



REVIEW ARTICLE

ORAL PATHOLOGY & SPACE SCIENCE.....!

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ARTICLE INFO

Article History:

Received 03rd August, 2016

Received in revised form

05th September, 2016

Accepted 05th October, 2016

Published online 30th November, 2016

Key words:

Aeronautic dentistry,
Oral tissues,
Microgravity,
Space sciences.

ABSTRACT

Today's era is the "Space Era". Our body is very well acclimatized to the gravity that is experienced on the planet earth. Under such conditions the normal functioning of the human body tissues & the oral tissues takes place at 1-g (gravity) on exposure to the routine environment. The behaviour of these general body tissues & oral tissues gets totally altered when they are exposed to the situations of microgravity almost 0-g. Space travel in the long term & outer space habitat dwelling might become a reality of tomorrow. Thus core understanding of the Oral Pathological conditions that a person will be subjected to at, microgravity is needed. This seems to be a newly emerging branch of dentistry where dental researchers & dental clinicians have a pivotal role to play.

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Citation: Dr. Noopur Kulkarni, Dr. Manasa Ravath, Dr. Roshini Vinod and Dr. Geeta Vadaje, 2016. "Oral pathology & space science.....!", *International Journal of Current Research*, 8, (11), 41985-41986.

INTRODUCTION

Aeronautic dentistry is that special branch of dentistry dealing with the aeronautical environment & extra terrestrial world. (Rai, 2006) Space science in recent times is developing by leaps & bounds. Exploring the planet Mars & settlement on the planet is becoming the primary objective of the Mars society. Long term space travel & living in outer space habitats may take a whole new dimension in the future. The physiological functioning of the human & oral tissues requires a gravity condition of 1- g, which is present on the earth (The Mars society, 2012). Because of lack of adaptability of these tissues to the microgravity conditions, the normal functioning of them is affected. Undertaking several studies & researches so as to study the micro gravity effects on the oral tissues & to know the space environmental conditions, can help us find out the various oral pathologies to which the astronauts (who travel to the outer space) might be prone to.

Microgravity & Oral Cavity

An experiment was carried out to study the influence of simulated microgravity on the anti oxidant status of the individuals human body. The study examined the oxidative marker 8 dihydro 2 deoxyguanosine (8- OH dG) concentration

in the saliva & blood of a normal healthy subject in simulated microgravity condition of -6degree with head down tilt (HDT) bed rest (Rai *et al.*, 2010; Rai and Kaur, 2011). It was observed that there was an increase in the 8- OH dG level in simulating microgravity conditions as compared to the condition before simulated microgravity (Rai *et al.*, 2010; Rai and Kaur, 2011). This clearly demonstrates that the oxidative stress levels is a crucial factor concerned to the long span space travellers. Psychology plays a very important role to carry out any task. Similar is the case with space travelers where their psychological well being is considered to be an important parameter. For this, a study on salivary stress markers & psychological stress in simulated microgravity was carried out. Such studies help in planning various space flights & interplanetary missions with ease (Rai and Kaur, 2011). The psychological status was evaluated by the stress test & cortisol, alpha amylase beta endorphin, chromogranin A (Cg A) were measured in the saliva. After observing for 1 week, it was found that all the space travelers have shown raised levels of Cg A, alpha amylase, beta endorphin, & cortisol (Rai and Kaur, 2011). Also after 1 week of HDT, it was also seen that all the volunteers developed psychological stress (Rai and Kaur, 2011). Mars seems to be one such orbiting space station where the duration of space flights seems to be increasing. This demands the need for thorough value based investigations of the biological importance of the space flight induced alterations in the stress parameters. HDT seems to be a reliable tool in order to facilitate this. Also in one of the studies, to evaluate

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the effect of simulated microgravity on the oral cavity, the facial nerve functioning, the facial sensation the regulation of the chemosensory system, various salivary biomarkers were looked for in the subjects at different time span that is just before, during, just after & post 6 weeks of simulated microgravity condition of HDT bed rest (Rai *et al.*, 2011). It was seen that vitamins E, C, sodium, potassium, calcium, phosphate, protein, amylase activity were decreased in HDT while as 8-hydroxyl deoxy guanosine, thiocyanate levels were significantly higher as compared to normal. Teeth, ductal openings of submandibular & sublingual areas, angle of the mandible, all these areas experienced increased amount of pain in HDT after observing the pain scores (Rai *et al.*, 2011). Also some of these areas showed evidence of swelling along with the pain in HDT in comparison to normal. To add on, movement of the mandible, opening of the mouth & tongue were restricted, when compared to the normal. These levels did not show much statistical significance. Overall findings suggested that change in the microgravity brings about facial oedema, altered taste sensation, xerostomia, pain in the tooth & so on. These could be categorized as some of the reversible changes. Irreversible changes include incidence of dental caries, periodontal problems, salivary calculus formation, fracture of the jaw bones, premalignancy & malignancy. Along with all the above mentioned findings, it was found in one of the study that there was a significant change in the levels of osteocalcin, cathepsin, & MMP's when the investigation of bone mineral density was done (Rai *et al.*, 2010).

