

**PRESSURE PROVOKING PAIN- BARODONTALGIA: AN OVERVIEW****Praveena Raman*¹, Hima Sai Chandana Devi A.², Arthi M.³ and Arun Kumar M.⁴**¹Senior Lecturer, Department of Oral Medicine and Radiology, Sathyabama Dental College and Hospital, Chennai, India.^{2,3,4}CRRI, Sathyabama Dental College and Hospital, Chennai, India.Article Received on
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Corresponding Author*Praveena Raman**Senior Lecturer, Department
of Oral Medicine and
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Chennai, India.**ABSTRACT**

Barodontalgia is the oral (dental or non-dental) pain due to changes in the barometric pressure gradient by altitude variations such as experienced by under-water divers, aviation personnel and air travellers. It 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. This form of dental pain is generally marked by a pre disposing dental pathology such as an acute or chronic periapical infection, caries, deep or failing restorations, residual dental cysts, sinusitis, or a history of recent surgery. Although considered rare, dentists may encounter oral pain evoked by a change in barometric pressure, and hence close attention to areas of dentine

exposure, caries, fractured cusp, integrity of restorations and periapical pathology is mandatory in those at risk. This article reviews the data regarding the history, etiology, pathophysiology, classification and types, syndrome associated, diagnosis, management and prevention of barodontalgia.

KEYWORDS: Aerodontalgia, Aerospace medicine, Aviation medicine, Barodontalgia, Barotrauma, Flyers tooth, In-flight toothache, Military medicine, Odontocrexsis, Patient education, Tooth squeeze.

INTRODUCTION

Barodontalgia was described to occur during diving at depths of 10-25m and flying at attitudes of 600-1500m.^[1] This phenomenon was observed first during World War II in the air crews and later this tooth related pain was also seen in divers.^[2] With increase in the scuba divers and air passengers barodontalgia became an emergency situation for dentist.¹ In divers,

maxillary tooth are predominantly affected where as in flying conditions both maxillary and mandibular teeth are affected.^[3] Manifestations like Barosinusitis and facial trauma are encountered in orofacial region and few common dental manifestations includes tooth ache, periodontal disturbances, and mandibular malposition.^[4]

Boyle's law states that "At a given temperature, the volume of a gas is inversely proportional to the ambient pressure."^[5] Inferring that as ambient pressure increases volume of gas decreases in diving conditions and volume of gas increases as the ambient pressure decreases in flying conditions. Hence, the pain, edema or vascular gas embolism occurs when a gas filled cavity cannot be communicated with the exterior and pressure cannot be equalized.^[6]

Etiology

Barodontalgia is a symptom rather than a pathological condition. The common etiologic pathologies for pain includes faulty dental restoration, necrotic pulp / Periapical inflammation, and dental caries without involvement of pulp, mucous retention cyst, impacted teeth, vital pulp and recent dental treatment. Sinusitis may also contribute to this symptom although it is not relate to tooth pathology.^[3]

Kallman proposed three hypotheses

- Expansion of trapped air bubbles under a root filling or against dentin that activates nociceptors.
- Stimulation of nociceptors in maxillary sinus with pain referred to the teeth.
- Stimulation of nerve ending in inflamed pulp.

In these last two hypothesis where strongly supported by histological evidence.^[7]

Pathogenesis

Pulpitis is known to be main cause of barodontalgia.⁸ Clinically, at ground level a mild pain is seen which is followed by acute pulp inflammation after 1 week and then subsides and chronic inflammation is seen for several days. During 1940, many hypotheses have been proposed regarding pathogenesis of barodontalgia.^[9]

Pathogenesis I

- Direct ischemia due to inflammation.
- Indirect ischemia resulting from increased intra pulpal pressure due to vasodilatation and

fluid diffusion.

