In an 18Fr enteral tube, material build-up of 1.3 mm on the inner Tube walls will decrease the diameter to the equivalent of a 14Fr Tube, thus **decreasing flow rate by as much as 50%.**

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Effects of clogged feeding tubes on syringe force - a bench top analysis

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Introduction

+ Feeding tubes (Tubes) are life-sustaining; providing nutrition, medication, and hydration to those unable to ingest orally.
+ Tubes clog at rates up to 35%[1-3], resulting in nutrition and medication interruptions.
+ Some clogs can form quickly, while others occur over time, causing uncertainty amongst healthcare practitioners regarding a patient's Tube patency status.
+ Research discusses preventative measures to Tube clogging and ways to remove clogs; however, the question as to how one can determine if a Tube is fully patent does not appear to have been addressed.

How does one ascertain when material build-up is adhering to the interior Tube wall if fluids can still be introduced into the Tube?

+ **Study Objectives:** Quantify the amount of required force to introduce air into Tubes with various levels of clogging with the end goal to correlate those values with a subjective "feel."

Methods

+ Within 14Fr Nasoenteric (NE) Tubes, in vitro produced clogs were created using a mixture of feeding formula and fiber.
+ Three (3) Tube Conditions were tested, N=15 trials, with n=5 trials/Tube Condition:

Condition #1
No clog in Tubes.

Condition #2
A single layer of clog mixture was introduced into Tubes and blown through with air, coating the Tube inner walls and baked (55°C for 3 hrs).

Condition #3
A secondary layer of clog mixture was added to the single layer presented in Condition #2 and baked again (55°C for 3 hrs).

+ **Force Measurement:** A 60-cc syringe was filled with air to the 50-cc mark, and the plunger depressed to the 10-cc mark using a force gauge (Fig 1).

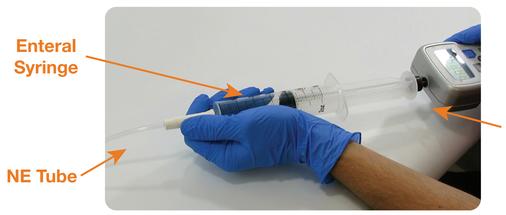

Figure 1

Results

+ Peak mean force (Newtons [N]) required to push air via the syringe significantly differed due to Tube Condition (Fig 2; Two-way ANOVA, Tukey's Multiple comparison test, different variables =$p<0.01$).

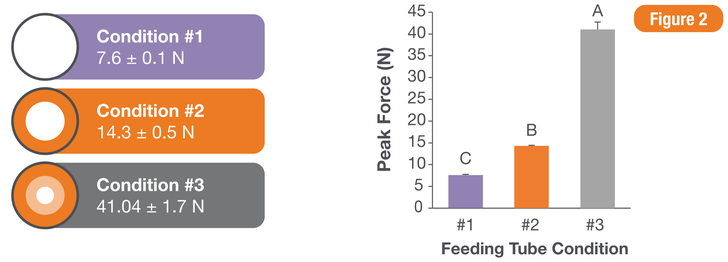

Figure 2

While these measurements demonstrate an increasing amount of required force, what does that feel like in practice?

+ Condition #1: Flushed without experiencing any major resistance.
+ Condition #2: Flushed almost as easily as Condition #1; however, the required force being nearly double. Suggesting that Tube clogs, or material build-up on the inner walls, may begin forming before becoming noticeable to healthcare practitioners.
+ Condition #3: Due to increased blockage, attempts to flush air through the Tubes proved the most difficult, requiring additional force as the syringe plunger pushed backwards towards the Operator.
  - Simulated clogs required a force that was nearly **5.5 times** that of the non-clogged Tubes.

Conclusion

+ Material build-up on the Tube's inner walls may be significant before a healthcare practitioner notices a change in the force required to flush the Tube, thus **they may not realize the Tube's inner diameter has decreased**.
+ By the time a healthcare practitioner notices a change in the required force, the Tube is already substantially clogged, thus **the patient may not achieve their caloric goals**.
+ Using a prophylactic approach prior to noticing changes in syringe force may minimize the risk of material build-up and maintain the full Tube inner diameter, thus **enabling uninteruppted and optimal enteral therapy delivery**.

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