

# Dentistry in Air

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## ABSTRACT

Subjection to microgravity and the space domain in space missions plays a prime role in well-being of astronauts. A number of calculative steps have been evolved and used for carrying these physiological changes. Adaptation of astronauts to such conditions is of prime concern. Aeronautical dentistry is a newly perceptible specialty in dentistry regarding its use to aeronautical territory. It is important to select only those astronauts with ideal oral health. This study is an attempt to recognize the outcome of microgravity on human body with its significance on orofacial constitution.

**Keywords:** Aeronautical dentistry, Microgravity, Well-being.

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## INTRODUCTION

In a flight, the aircrew ensures the safety of all the staff and passengers. Sudden debilitated health conditions could endanger the flight's safety. Henceforth, it is necessary that all the members traveling are in a proper health condition.<sup>1,2</sup> Since ages, it is believed that microgravity plays a major role on human physiology and astronauts linked with various health-related issues during space-flights, such as bone loss, muscle atrophy, cardiac dysrhythmias, and altered orientation.<sup>3-5</sup> Research says that during simulated skylab mission, there is an alteration in the flow, and composition of saliva along with oral health is jeopardized.<sup>6,7</sup>

As we entered the modern 20th century, in-flight health conditions began to be reported, including those

relating to the face and the oral cavity. Debilitated health conditions, in-flight pain, vertigo, incapacitation, and premature cessation of flights were the main concern of carving guidelines for dental care of the members, which has been gaining concern in the publications since 60 years.<sup>8-12</sup>

Studies reported that in-flight pressure in the pulp chamber due to metallic restorations may produce odontalgia. Henceforth, it is advised to replace with plastic restorations.<sup>13</sup> However, due to insufficient data and knowledge about in-flight dental health, vision of post-graduate training in aviation dentistry is not up to the mark.<sup>14</sup> Moreover, research work is negligible and only briefly discussed in dental textbooks.<sup>15,16</sup>

## HEAD AND FACE BAROTRAUMA

According to Boyle's Law, the volume of gas at constant temperature varies inversely with the surrounding pressure. The changes in gas volume inside the body's rigid cavities, associated with the changing atmospheric pressure, can cause several adverse effects known as *barotrauma*. Barotrauma can occur during flying, diving, or hyperbaric oxygen therapy.<sup>17</sup>

## EFFECT ON ORAL HEALTH AND PERIODONTIUM

A major side effect is osteoporotic changes and teeth mobility after each space flight. Due to change in microgravity, there are changes in normal oral mucosal flora. Eventually, there is a variation in salivary flow rate and quality of saliva<sup>18</sup> such as:

- 8-Hydroxydeoxyguanosine levels were increased due to increase in oxidative stress.<sup>19</sup>
  - Salivary glucosyltransferase B levels were increased.
- Other changes recorded due to fluid shift mechanism are:
- Obstruction in sublingual and submandibular opening duct regions
  - Abnormal facial expression
  - Loss of sensation of pain and temperature
  - Xerostomia leading to increase in incidence of caries with teeth more prone toward periapical and periodontal pathologies<sup>20</sup>
  - Change in taste, edema of face
  - Reduced mandibular movements in microgravity environment were observed.

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## BARODONTALGIA

Barodontalgia (previously known as *Aerodontalgia*), caused by a variation in barometric pressure, in an asymptomatic tooth, may be sufficient to jeopardize in-flight dental health conditions.<sup>14</sup> Data revealed barodontalgia to be one of the major complaints in altitude chamber simulations carried out in the United States Air Force in the 1940s.<sup>21</sup>

Analogously different altitude chamber simulations showed:

- 0.26% of the German Luftwaffe during the 1980s
- 0.3% of the Turkish Air Force flights in the last decade<sup>22</sup>

Barodontalgia is usually a sudden outburst of already prevailing subclinical oral-maxillofacial disease due to an alteration in barometric pressure. Possible origination of barodontalgia: Dental caries, defective tooth restoration, pulpitis, pulp necrosis, apical periodontitis (jawbone cyst and granuloma), periodontal pockets, impacted teeth, and mucous retention cysts.<sup>23-25</sup>

## PREVENTION

Due to continuous efforts of research and published articles, measures have been taken to demonize the chaos of in-flight dental situations of pressure alterations compared with earlier times.<sup>9</sup> Rayman highlighted the significance of healthy dental standards by crewman, in order to intercept in-flight debilitations as well as to shut off prevention of dental issues in secluded places (where dental unit is not available or where contagious diseases, such as acquired immunodeficiency syndrome and hepatitis prevail and there is increased risk of infection throughout dental treatment).<sup>11</sup> Dentists play an important role in educating their patients about the significance of a nutritional diet and encourage them in upholding proper oral hygiene.

## FLIGHT RESTRICTION

Flight grounding of a patient is necessary when intervention in the flight capabilities of the crew member is doubted. Certain drugs can cause dizziness or lack of concentration (e.g., analgesics), whereas others can cause diarrhea (e.g., antibiotics). Alteration in the pressure for several hours after any dental surgery can dislocate the blood clot leading to intraoral bleeding, with problems in speech. Furthermore, in such environment, the risk of emphysema accentuates as well.<sup>26</sup> Situations where jet and helicopter pilots have facial swelling due to any dental extraction can restrict them from wearing helmets adequately.<sup>27</sup> Also people having oroantral communication should be restricted.<sup>28</sup>

## DOCUMENTATION

Obtainable as well as current dental documentation is most functional for recognition in air crashes as the corpses in such cases are generally not in a condition to be identified by fingerprints. Moreover, other procedures, such as deoxyribonucleic acid profile analysis may be used but it comes with difficulty and is time consuming. Dental comparison is often the primary method of identifying disaster victims due to the high likelihood of dental anatomy preservation in traumatic deaths (up to 1,600°C). Sustaining dental arches can be instantly used for recognition purposes, provided there are existing antemortem dental data. A recent panoramic radiograph is most helpful for comparison with the postmortem dental arch.<sup>29</sup>

## CONCLUSION

In-flight dental problems are often faced by crew members and passengers, which creates a lot of hindrance for everyone. So, this study is an attempt to create awareness among dentists and help them to encourage their patients to know and take necessary prevention against such odds.

## ACKNOWLEDGMENT

“Man must fly above the earth to the top of atmosphere and beyond for only then he will fully understand the world in which he lives.” – Socrates

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