

Dental tourism and the risk of barotrauma and barodontalgia

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Key points

Dental tourism is characterised by a short staying time at destination, and frequent travel to and from the foreign dental office.

After the procedure, due to pressure changes during the flight back home, the patient may suffer from sinus barotrauma or barodontalgia.

In order to prevent postoperative barosinusitis and barodontalgia, the patient should not fly back home immediately after procedure.

Abstract

Background and aim Dental tourism, which reflects the provision of health care services abroad, also includes a travelling component. Air travel after dental intervention may cause barotrauma and barodontalgia. This paper aimed to provide guiding principles regarding the minimal time interval between dental procedures and air travel to prevent these adverse effects.

Methods A literature search was performed to reveal information with regards to complications related to flights following dental treatments. There is little research in this area and most of it has been conducted on the military aircrew population, which has different characteristics of flight and personnel than civilian commercial flights.

Results The recommended time of flying is one week after most dental intervention and six weeks after a sinus lift procedure. The minimal time required between a procedure and flight is 24 hours after restorative treatment, 24-48 hours after simple extraction, 72 hours after nonsurgical endodontic procedure, surgical extraction, and implant placement, and at least two weeks after sinus lift procedure.

Conclusions The provided guidelines may serve as a starting point for the clinician's decision-making. The tailoring of an individual treatment plan to the patient should take into consideration the patient's condition, dental procedure, complications and flight characteristics. Further research based on commercial flights is needed to formulate more accurate guidelines for the civilian population.

Introduction

Medical tourism is the travelling to another country for medical care. Millions of people travel annually for health care, mostly to get therapy at a lower cost in comparison to the traveller's country. To a lesser extent, patients

travel to get care from a provider who shares the same culture/language, therapy that is not available or approved in the traveller's country, or a complex treatment where, in the traveller's country, there is no satisfactorily experienced or suitable specialist, or devices to perform treatment.^{1,2,3} Before the COVID-19 pandemic, the medical tourism industry was estimated to constitute 5% of all tourist travel in European Union countries.⁴

Unfortunately, as for dental tourism, there is no valid and checked monetary data. According to market research, the dental tourism market would grow by 12% and hit US\$5.83 billion by 2025.⁵

Dental care is one of the most common procedures in medical tourism, along with surgery and cosmetic surgery, fertility treatments, transplantation and oncologic treatment.¹ Although accounting for approximately one-third of medical tourism, international dental tourism has been surprisingly neglected in the medical literature,

as well as in medical manuals of airlines and of the International Air Transport Association (IATA).^{6,7}

Dental tourists usually travel from Western European countries to Eastern European countries, such as Hungary, Greece and Poland. North American patients typically favour dental services in Mexico or Costa Rica, while Australian citizens tend to travel to Asian countries, including Malaysia, India and Thailand.⁸ In all of the above destination countries, complex dental procedures are considerably less expensive than in the travellers' home countries. It is clear that for the sake of economic viability, dental tourism is performed when extensive oral rehabilitation is needed, including endodontic and pre-rehabilitative surgery, sometimes necessitating staged treatments (for example, implant surgery), requiring frequent travel and short stays at the destination. In general, a dental tourist stays abroad for approximately 15 days, with an

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average of eight days for a single intervention, spending an average of ten hours in the dental office on alternating days.⁹

Obviously, dental tourism necessitates frequent air-travel. Despite the pressurisation of commercial airplanes' cabins to pressure conditions of altitude <8,000 ft, there is still a risk of a number of adverse physiological effects caused by the air pressure changes. Thus, the dental tourist may be exposed to various health risks; two of which are barotrauma and barodontalgia.^{10,11} The aim of this paper is to present these phenomena to the dental practitioner in the context of dental tourism and to offer prevention guiding principles.

Methods and sources

The authors surveyed the relevant literature sources, including Medline, PubMed, PubMedCentral, Medscape, for the terms: air travel, barodontalgia, barotrauma, dental tourism and in-flight emergency. All the relevant medical literature mention barodontalgia and its triggering factors but none of them provide a guideline for waiting time. Neither the medical manual of the main 67 airlines, nor IATA and International Civil Aviation Organisation's medical manuals do give it, some of them even do not mention the pressure-related problems. Besides the literature, some webpages of dental practitioners were surveyed about the question: how long is the suggested waiting time after dental intervention? Later, the authors discussed, based on their own experiences, and formulated a guideline for the estimation of necessary waiting time after dental interventions.

Barotrauma

According to Boyle's law, at a constant temperature, gas volume varies inversely and directly to the pressure change. In the body areas with trapped gas, these gas volume changes may cause adverse effects called barotrauma. One such condition is barosinusitis (or sinus barotrauma), which may affect one or more of the paranasal sinuses. This inflammation develops due to the inability to balance pressures between the air in the sinuses and the air in the external environment because of upper respiratory disease, polyps, nasal injury etc.¹² Therefore, during flight, when the external atmospheric pressure increases (for example, during

Table 1 Recommended waiting times after some dental interventions before air-traveling back home

Intervention	Earliest time of flying*
Restoration	After 24 hours
Simple extraction	After 24–48 hours
Implant placement, uncomplicated	After 72 hours
Surgical extraction (eg wisdom tooth)	After 72 hours
Root canal treatment, non-surgical	72 hours
Difficult orofacial interventions (for example, sinus lift, dental bone graft implantation, hyaluronidase filling)	After minimum of two weeks

*Provided there is no pain, swelling or bleeding at the procedure site

descent), the gas trapped in the sinus will be sucked into the sinus along with other mucous secretions and may cause intense pain and the development of inflammation.