In one of the study species to species interaction under microgravity conditions between two strains of streptococcus was demonstrated. It was observed that the acid tolerance capacity was improved, there was a modification in the bio film architecture, along with the distribution of S-mutans extra cellularly. Some other changes like rised levels of S mutans within a dual species biofilm were also seen (Xing qun Cheng *et al.*, 2014). It was thus concluded that the increased colonization of S -mutans in the environment of microgravity would lead to an imbalance ultimately giving rise to dental caries (Xing qun Cheng *et al.*, 2014). Under the conditions of microgravity the salivary production & flow rate is totally altered, as a result of which the person will be more prone to dental problems. Thus high quality of dental care is recommended for people in those conditions (Rai, 2009). Researchers have sifted focus to study various salivary biomarkers to detect Alzheimer's disease, other tumors & various other illnesses (Rai, 2012). Emphasis now as to be made on the various possible effects of the aeronautic environment on the oral cavity, various dental emergencies that can be encountered under those conditions & the importance of emergency dental kits (Rai, 2012). New approaches for the upcoming interplanetary missions need to be methodized (Rai and Jasdeep Kaur, 2012).

Conclusion

It is evident from the above mentioned researches that there is an increasing need to shift focus & dental research towards this direction. It is vivid that this is a newly emerging field that needs to be developed because of the tremendous effects of microgravity conditions on the oral tissues. Larger sample sizes can be included & various studies & researches can be carried out in a comprehensive way. There has to be an increasing awareness & knowledge spread among masses regarding these several problems that an astronaut might be prone to during space missions. Several interesting collaborations with dental organizations & team studies should be emphasized & meticulously carried out. This special branch of Dentistry can become a very innovative & novel segment of Oral Pathology in the near future.

REFERENCES

- Rai B, Kaur J, Catalina M. 2010. Bone mineral density, bone mineral content, gingival crevicular fluid (matrix metalloproteinases, cathepsin K, osteocalcin) & salivary & serum osteocalcin levels in human mandible & alveolar bone under conditions of simulated microgravity. *J Oral Sci.*, 52: 385-90
- Rai B, Kaur J, Foing BH. 2011. Evaluation by an Aeronautic Dentist on the adverse effects of a 6 week period of Microgravity on the Oral cavity. *International Journal of Dentistry*, Article ID 548068, 5 pages doi: 10.1155/2011/548068
- Rai B, Kaur J, Jain R. 2010. Salivary & Serum 8 hydroxydeoxyguanosine level in simulated microgravity. *Maced J Med Sci.*, 3(4):364-7.
- Rai B, Kaur J. 2011. Salivary stress markers & psychological stress in simulated microgravity : 21days in 6 °head down tilt. *J Oral Sci.*, 53(1):103-7
- Rai B. and Jasdeep Kaur. Review article, *North American J of Med Sci.*, 2012 Vol 4 Issue 11; 548-557
- Rai B. Press release –Oasis Diagnostics. July 2012
- Rai B. Space Dentistry :Longer duration manned missions
- Rai B. Virulence of oral bacteria & microgravity : Aeronautic Dentistry. *Int J of Dent Sci.*, 2009 July Vol 7 Issue1 page15
- Rai, B. 2006. Aeronautic Dentistry. A new specialized branch & its curriculum guidelines. *The Internet Journal of Dental Science*, vol5 No.1
- The Mars society. The purpose of the Mars society is to explore & settle the planet Mars. (serial on the internet) (cited 2012 Feb 25); (about 2p). Available from <http://www.marssociety.org/home/about/purpose/2012feb>
- Xing qun Cheng *et al.* Effect of simulated microgravity on S-mutans physiology & biofilm structure.; DOI; <http://dx.doi.org/10.1111/1574-6968> online : 1 October 2014
