

The Effect of Toothpaste Tablets on the Viability and Proliferation of Gingival Fibroblasts

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PG Periodontics

Background: Problem



- 400 million toothpaste tubes/year in US landfills
- 20 billion tubes/yr globally
 - Enough to circle globe 50x
- 500 years to biodegrade

Proposed Solution



Toothpaste Tablets

- Chew tablet and brush as normal
- Glass, aluminum, or recycled paper packaging
- Refillable
- Paired with sustainable products
 - Bamboo toothbrushes



Toothpaste Tablet Benefits

- Reduced waste
- “Clean and natural ingredients”
- Waterless production:
 - Reduced carbon emission
- Travel-friendly



Toothpaste Tablet Ingredients

“Clean + natural”

- No SLS or sulfates
- Fluoride-free: “non-toxic” (some)
- Xylitol-free: pet safe (Chomp)
- No harsh chemicals
- No artificial flavors/sweeteners



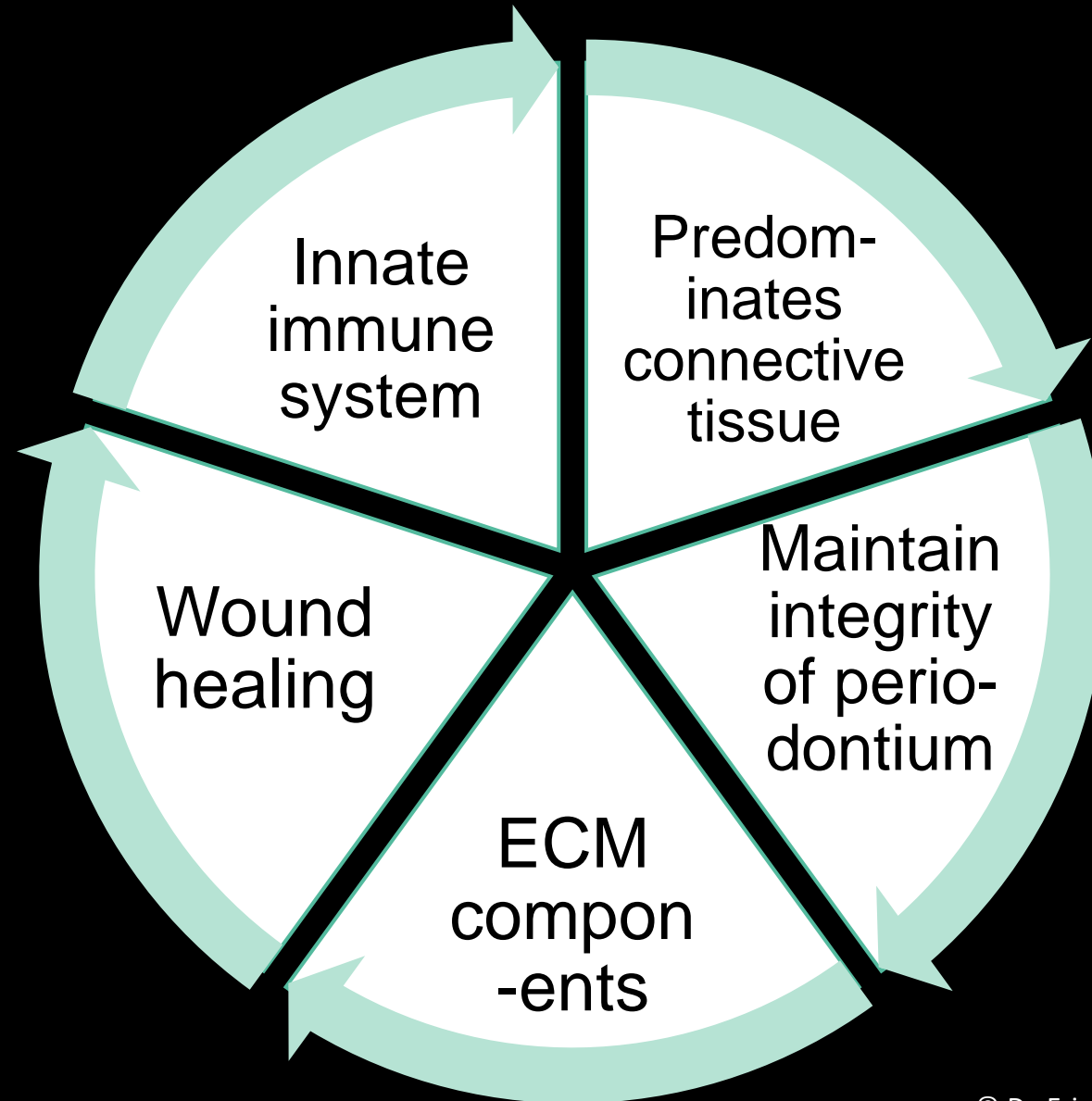
The image shows three panels from a website, each with a green icon at the top, a title, a descriptive paragraph, and a button at the bottom.

