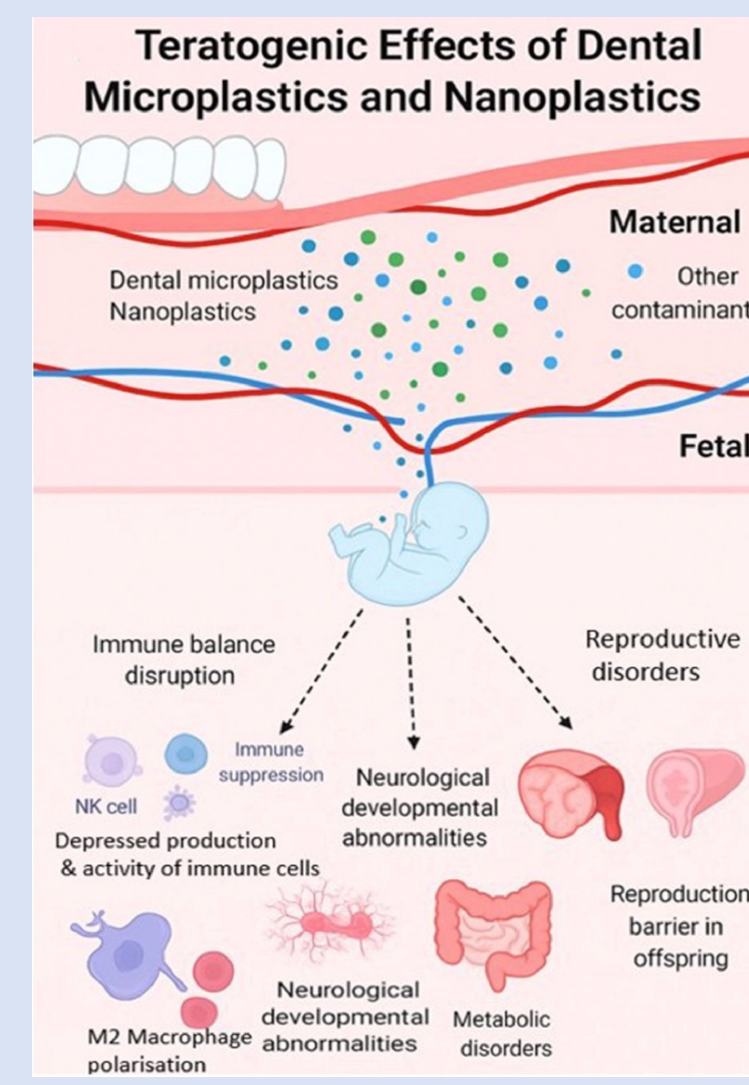
