

Barodontalgia – A Diagnostic Dilemma in the Dental Pain of Servicemen-A Structured Review

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Abstract: Barodontalgia is caused whenever the pulp is exposed to differential pressure gradient. In the service men it can occur when they are in aviation (Air force) or when they have to dive deep for recreation, training or duty (Navy seals). Currently as air travel becomes affordable and common more passengers also complain of discomfort during the take off and landing time. Kollman's hypothesis is accepted in this review as possible cause of the nociception. The cornerstone of Barodontalgia treatment is prevention. Good oral hygiene and exemplary restorative filling work all play a role in satisfying patients who may be suffering from Barotrauma. FDI recommends that all the patients (Submariners, Divers, Pilots, Aircrew, and even regular air travellers) at risk must have annual check up. These authors upon the detailed review would like to suggest a bi-annual check for such personnel. Another important aspect is detailed tooth charting and a digital orthopantomograph for all service men to be made mandatory. The forensic odontology uses of such records are quite obvious.

Keywords: Barotrauma, Dental pain, Service Men, Airforce Pilots, Air Passengers, Navy Seals, Divers.

I. Introduction

Barotrauma or the damage caused due to the pathological differential air pressure in pulpal environment is a serious differential diagnosis for dental pain in the service men, notable air force and navy personnel. Kieser J and Holborrow D¹ have enunciated that the Boyle's law which establishes a relationship between the volume of gas and the pressure as inverse, for a given temperature. The impact will be amplified if the gas is in closed volume of tissue like pulp.

This process appears to affect the nociceptive nerves in the pulp at the altitude of 3000 metres and for divers at the depth of 10 metres for ambient pressure between 0.75 to 1 atmosphere (Lyons KM et al²).

Historical review reveals that such pain was identified by the pilots of the world war II planes. Hutchins HC et al³. In fact in the initial work^{3,4,5,6} the term preferred is Aerodontalgia. It is after 1988 Goethe et al⁹ we find the term Barotrauma or Barodontalgia appear in the different discussions in the scientific pain literature.

II. Brief History

In 1940's the USAF experiments³ with pressure chamber simulations resulted in preliminary data that dental pain occurred in 0.7 to 2.0 % of the air force members. This pain was ranked fifth in the range of physiological reactions causing discomfort to the pressure chamber.

2.1 The first mention of pain caused by pressure changes appears in 1947 by Hutchins HC³ and the term he used was 'Aerodontalgia.'

2.2 The other scientific workers Carpousis⁴ (1954), Curville J⁵ (1957), (1965), Bolinder G et al⁶ (1972), upto the work of Fleury JE et al⁷ 1988 Aerodontalgia term was used to denote this pain.

2.3 Even though isolated references related to Barodontalgia are seen prior to 1989 it was Goethe WH⁸ et al who started the serious discussion of Barotrauma and Barodontalgia in navy divers and submariners. Subsequently it was Seoane JM⁹ et al 1990; Kollmann W¹⁰ 1993; Holowatyj RE¹¹ 1996; All these mentioned that air crew, the military and even the commercial travellers may suffer from such a pain which may be called as the Barodontalgia.

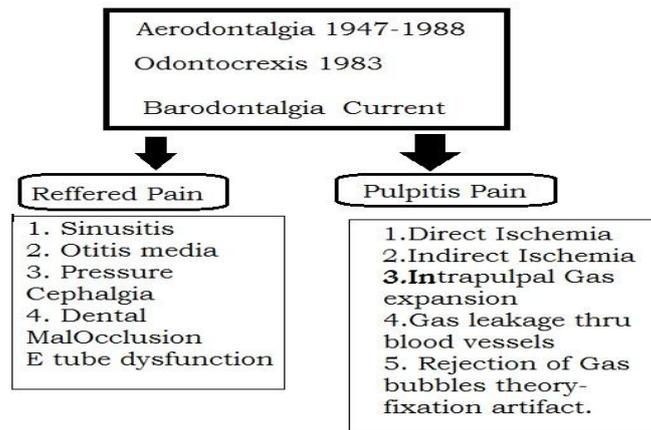
2.4 Zadik Y¹² in the time period 2007 - 2015 has been a proliferative scientific worker in the domain of Barodontalgia and we located a total of 9 exemplary works in the pubmed directly attributed to him. His classical reference of 2010, Barodontalgia what we have learned in the past decade? reviews the work in a decade and very succinctly places it on record for clinicians to use.