- All Natural**: Icon of a leaf. Text: "No cheap fillers, sulfates, parabens, artificial preservatives, harsh chemicals, or artificial ingredients." Button: "Ingredients".
- Cruelty-Free**: Icon of a rabbit. Text: "Never any animal testing and our toothpaste is 100% vegan." Button: "Our Mission".
- Plastic-Free**: Icon of a cardboard box. Text: "We love Mother Earth. All of our production and shipping is environmentally friendly." Button: "Sustainability".

Gap in Knowledge:

Limited research on the effects of toothpaste tablets on cells of the oral mucosa

Gingival Fibroblast



Aim:

Evaluate the effects of toothpaste tablets on
human gingival fibroblasts

Materials

Cell lines

- Human gingival fibroblast cells isolated from healthy gingiva of LSUHSC patients

Extract preparation

- 1 tablet or 1.3g toothpaste in 15 mL media

Extracts

Toothpaste Tablet

Bite

Hello Whitening

Unpaste

Unpaste + fluoride*

Hello charcoal

Simplut*

Pure Earth*

Chomp

Globoid

Toothpaste

Colgate CP*

Crest 3D White*

Hello AP Whitening

* contains fluoride

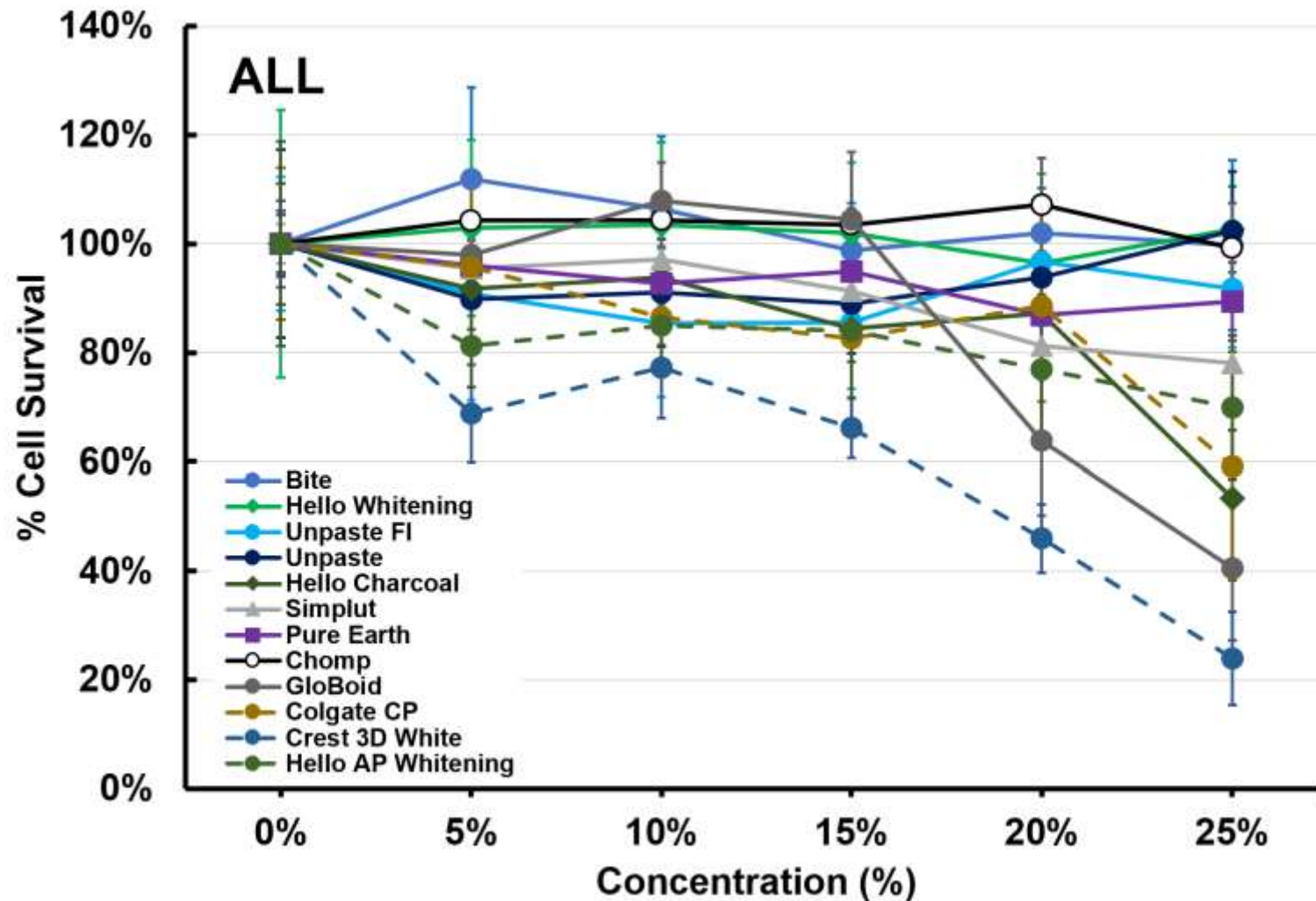
Cytotoxicity

Methods

Cytotoxicity assay

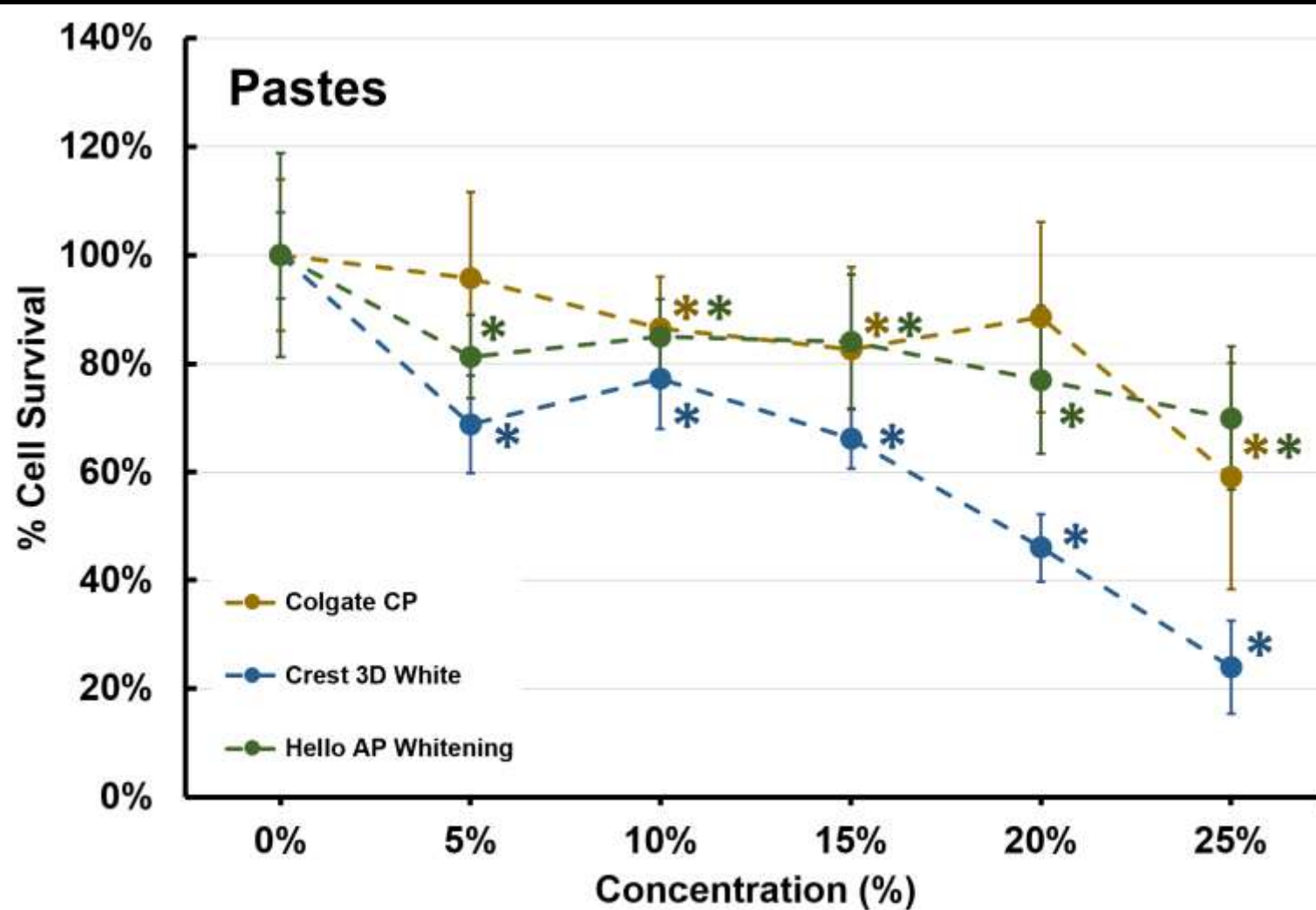
- 12 Extracts: 5%, 10%, 15%, 20%, 25% concentrations
- 8 samples of each
- 3-minute exposure
- Treated with Calcein AM dye
- Read in plate reader

