort of pathology in oral tissues or sinuses must both be present to result in symptoms of barodontalgia.⁵ However, further understanding of diagnosis and treatment challenges would undoubtedly be gained from research broadened to include recreational divers and civilian aviators.

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Pain in Plane: A Case Report and Review on Barodontalgia

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Classification of Barodontalgia (TABLE I)

Class		Symptoms
Class I	Irreversible Pulpitis	Sharp transient (momentary) pain on ascent.
Class II	Reversible Pulpitis	Dull throbbing pain on ascent.
Class III	Necrotic Pulp	Dull throbbing pain on descent.
Class IV	Periapical Pathology	Severe persistent pain (on ascent or descent).

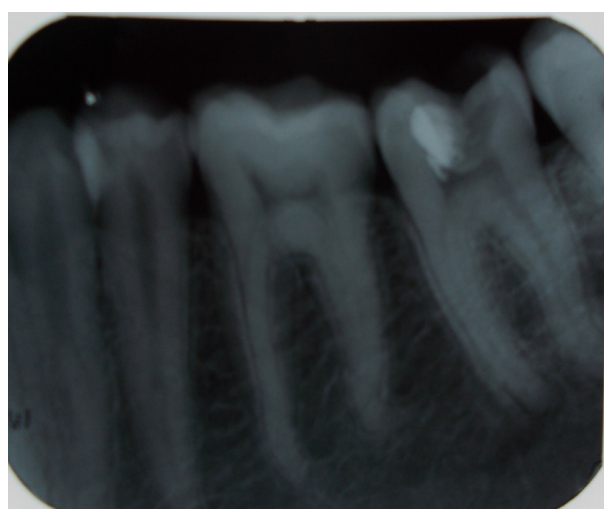


FIGURE I



FIGURE II