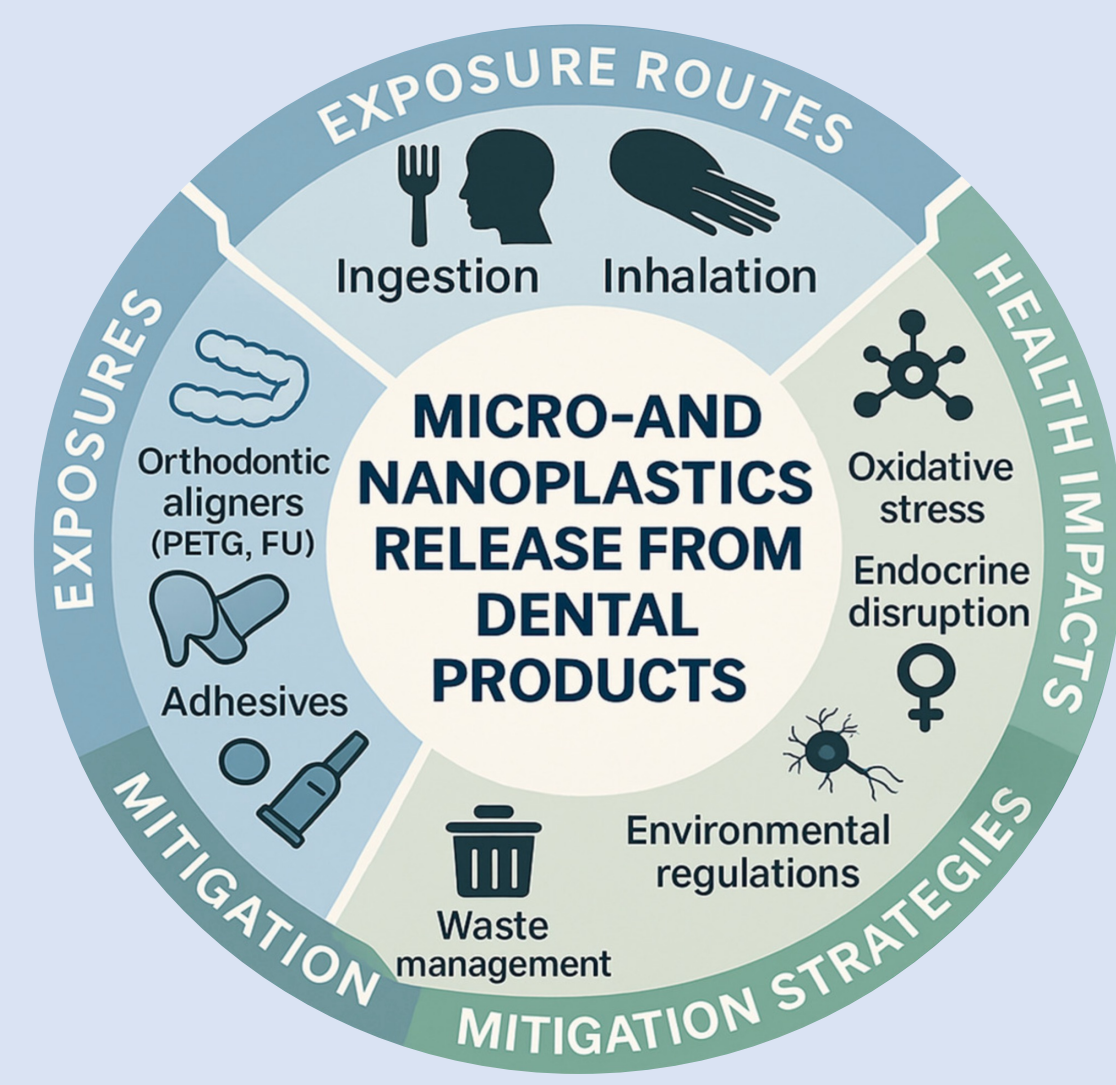