Results – Cell Survival



- Tablets and toothpastes differentially effected cell survival

Results – Toothpastes Survival

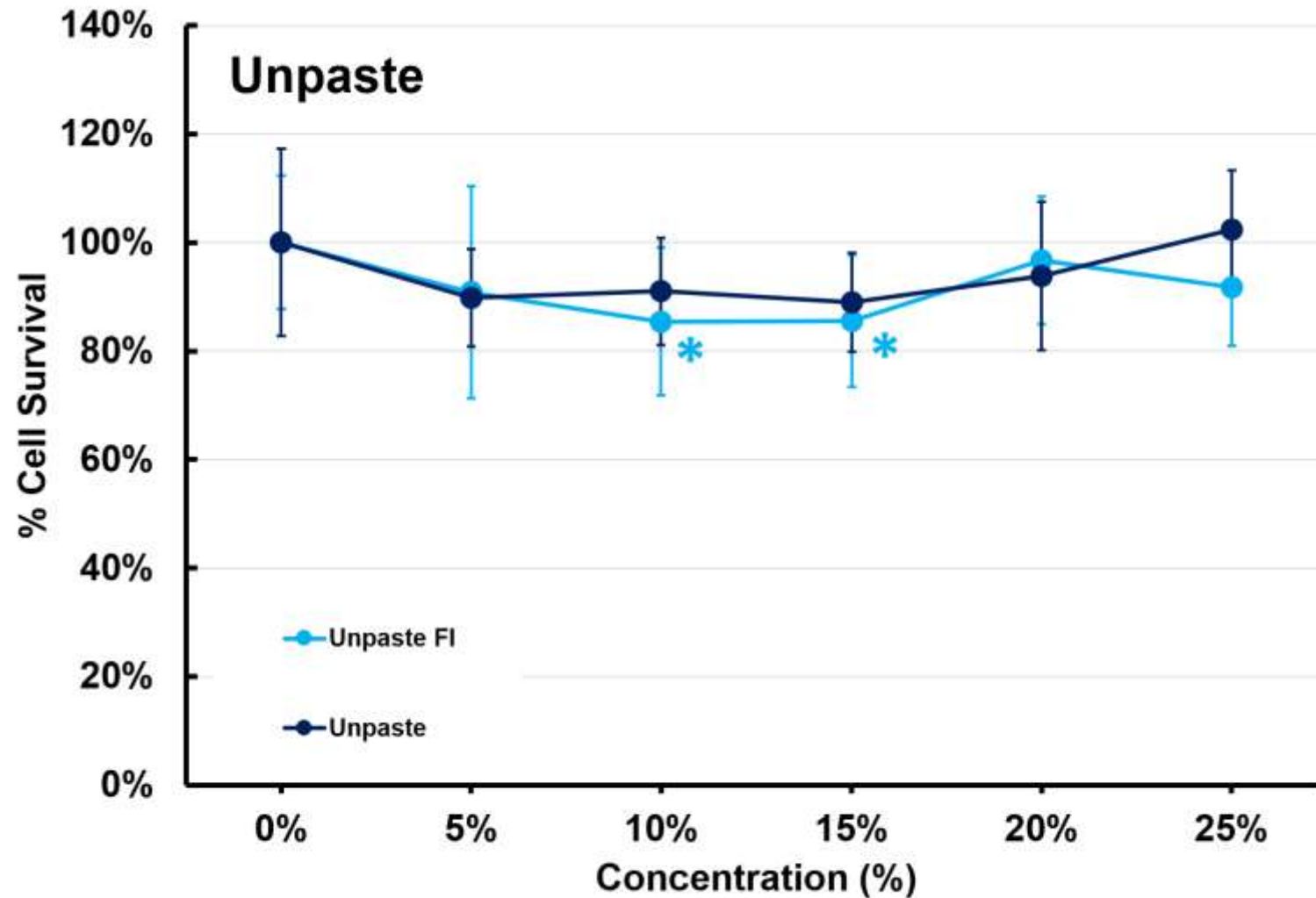