- Due to intra pulpal gas expansion.
- Due to gas leakage through vessels because of reduced gas solubility.
- Hyperemia in the pulp canal due to decompression.
- Barometric pressure changes may force oral fluids to be sucked from the dentinal tubules causing sensitivity or pain in pulp chamber.^[1]

Pathogenesis II^[10]

Defective or faulty restoration when changes in ambient pressure occurred might have oral fluids to be sucked from the inner dentinal tubules



Sensitivity or pain in the pulp chamber or may cause inflammation



Barodontalgia

CLASSIFICATION OF BARODONTALGIA

Barodontalgia is divided into^[1,3]

1. Direct barodontalgia- Pulp or peri apical pathosis related barodontalgia.^[6]
2. Indirect barodontalgia-Barotitis or barosinusitis induced barodontalgia.

The classification was developed by Ferjentsik and aker in 1982 which is primarily based on the causes and clinical symptoms which was established in 1940 consists of three groups and included pulp pathologies and other causes of barodontalgia such as Barosinusitis, Barotitis media, and partially erupted teeth.^[1]

Classification of barodontalgia

CLASS	CAUSE	SYMPTOMS
Class I	Irreversible Pulpitis	Sharp pain on ascent
Class II	Reversible Pulpitis	Dull pain on ascent
Class III	Necrotic pulp	Dull pain on descent
Class IV	Periapical pathology	Severe persistent pain on ascent and descent

Federation Dentaire Internationale (FDI) has also classified barodontalgia (Goethe 1989)

	Chief complaint	Clinical findings	Diagnosis	Treatment
Class I	Sharp momentary Pain during ascent (decompression) Asymptomatic on Descent (compression) And afterwards Dull throbbing pain During ascent (decompression)	Caries or restoration with inadequate base Tooth is vital No Periapical pathosis	Acute Pulpitis	Zinc oxide eugenol temporary followed by permanent restoration. After 2weeks, endodontic therapy if irreversible.
Class II	Asymptomatic on Descent (compression) And afterwards Dull throbbing pain During descent (compression)	Deep caries or restora Tooth is vital/non vital No Periapical pathosis	Chronic Pulpitis	Root canal therapy Or extraction of Unrestored tooth
Class III	Asymptomatic on ascent (decompression) and afterward	Caries or restoration Tooth is non vital Periapical pathosis is Present	Necrotic Pulp	Root canal therapy Or extraction of Unrestored tooth
Class IV	Severe persistent pain after ascent(decompression) or descent	Caries or restoration Tooth is non vital Definite Periapical pathosis is present	Peri apical Abscesses o Cyst	Root canal therapy And/or surgery or Extraction of Unrestorable tooth

Barodontalgia in divers

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 the pulp chamber and root canals. The dentist must be aware that dental related problem may also occur in scuba divers. Pain has been reported to appear at the depth ranging from 30-80feet.^[11]

Type 1: Commonly upper teeth is affected than the lower teeth^[11] and majority appeared on descent compressed air reaches the dentin tubules or the pulp through primary caries, recurrent caries along the margins of the restoration.^[12]

Type 2: Barotrauma is caused when the compressed air that has been trapped in an enclosed space and then expands air the diverse ascends. This is seen in incomplete RCT or neglected restoration.^[1] In severe cases, the pressure build up in the tooth may lead to an explosion of tooth called odontocrexsis.^[13]

Clader and Ramsey stated that the physiological properties of the gas mixture used during deep sea diving may cause barodontalgia.^[14]

The oxygen is natural diluent gas; nitrogen is replaced by helium resulting in low viscosity. This gas can enter the tissue/tooth/closed spaces (root canal or pulp chamber).^[14]

Divers mouth syndrome

Divers mouth syndrome is the pain in the temporomandibular joints and orofacial muscles after diving.

Etiology: It is caused by biting on mouthpiece with anterior teeth. The mandible should be placed forward to keep the mouth piece in place. Holding this mouthpiece for a longtime causestemporomandibular dysfunction.^[16]

Management: Custom fitted mouthpiece can help to correct this condition.