Background

Microplastics, defined as polymeric particles ranging from 1 nm to 5 mm in size, result from everyday products and have raised growing concern due to their environmental persistence and potential health risks.



Routine toothbrushing has been identified as a possible source of microplastic generation. The ingestion and adsorption of microplastics may lead to endocrine-disrupting chemical (EDC) activity.

Methodology

1. Sample Selection:

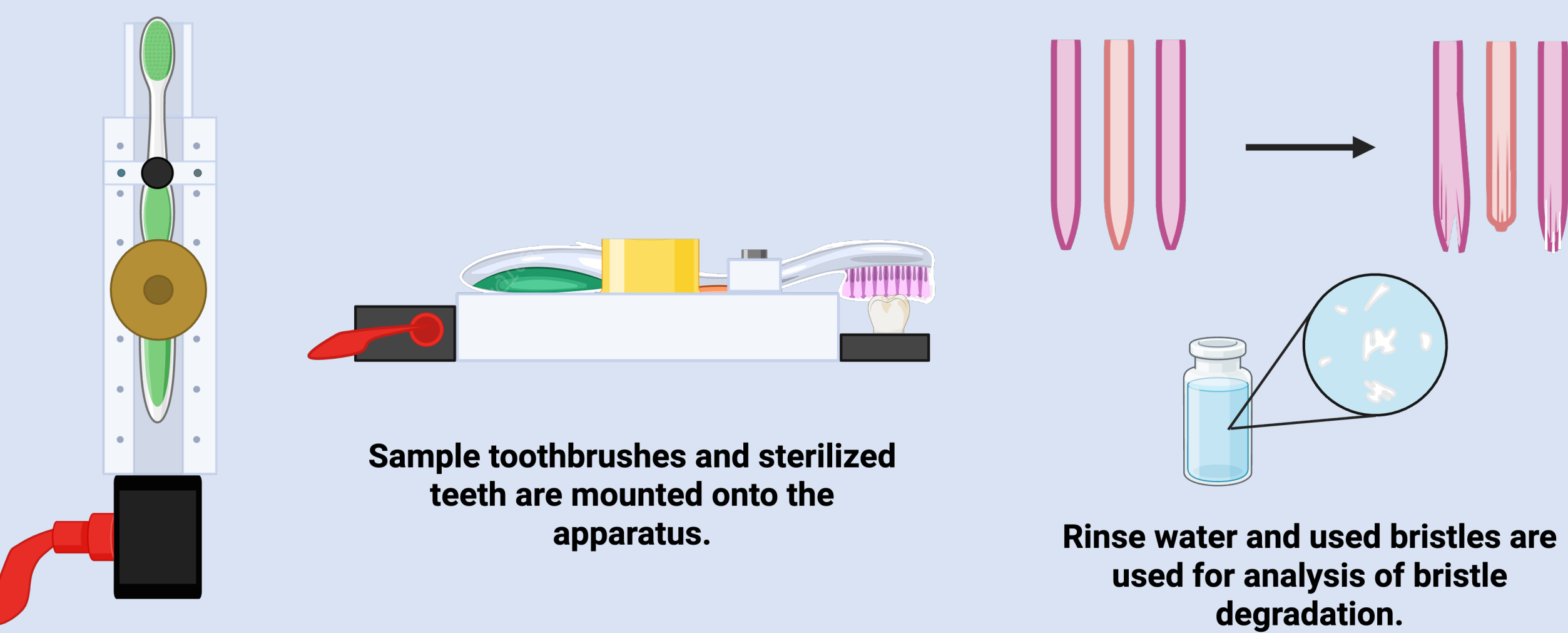
Conventional and biodegradable brushes of soft and medium bristle hardness will be tested.

Conventional:
 Oral B Soft/Medium
 Colgate Soft/Medium

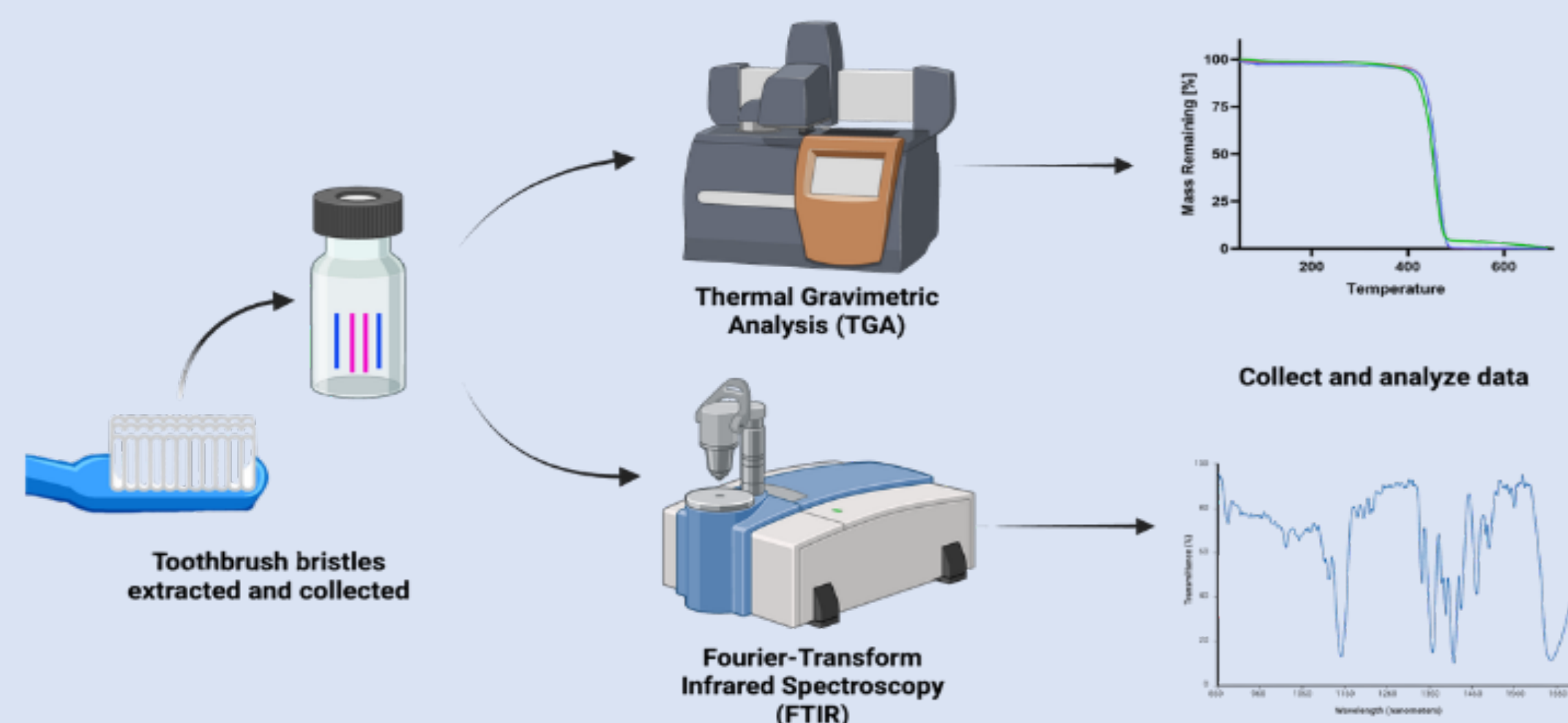
Biodegradable:
 Vivago Bamboo Soft
 Vivago Bamboo Medium

