INTRODUCTION

• Worldwide decline in dental caries in the past few decades are primarily attributed to the widespread use of fluoride. However, caries is still an important health problem as it is the number one chronic condition worldwide (Kassebaum et al., 2015).

• Fluoride positively affects the caries process when available in the oral fluids, especially the fluid phase of the biofilm (Margolis and Moreno, 1992), by reducing dental demineralization and enhancing remineralization (Fejerskov et al., 1981).

• After the use of topical fluorides, fluoride can be retained in oral reservoirs. These are precipitated minerals, such as calcium fluoride, or fluoride bound to calcium on the surface of bacteria or proteins (bio-Ca-F) (Rose et al., 1996; Vogel et al., 2011).

• The formation of these reservoirs is dependent on both calcium and fluoride concentrations in the oral fluids. However, bioavailable calcium concentration before fluoride use is usually low (around 1 mM), limiting the formation of these calcium-based fluoride reservoirs.

• Previous studies showed that a preapplication of calcium (in a rinse) prior to administration of fluoride greatly enhances fluoride concentration in the mouth (Vogel et al., 2008; 2014) and the anticaries effect of fluoride [Souza et al., 2016].

• Another approach to increase calcium concentration before fluoride application could be through chewing calcium supplements [Pippet et al., 2018]. Nevertheless, the capacity of these to release calcium to increase its concentration in the oral fluids is unknown, as well as if the increase in calcium concentration can improve fluoride retention.

OBJECTIVE

Part 1: Determine the ability of chewable calcium supplements to release calcium during chewing in order to increase calcium concentrations in the oral fluids to levels higher than baseline.

Part 2: Determine if chewing calcium supplements before a fluoride rinse can improve the oral fluoride retention.

METHODS

• In vivo randomized, crossover, analyst-blind study (NCT04620252) (approved by the IRBMED, University of Michigan).

• Part 1: Effect of calcium supplements to increase introral calcium levels; 10 participants:
  1. negative control (Mentos® (no calcium)
  2. Calcium carbonate-based (Tums®, CaCO₃ (400 mg Ca/piece))
  3. Calcium citrate-based (Solvay®, Ca-cit) (250mg Ca/piece)
  4. Tricalcium phosphate-based (NatureMade®, TCP) (250 mg Ca/piece)

Saliva samples collected up to 5 min after chewing

• Part 2: Effect of two calcium supplements before a fluoride rinse; 15 participants (data from 11 collected so far):

Fluoride rinse (CloSYS Silver) (226 ppm F) after calcium carbonate or calcium citrate supplements

Saliva samples collected before and up to 120 min after treatments

RESULTS

Part 1:

One calcium supplement tested each phase (3 experimental phases)

Determine the ability of chewable calcium supplements to release calcium during chewing in order to increase calcium concentrations in the oral fluids to levels higher than baseline.

Part 2:

One calcium supplement tested before a fluoride rinse in each phase (3 experimental phases)

Calcium concentration determined using a colorimetric reaction (Arsenazo III) in a microplate reader (Vogel et al., 1983; Tenuta et al., 2008)

Fluoride concentration in whole saliva was determined using an ion-selective electrode.

• Area under the curve (AUC) of salivary fluoride concentration vs. time calculated
• Data analyzed by ANOVA and Tukey test (α=5%)

Figure 1: Total and soluble calcium in saliva 15 s after chewing the calcium supplements (µg±SD, n=11). Different letters represent statistically significant groups.

Figure 2: AUC of total fluoride concentration vs. time according to treatments for the samples collected so far. Left: Avg±SD (n=11). Right: dots connect values from the same participant.

SUMMARY

• Chewable calcium supplements can significantly enhance total or free calcium concentration in saliva; some formulations have a higher release profile than others.

• The potential of both salivary calcium pools to react with fluoride and increase retention is still being investigated.

CONFLICT OF INTEREST STATEMENT: none to report

Acknowledgements: This study was supported by the Pathways Program, University of Michigan School of Dentistry.