Diagnosis

Barodontalgia is a symptom and not pathology. It can even be diagnosed as a flare up of the commonly encountered dental problems like dental caries, defective restoration, Pulpitis, necrotic pulp, periodontal pockets, periodontitis, pericoronitis, jaw pathologies.^[17,18,19]

Kollmann's et al conducted a high altitude chamber stimulation series and concluded that deep caries without pulp exposure was the most common incidental cause which was found out to be 36% and followed by exposed vital pulp 29% and Pulpitis or Periapical periodontitis 14%.^[17]

The main cause of dental pain in Spanish air force survey were peri-apical periodontitis 39% and defective restorations 23%.^[20] 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 or Periapical periodontitis 18.5%.^[8] The study concluded that the main cause of barodontalgia among Jordanian pilots was faulty restorations 34.48% and untreated carious teeth 24.14%,pericoronitis 20.69% periodontitis and Periapical periodontitis 10.34%.

Military air crews are not only vulnerable to barodontalgia but also to dental fracture in high altitude conditions, tooth wear, mal occlusion and high prevalence of periodontal disease.^[13]

Management

Barodontalgia is a rare phenomenon, even though it is a rare phenomenon, it can cause serious risk to scuba divers, sub mariners, air crews and passengers. FDI has recommended for scuba divers, sub mariners, air crews & passengers for annual dental checkup.^[21]

After dental treatment & other surgical treatment that last for more than 7 days patient are advised not dive or fly in non pressurized cabins for the next 24 hours.^[21]

Screening panoramic radiographs are recommended for these populations at 3-5 year intervals. Special attention for faulty restoration, secondary caries lesion and signs of attrition and periapical pathology.^[17]

During world war II, for aircrew patient all pulp less teeth were removed and all metallic restorations were replaced with non-metallic restoration in order to minimize the pressure in pulp chamber that may produce odontalgia. Rossi(1995)contraindicated direct pulp capping in air crew patient and recommend endodontic treatment in each case of suspected invasion to pulp chamber in order to prevent sub-acute Pulpitis or silent pulp necrosis and their potential barometric pressure –related consequences.^[7,22]

During restorative treatment to aircrew or diver patient, after carious tissue is removed, the clinician has carefully examined the cavity floor and ruled out penetration to pulp chamber. A protective cavity liner/base (with zinc oxide eugenol the chosen material) should be applied before the tooth is restored.^[22]

Endodontically treated tooth that have been temporarily sealed have reported to explode on deep sea diving, full porcelain crowns have been reported to shatter at a dive of 65 feet. Hence meticulous oral health advice should be given to divers, all carious lesions should be restored, all ill fitting crowns should be replaced with good cementing medium, active periodontal lesion treatment and completion of endodontic treatment should be done. It is recommended that if we are unable to complete treatment before deep sea diving or flight, extraction may be a treatment of choice.^[23]

Dentist should employ the described preventive measures when treating pilots and diver patients and should use data available for diagnosing the cause of barodontalgia.^[1]

Prevention

The important feature for prevention of the barodontalgia is good oral hygiene. Other than good oral hygiene, caries excavation procedures and restorations should be completed.

Extensive restorations should be ruled out using Periapical radiographs and pulp testing procedures.^[1] Resin cements are preferred for cementation. During flight conditions, chewing

gums will increase salivation.^[23]

Treatment

Treatments carried out are those usually performed in the dental practice for similar conditions

- Immediate treatment-Administration of analgesics.
- Control infection -Antibiotics and anti-inflammatory drugs.
- No pulp involvement -Careful restorations.
- Pulp involvement -Root canal treatment.
- Vestibular sinus –Apicectomy.
- Impacted wisdom tooth –extractions.^[24]

Caution^[20]

S.No	Condition	Treatment Plan	Reason
1.	After Endodontic treatment	Full coverage metal porcelain Crown	To protect the tooth structure
2.	During extraction of maxillary pre molars and molars	To rule out oroantral Communication	To prevent sinusitis and complications on pressure Change ^[12]

CONCLUSION

According to the literature evidence, barodontalgia is a rare phenomenon so the controversy still exist regarding the exact etiology. Dental clinicians will be able to provide more efficient diagnosis and care by referring to FDI guidelines, as well as knowing how certain dental materials respond to pressure gradients. Dentists should advise patients to avoid exposure to pressure changes until all necessary surgical conservative, and prosthetic procedures have been completed.

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