Implications

As mentioned, commercial flights involve atmospheric pressure changes, despite cabin pressurisation. In the context of dental tourism, flying shortly after a sinus lift procedure may cause an inability to balance pressures, therefore exposing the patient to barosinusitis during in-flight pressure changes.¹³ Moreover, in the case of sinus lift surgery, established barosinusitis may result in failure of the procedure. Therefore, when determining a treatment plan that includes a sinus lift for a dental tourist, the patient should be guided about the risk and the need to plan the journey back home by ground (or sea, if relevant). If air travel is unavoidable, it is advisable to wait at least two weeks from the time of the procedure until the flight and to make sure there are no sinus symptoms before air travel.¹²

Barodontalgia

Barodontalgia is a toothache that occurs as a result of atmospheric pressure changes,¹⁴ usually in teeth with previous disease or necrotic dental pulp. This phenomenon was reported on transport (military) flights, where the conditions were the same as commercial flights;¹⁵ 7% of the crews on these flights reported at least one event of barodontalgia.¹⁶ Close to one-third of cases are due to recent dental restorative treatment (that is, up to one week between dental treatment and flight), termed post-operative barodontalgia, and nearly one-fifth were due to referred pain of barosinusitis.¹⁶

Implications

To prevent post-operative barodontalgia, flying should be postponed for at least 24 hours (although one week is recommended) after restorative dental treatment.¹² It should be noted, however, that despite the pain, exposure to air pressure changes after restorative dental treatment has no long-term impact on treatment success or prognosis. The recommended waiting times after dental interventions, before air-traveling back home, are listed in Table 1.¹⁷ If air travel is inevitable, the dental practitioner should equip the patient with an effective analgesic, such as a combination of non-steroidal anti-inflammatory drugs (NSAIDs) with an other non-NSAID analgesic, such as paracetamol or dipyrrone, where available (provided that there is no contraindication).¹⁸

Discussion

Medical tourism, including dental tourism, is not without controversies and complications.^{8,19,20} The latter may originate from the medical procedure itself (such as quality of care) or from the travelling. The American Centre for Disease Control and Prevention (CDC) indicate that flying after surgery may increase the risk of blood clots, including deep vein thrombosis. Therefore, in order to prevent complications related to pressure changes, the CDC recommends to avoid air travel for at least ten days after chest or abdominal surgery, and for 7–10 days after face, eyelids, or nose surgery (such as cosmetic or laser procedures).¹ In the absence of research in the field of dental tourism, no recommendations have been published to date regarding air travel after dental care for dental tourists. Therefore, we present, for the first time, our recommendations based on what is known in the scientific literature and our experience (Table 1). Most of

the knowledge in the field was obtained from studies in populations of military aircrews. The flight conditions of military transport flights are similar to the flight conditions of commercial flights. Earlier, we found a higher barodontalgia rate in the civilian population in comparison to the military population.²¹ Moreover, it might be assumed that the prevalence of barodontalgia among dental tourists is higher due to the poor dental status in tourists compared to military aircrews, who are required to have periodic dental examinations,^{22,23} and because of tourists flying shortly after intensive dental care, compared to grounding of military aircrews after dental treatments.²⁴

In addition, the CDC recommends that if the patient plans to take advantage of travelling abroad and include a vacation in the trip, there are activities, such as swimming or taking tours, which may not be permitted after medical treatment.¹ In the context of the above-mentioned dental care, it can be said that diving, mountaineering or other activities that may expose the patient to atmospheric pressure changes should be avoided.²⁵

This paper aimed to introduce the risk of barotrauma and barodontalgia with regard to flying shortly after dental treatment. It should be mentioned, however, that the post-operative effect of pressure change is not limited to these phenomena. Although quite rare, pressure changes may cause subcutaneous emphysema. For example, during multi-visit endodontic treatment, damaged temporary restoration, which causes open (unfilled) root canals, may predispose the tourist patient to subcutaneous emphysema.²⁶ Another example of potential risk for subcutaneous emphysema is the exposure of the post-extraction socket to the pressure changes of diving or flight.²⁷ Therefore, if the endodontic treatment is performed in more than one session, the cavity should be well-sealed with a temporary restoration material using the double seal method, in which a material with improved sealing abilities be placed first inside the cavity, followed by a second heavy layer of a material with improved compressive strength.²⁸ Alternatively, in such cases, the dental surgeons may consider using

a material intended for permanent restoration as a temporary restoration.

Conclusion

In conclusion, dental practitioners who treat dental tourists should be familiar with the post-operative risks involved in air travel and should advise their patients on how to prevent or reduce these risks. The provided guiding principles may serve as a starting point for the clinician's decision-making. The tailoring of an individual treatment plan to the patient should take into consideration the patient's condition, dental procedure, complications and flight characteristics. Further research, based on commercial flights, is needed to formulate more accurate guidelines for the civilian population.

Ethics declaration

The authors declare that there are no conflicts of interest and they have received no financial support.

Ethical approval was not required for this study as it is a literature review.

Author contributions

Peter P. Felkai: conceived the presented idea, developed the theory and formed the table. Idan Nakdimon and Yehuda Zadik: took the lead in writing the manuscript. Thomas Felkai: helped supervise the project and collected the relevant literature. Liran Levin: took the lead in writing the manuscript, checking the language and editing it. All authors discussed the results and contributed to the final manuscript.

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