III. Theory Of Action On Pulp And Pain Generation

3.1 The pain generation has been postulated by two main mechanisms, the direct and the indirect. The direct being the pressure changes being felt due to presence of pathology in the tooth, like pulpitis, fractured filling with microleakage, periapical pathology and recent trauma to the tooth. [Gunepin M¹³ et al 2015 - 5.3% of

divers had direct dental barotrauma] The indirect pain mechanism would primarily be due to the referred pain from otitis media(barotitis) [Zadik Y and Drucker S¹⁴ 2011] , sinusitis (barosinusitis)[Weber R¹⁵ et al 2014] and pressure headache (baro-cephalgia) Lal D¹⁶ et al 2015. Lal D¹⁶ found that 7% of the complex head ache cases in their series had dental pathology as primary cause . In rare cases even the nerve changes due to pressure termed as Baroparesis of Br V cranial nerve and Br VII cranial nerve also may reflect a barodontalgia.¹⁴

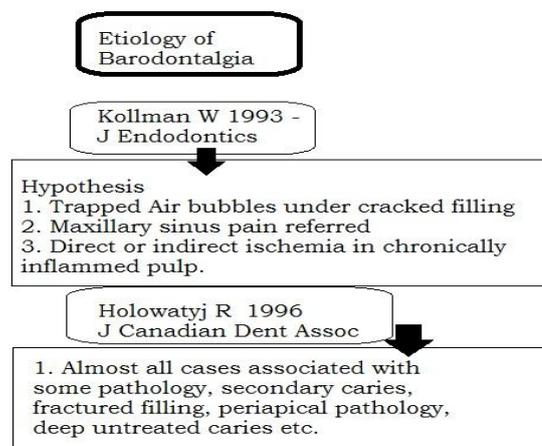
Figure No. 1: Showing two mechanisms, direct and indirect [Nakdimon I et al¹⁷ 2014] which may explain the Barodontalgia in the Aircrews and the divers. Pulpitis pain is due to the direct and verifiable pathologic changes in the pulp and peri-pulpal areas. The second,indirect would be otitis media, sinusitis, pressure headache and pressure changes in the nerves termed as pressure paresis of the cranial nerves specifically Br V and Br VII.[Zadik Y¹⁸ 2009]



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IV. Diagnostic Finesse In Barodontalgia

- 4.1** The diagnostic finesse in the establishment of the Barodontalgia as a label will be dependent on the
- Past occupational history of working as aircrew , diving (navy or for commercial) and Caisson workers[tunnel and underwater pressurized construction] Zanotta C¹⁹ et al 2014.
 - Nature of the pain, usually sharp, severe properly localized with radiographic evidence of fractured filling, peripical pathology or periodontal ligament widening.
 - Orthopantomograph or CBCT [Cone beam Computerized Tomography] showing changes in the maxillary or other para nasal sinuses changes, otitis media changes and or persistent vascular headaches.
 - The pressure changes are being measured today by using intra-canal transducers in experimental ways [Roberts HW et al²⁰ 2015] but their use for in vivo measurement is still to be attempted as a diagnostic tool.



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V. Debates And Discussion

The secondary caries and arrested caries in patients often remain symptomless but in pressure changes related to aviation they may flare up and cause severe pain . In fact Verunac JJ²¹ has reported a case of facial emphysema in patient of incomplete root canal when he went for duty on the submarine. Currently the above investigators all state that all the dental treatment should be complete and not even a hint arrested caries should be allowed to remain in patients who may be going to the high pressure occupational domains.

