

Dental Fracture/Exposed Pulp CLIFF Peer Review

1. *Strength of evidence presented in CLIFF in modeling the characteristics and mission impact of this medical condition within the spaceflight environment?*

Score: 2

Grading Scale:

4 - *Confident*

3 - *Somewhat confident*

2 – *Neutral*

1 – *Somewhat unconfident*

0 – *Not confident*

2. How confident are you that these data accurately represent the spaceflight environment?	Tables 1, 2 Composite Incidence and Level of Confidence	Table 3, 4 BC/WC Loss of Crew and probability	Table 4 - Clinical Phase 1, 2 durations Table 5 – CP 2 Loss of Crew	Table 4 – RTDC % Table 6 – RTDC Loss of Crew	Table 4 – Loss of Crew Life % Table 7 – Loss of Crew Life, Loss of Crew	Table 8 – TI
Score	2	2	3	2	3	3

Comments and limitations:

1. General comments. Pulpitis is an inflammation of the dental pulp which can be caused by trauma, tooth fractures or untreated caries. Complications can include pain and, less commonly, periapical abscess. Tooth fractures are very common in children due to trauma but decrease with age. It is very unlikely that astronauts will have untreated caries because of regular dental exams and preflight check-ups. Dental fractures are felt to be very unlikely in microgravity due to training to handling objects of high mass which might cause traumatic injuries and lack of gravitational forces to cause falls. During surface EVA's, the EMU helmet provides protection from dental trauma. Best case is defined as reversible pulpitis with pain controlled by removing the painful stimuli, oral pain reliever, sensitive toothpaste, or by topical anesthetic, OR a fractured tooth (non-crowned) limited to enamel or dentin exposure (not involving the pulp or root). Worst case is defined as irreversible pulpitis, or fractured tooth (non-crowned) involving the pulp or root, that requires oral pain medications and/or injected analgesia. Treatment includes anesthetics and analgesics as well as tooth extraction, if necessary. There have been no spaceflight reports of this condition. Dental abscesses are covered in a separate CLIFF.

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2. Incidence. The best data on pulpitis comes from two military studies. The resultant distribution is felt to be an overestimation of pulpitis occurring during a mission since astronauts will be closely screened for any dental problems prior to spaceflight. Analog studies reporting the risk of tooth fracture are thought to grossly overestimate the risk to astronauts during spaceflight since a significant number of terrestrial tooth fractures result from falls. In addition, no tooth fractures have been recorded during about 50 person-years of space operations. Therefore, it was felt that the best estimation of the risk of the medical condition as defined was to use the data corresponding to pulpitis. The best case/worst case probabilities, clinical phase durations, RTDC and Loss of crew life probabilities are supported by terrestrial evidence, and I am in agreement with their calculation. The probability density curve that was derived appears to be a reasonable representation of the data presented. Because of the large sample size, the studies used to compute the composite incidence most likely overestimate the confidence we have in the assigned value.

3. Clinical phase data. I am in agreement with the clinical phase 1 duration entered in this CLIFF. This data was compiled by a team of expert clinicians, and I was involved in the discussions leading to the calculation of the clinical phase duration. CP2 was supported by terrestrial evidence.

4. Task impairment. The analysis was performed and reviewed by a separate team of expert clinicians. I am aware of the methods that were used but did not directly participate in the discussions.

5. Dependence on mission phase or duration of mission. This medical condition should not be dependent on mission phase.

6. Limitations

- It was very difficult to find any terrestrial studies that accurately reflect the incidence of this condition during spaceflight conditions. Studies that reported incidence of tooth fractures grossly overestimate the risk to astronauts in microgravity. Studies reporting pulpitis are also likely to be overestimates, as well, due to the meticulous dental care that astronauts receive prior to missions. Thus, computing the incidence using terrestrial studies that investigated pulpitis alone was thought to be the best estimate of the combined incidence of pulpitis and fractures.
- Because of the large sample size, the studies used to compute the composite incidence most likely overestimate the confidence we have in the assigned value.
- Under-reporting for this condition could have been significant during past space missions due to subtle disease that may not have been apparent to the crew. This may result in underestimation of the incidence.

Reviewed by:

David C. Hilmers