A.G.A.T.E
Anti-Gravity Affects on Teeth Evulsion

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Introduction

Two well-studied health effects from space travel are weakened muscles and hardened arteries [1]. Dental health is not as closely examined. So then, teeth in astronauts could be moving out of their peg and socket joint. The cementum substance that holds the tooth into place might be deteriorating over time. A cone beam computed tomography (CBCT) scan [4] will detect this.

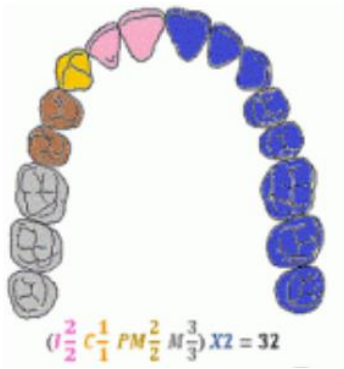

Figure 1: Dental formula for permanent teeth in humans.
I: incisor, C: canine, PM: premolar, M: molar
Photo Credit: Dental education pub

Hypotheses

- #1 The teeth of the astronauts are slowly moving out of their peg-and-socket joints.
- #2 Teeth in the mandible will move more than teeth in the maxilla.
- #3 The cementing substance will be affected by a loss of gravity.

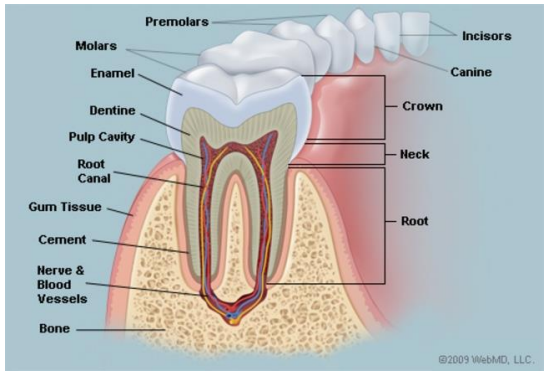

Figure 2: Diagram of a human tooth specifically showing the crown, root, and cementing substance between the bone and tooth
Photo Credit: Matthew Hoffman

Experimental Flowchart

1. Take a CBCT scan before launch
2. Take a CBCT scan upon reentry
3. Document changes in tooth movement
4. Get a routine 6-month checkup after return
5. Potential creation of unique mouthguard retainers

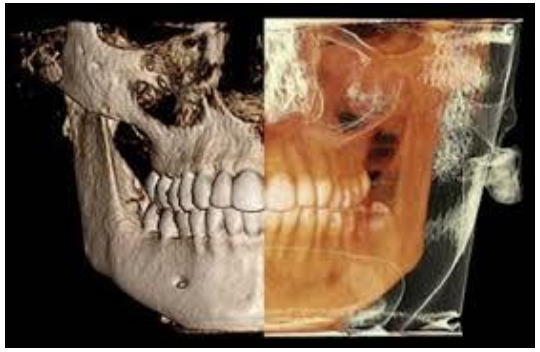

Figure 3: A CBCT scan of a person's mouth in 3-dimensions showing the composition of the bones and soft tissues of a mouth. Through this type of scan the tooth length will be determined
Photo Credit: Summit

Figure 4: NASA dentist helping develop a device that could detect pre-periodontal disease
Photo Credit: Brian Dunbar

Conclusion

With the current low amount of understanding, more procedures need to be done in order to keep astronauts' teeth safe. One solution is to use a CBCT scan before launch, upon reentry and every 6-months after returning home so that any movement of the teeth away from their peg and socket joints could be followed. It would be beneficial to create a mouthguard retainer to prevent these problems.

References: [1] Chang Andrew, et al. Canadian scientists investigate effects of space travel on human body. National (CBC Television) [Internet]. 2019. Accessed 16 Oct. 2020. http://search.ebscohost.com/login.aspx?direct=true&db=n5h&AN=6JN3267843996&site=ehost-live [2] Dental Education Hub. Human dental formula: An easy guide for students. Dental Education Hub [Internet]. n.d. https://dentaleducationhub.com/human-dental-formula-an-easy-guide-for-students/ [3] Dunbar Brian, Canright Shelley. Taking a bite out of discomfort. NASA [Internet]. 2009. https://www.nasa.gov/audience/foreducators/k-4/features/F_Bite_Out_of_Discomfort.html [4] Flores-Mir Carlos, Rosenblatt Mark R., Heo Gisseon, et al. Measurement accuracy and reliability of tooth length on conventional and CBCT reconstructed panoramic radiographs. *Dental Press Journal of Orthodontics*. 2014;19(5):45–53. Accessed 6 Nov. 2020. *NCBI*, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4296663/#__ffn_sectitle [5] Hoffman, Matthew, MD. Picture of the Teeth. WebMD [Internet]. 2015. https://www.webmd.com/oral-health/picture-of-the-teeth#1. Summit Oral & Maxillofacial Surgery. CBCT scan. Summit. [Internet]. 2020. https://www.summitfacial.com/cbct-scan/