2. Toothbrushing Simulation Apparatus:

To simulate brushing, a controlled number of cycles was completed on the below brushing apparatus at the equivalent of 1 year of brushing- about 10,000 cycles.

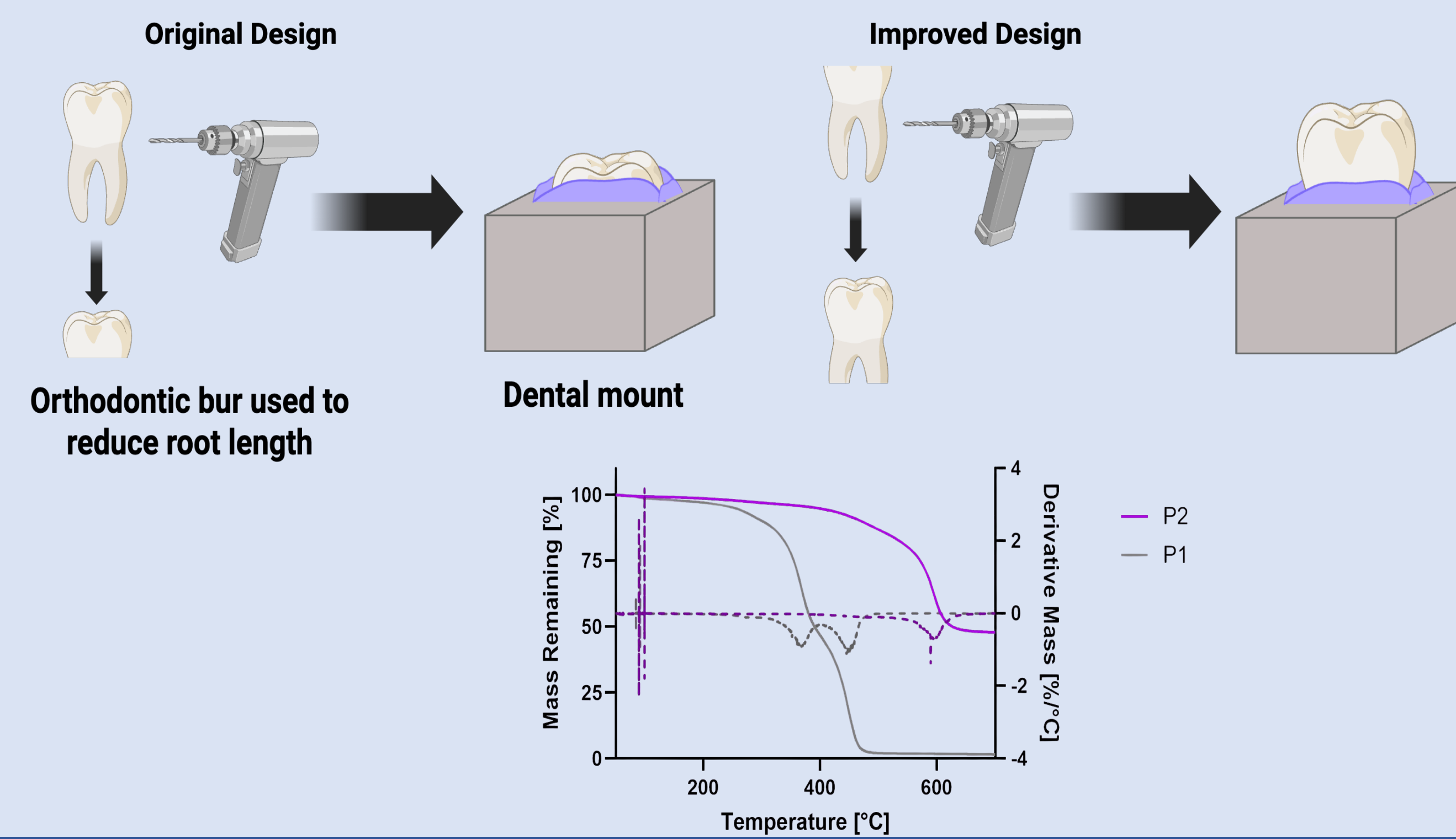


3. Microplastic Analysis:



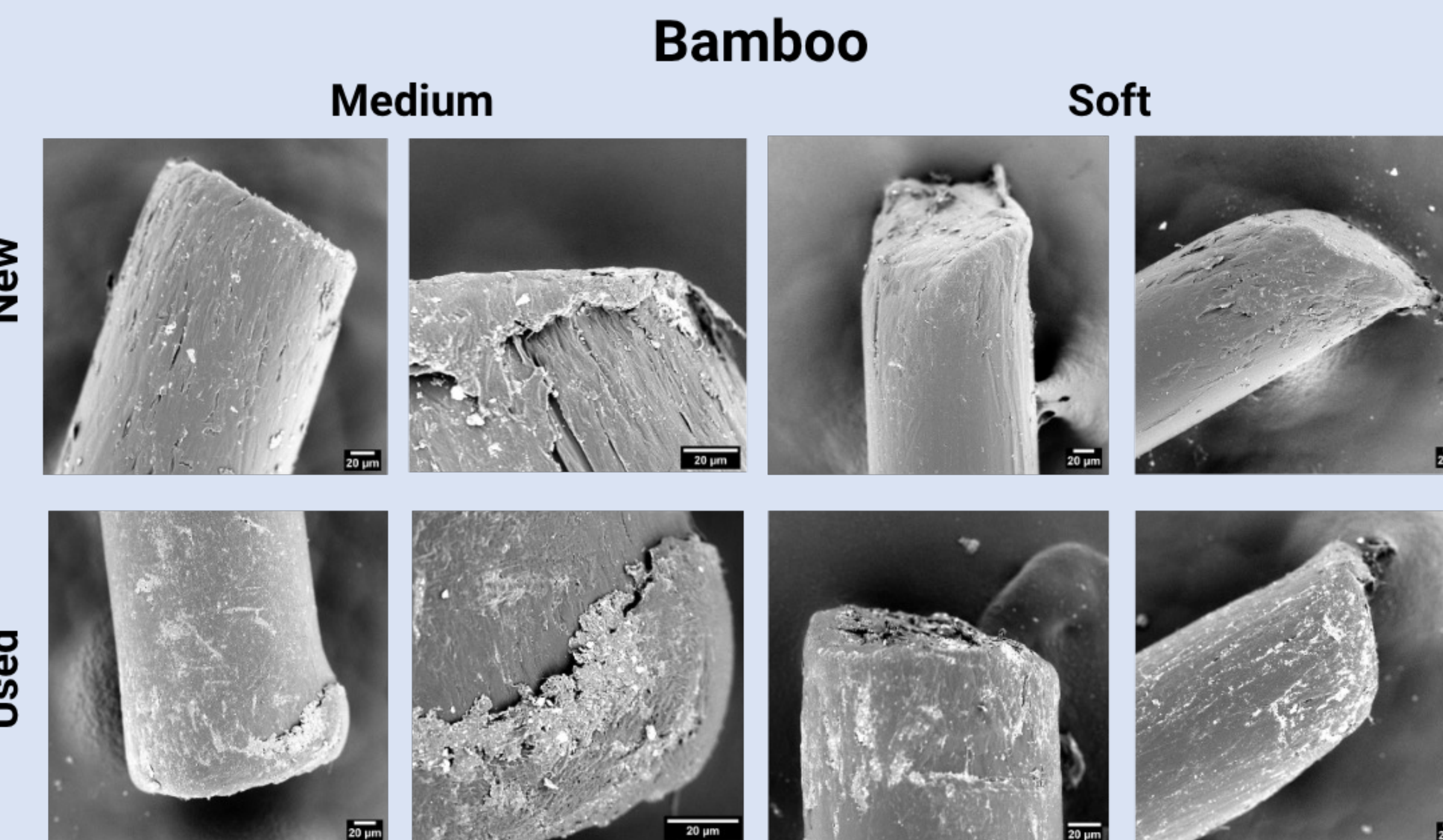
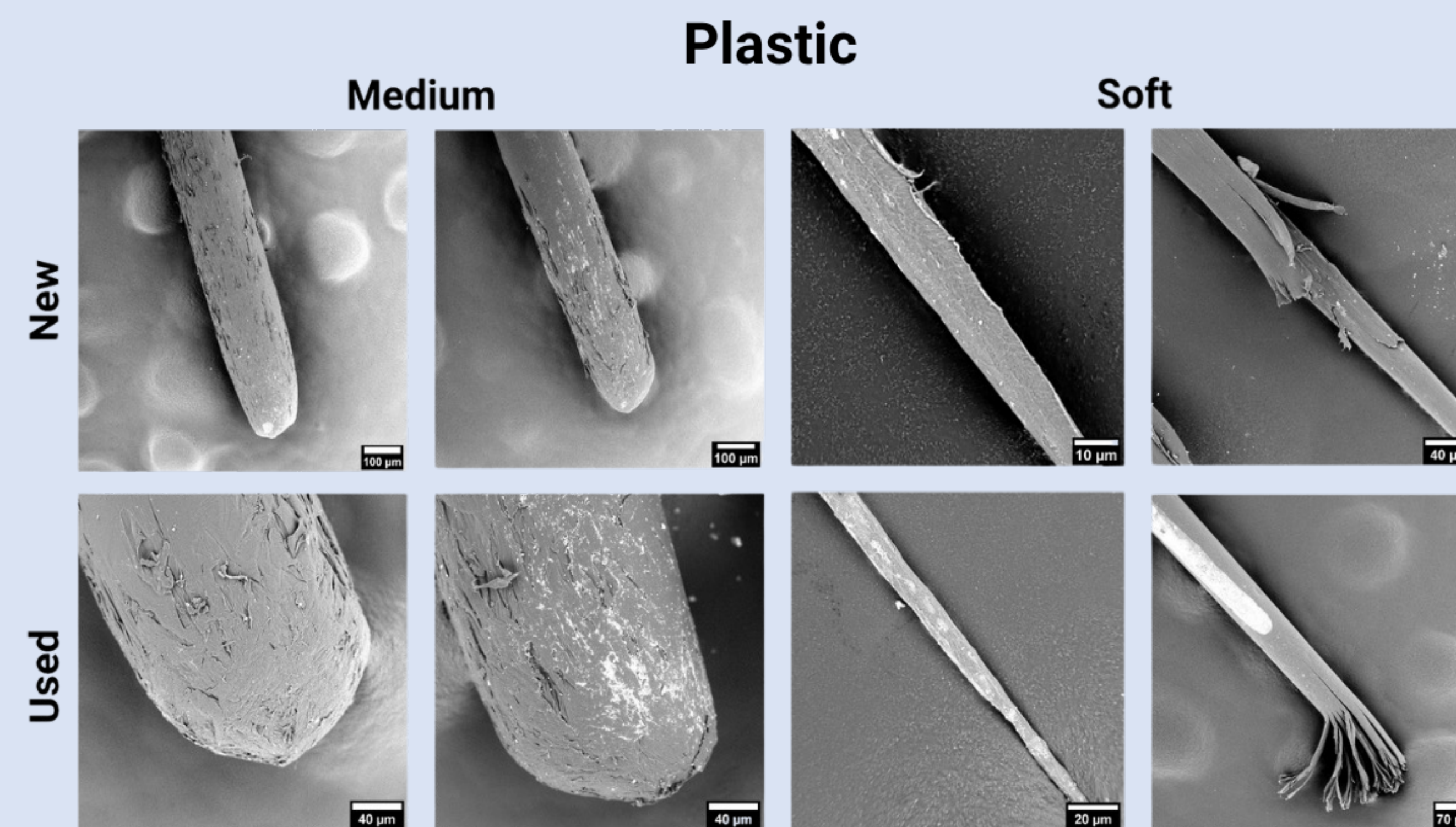
Bristles collected before and after toothbrushing can be analyzed using FTIR to identify microplastic polymer composition based on characteristic bond vibrations and TGA to evaluate bristle degradation by comparing the residual inorganic material between pre- and post-toothbrushing samples.