In case of prosthesis Wolfart S²² et al mentions that fixed or implant supported prosthesis should always be preferred compared to the removable ones. Lyons KM²³ et al were of the opinion that the use of resin cements was most conducive in the high pressure environments. Other cements caused breakages of the restorations and pain complications in the pressure environments.

The proper maintenance of the dental records also helps to identify the deceased in cases war deaths or air crashes. Smith A²⁴ demonstrated very cogently how this helped in the period 1945-2002 in various aviation incidents.

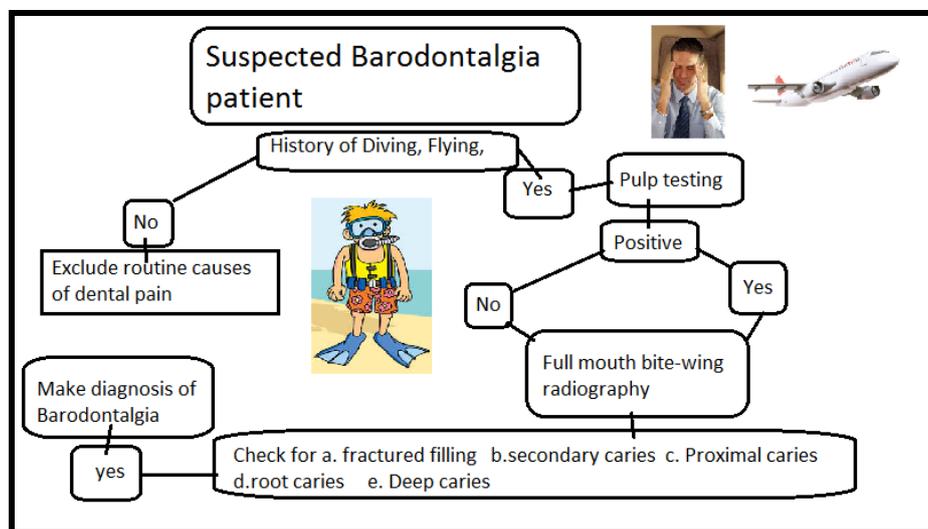
Another factor that may complicate the pain in the oro-dental regions is the presence of high incidence of bruxism and per the study of Lurie O²⁵ et al 2007. The bruxism may cause fractured fillings or aggravate the periapical lesions precipitating the severe barodontalgic pain.

Considering all these factors Zadik Y¹⁸ 2009 and Hanna HH²⁶ et al 1979 have emphasized the fact that prevention and regular check up of all these personnel will go a long way in avoiding the problems of barodontalgia.

VI. Current Concepts

Barodontalgia is a fairly uncommon occurrence in the routine clinics, but in areas where service men , pilots and navy divers are coming to the clinics , its importance cannot be overemphasized.

If patient comes to the clinic complaining of the what is suspected as barodontalgia , use this algorithm to confirm the diagnosis. Ask about the history of recent flying, as passenger, pilot or cabin crew. Find out about the diving history, professional or as a tourist. If the answer is Yes then perform a pulp testing of the quadrant or the teeth involved. If they are testing positive to pulpal inflammation then perform a full mouth bite-wing radiography correlate with the presence of a. secondary caries b. deep caries c. Proximal caries d. root caries e. evidence of microleakage from fractured restorations.



VII. Conclusion

Even though the theories of Barodontalgia mentioned earlier in the article appear plausible, many of the researchers in the field still mention that the exact etiology of Barodontalgia is still elusive. It is agreed that changes in pressure gradient and the innate pathology in the pulp both are high risk for Barodontalgia. The ongoing research into different dental materials will lead us to further elucidate the contributions of these behaviors into the pain caused in divers and pilots. A thorough dental check up and preventive action of sealants and flourides both are highly recommended in Airmen and Navy divers and also in the tourists and recreational flyers and divers. The simple algorithm will help the general practitioners into the diagnosis of this uncommon diagnosis , the barodontalgia.

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