

Association Between G-Tube Formulas and the Amount of Calculus in Medically Complex Patients

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PURPOSE

To compare various G-tube formulas and the amount of calculus in medically complex patients during their recall visits at UPMC Children's Hospital of Pittsburgh. It was hypothesized that children who were prescribed plant-based formulas had less calculus accumulation compared to those who were prescribed animal-based formulas.

INTRODUCTION

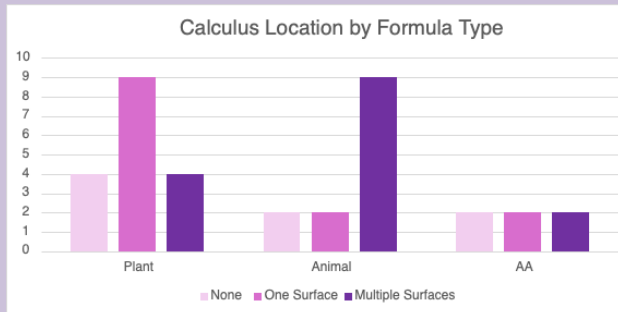
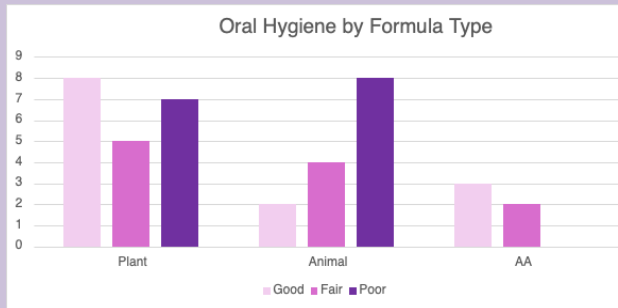
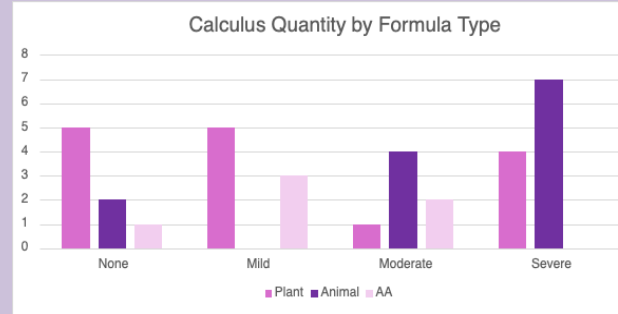
Children with complex medical conditions tend to experience various challenges when it comes to adequate nourishment and appropriate growth often requiring a gastrostomy tube (G-tube) or jejunostomy tube (J-tube), including risk for poor oral health like supragingival calculus due to the absence of oral food intake and lack of chewing with reduced salivary flow.¹ Oral care in these children may also be difficult due to impaired oral motor control, involuntary biting and/or vomiting reflexes.¹ Klein and Dicks found that calculus formation was significantly faster in tube-fed individuals, with 71% of calculus forming within the first 30 days after cleaning.² Patients are prescribed specialized formulas based on digestive capability, caloric needs, dietary restrictions, and patient/caregiver preferences. There are many options available, with standard protein formulas being the most common. The proteins are extracted from various sources including cow's milk (animal-based), soybeans (plant-based), or protein isolated from other food sources.³ Some patients are also prescribed a combination of formulas with various sources of protein. Understanding whether formula type correlates with calculus severity could inform preventive strategies and improve oral health outcomes.

METHODS

Patients, ages 2 to 25 years old (56% males, 44% females), who visited the dental clinic at the Children's Hospital of Pittsburgh for routine hygiene visits were included. The type of formula (animal-based, plant-based, amino acid-based), the patient's oral hygiene, and the length of time between recall appointments was recorded. Patients who ate anything by mouth, including "pleasure feeds" were excluded. A chi-squared test was used for analysis.



Image 1: Calculus formation in a patient prescribed an animal-based formula (left) versus a plant-based formula (right)



RESULTS

Data was collected for 11 months, and 82 patients were evaluated. A total of 44 patients were included in the study. When comparing the quantity of calculus (none, mild, moderate, severe) to formula type, there is a statistically significant value of ($p < 0.05$). Patients prescribed animal-based formulas displayed more severe calculus accumulation when compared to patients that were prescribed formulas with other protein sources. No significant differences were found for overall oral hygiene or the number of tooth surfaces.

DISCUSSION

While specific studies directly linking G-tube formulas to calculus formation are limited, the ingredients in nutritional supplements and milk-based formulas (such as proteins) can contribute to plaque formation and increased calculus, especially in cases of limited oral hygiene or lack of mechanical cleaning through chewing as their oral biofilms may remain undisturbed without mechanical plaque removal provided by mastication.⁴ This study demonstrates that the composition of G-tube formulas may influence the oral environment and the mineralization of dental plaque. Formulas may also differ in buffering capacity and salivary stimulation. It is important to maintain optimal oral health in compromised children because, notably, the calculus of tube fed children has also been found to contain more aspiration pneumonia-associated bacteria than children who eat by mouth exclusively. Tailored oral hygiene protocols may be needed based on formula type. For example, anti-cavity and anti-tartar toothpaste has been shown to result in a 68% decrease in calculus buildup.⁵ Further customizations to oral hygiene practices for children with G-tubes can not only affect oral health, but overall health.

CONCLUSIONS

Calculus formation is a complex, multifactorial process with significant implications for oral and systemic health. By identifying biological and behavioral predictors, we can move toward precision dentistry, reducing calculus-related complications and improving long-term patient outcomes. Enteral nutrition type shows a significant correlation with dental calculus severity.

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