Design

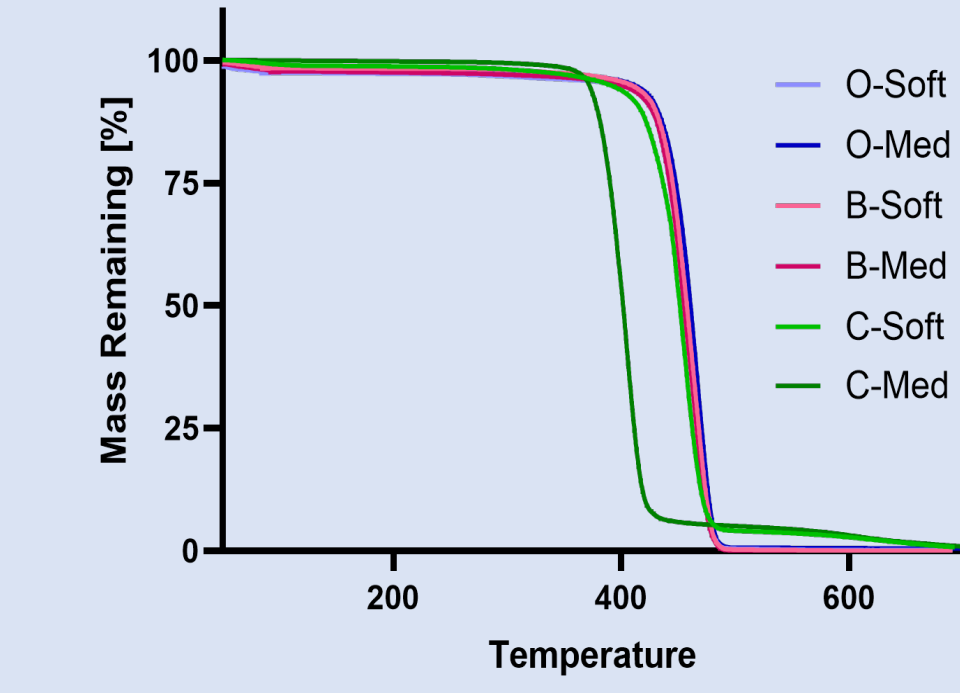


Bristle and Rinse Analysis

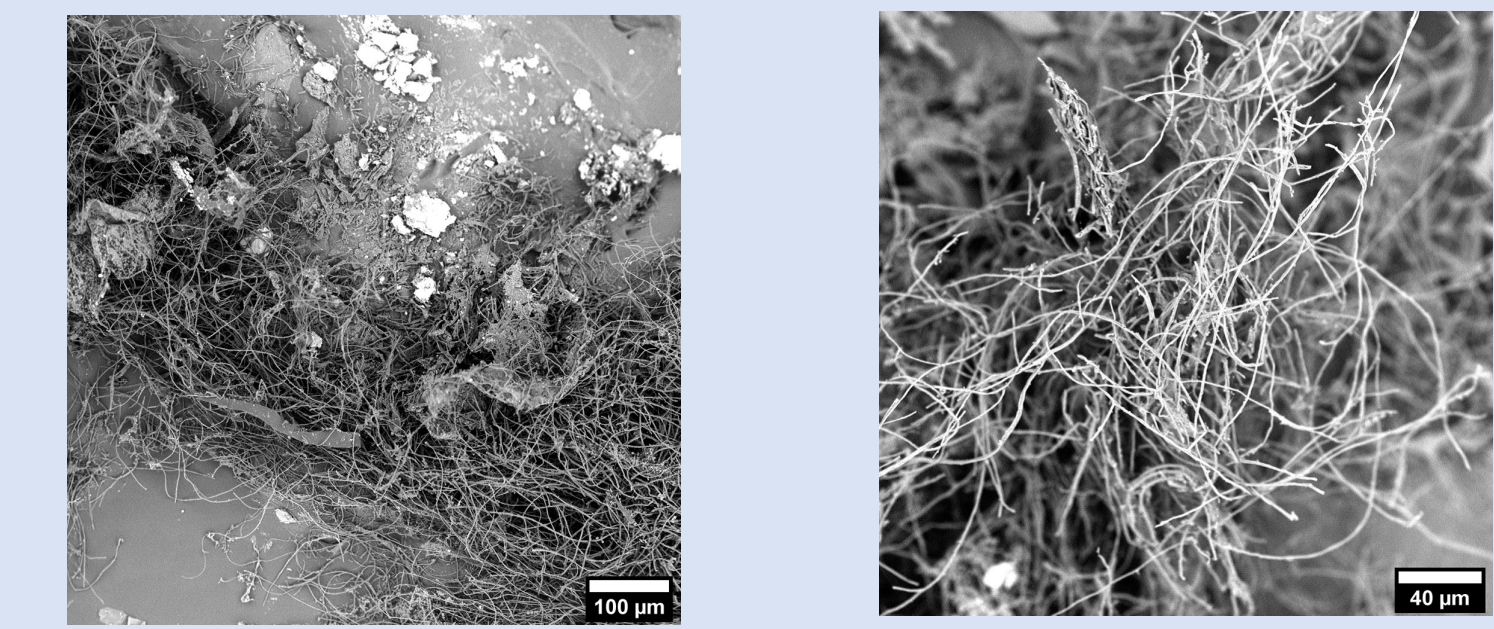
Assessment of Bristle Degradation via Scanning Electron Microscopy (SEM):



Assessment of Bristle Degradation via Thermal Gravimetric Analysis (TGA):



Particulates Recovered from Rinse:



Direction

Assessing microplastic generation from children's dental products

- Because children's toothbrush bristles are typically softer, we hypothesize that they will exhibit greater microplastic release relative to adult toothbrushes, consistent with prior observations that softer bristles degrade more readily than harder bristles
- We expect children's toothpastes to contribute more significantly to microplastic generation, as they often contain synthetic beads (e.g., Crest Sparkle Fun)

Implications

Public Health:

Quantifying microplastic release during toothbrushing and distinguishing contributions from bristle degradation and toothpaste-derived polymers will provide insight into potential exposure pathways associated with routine oral hygiene. This is particularly relevant for children, who may experience elevated exposure due to softer bristle materials and the use of bead-containing toothpastes. These data will support improved risk assessment of long-term health effects, including potential endocrine system disruption.

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