- Toothpastes significantly reduced cell survival

- N=8

- * = $P < 0.05$

Results – Unpaste Tablets Survival

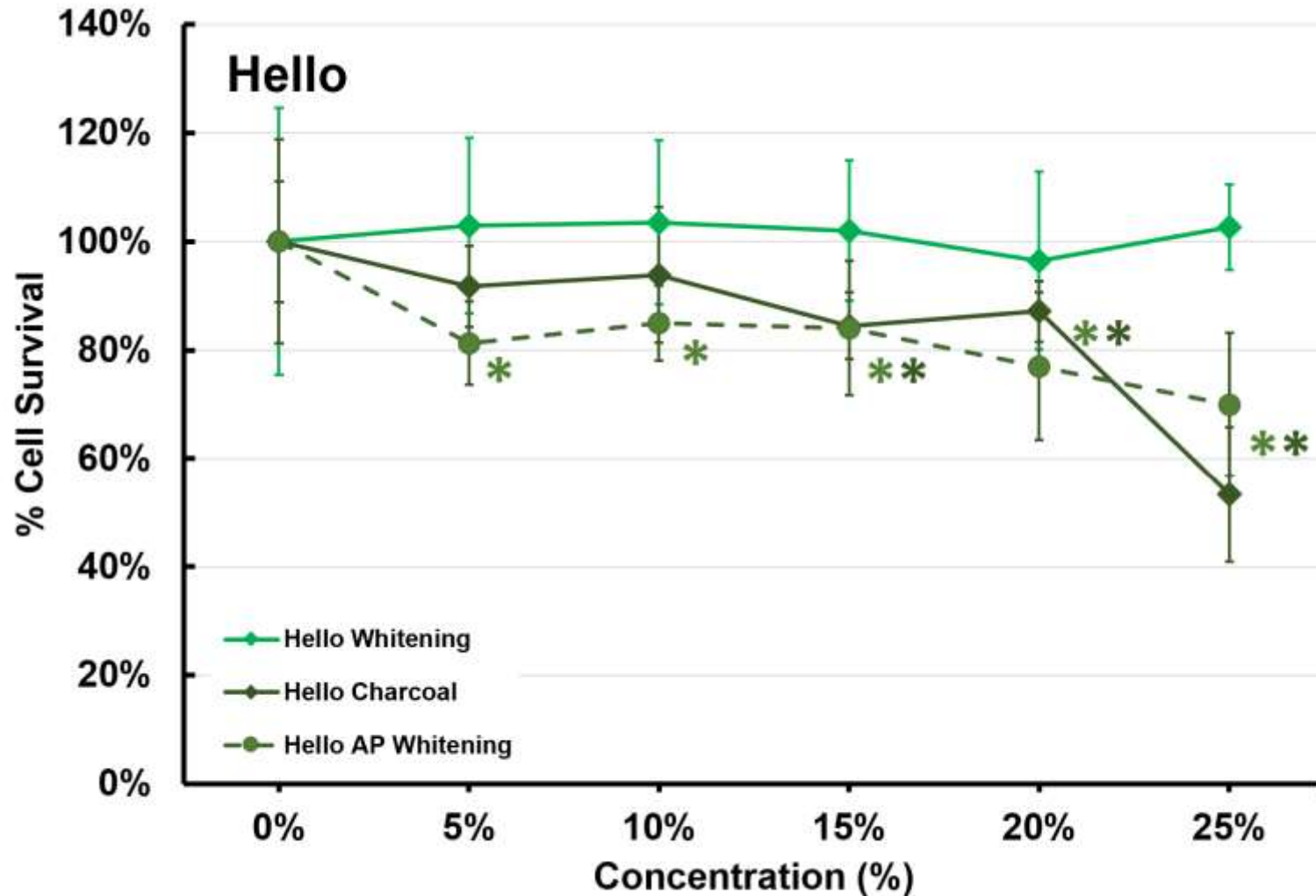


- Unpaste tablets had minimal effects on cell survival

- N=8

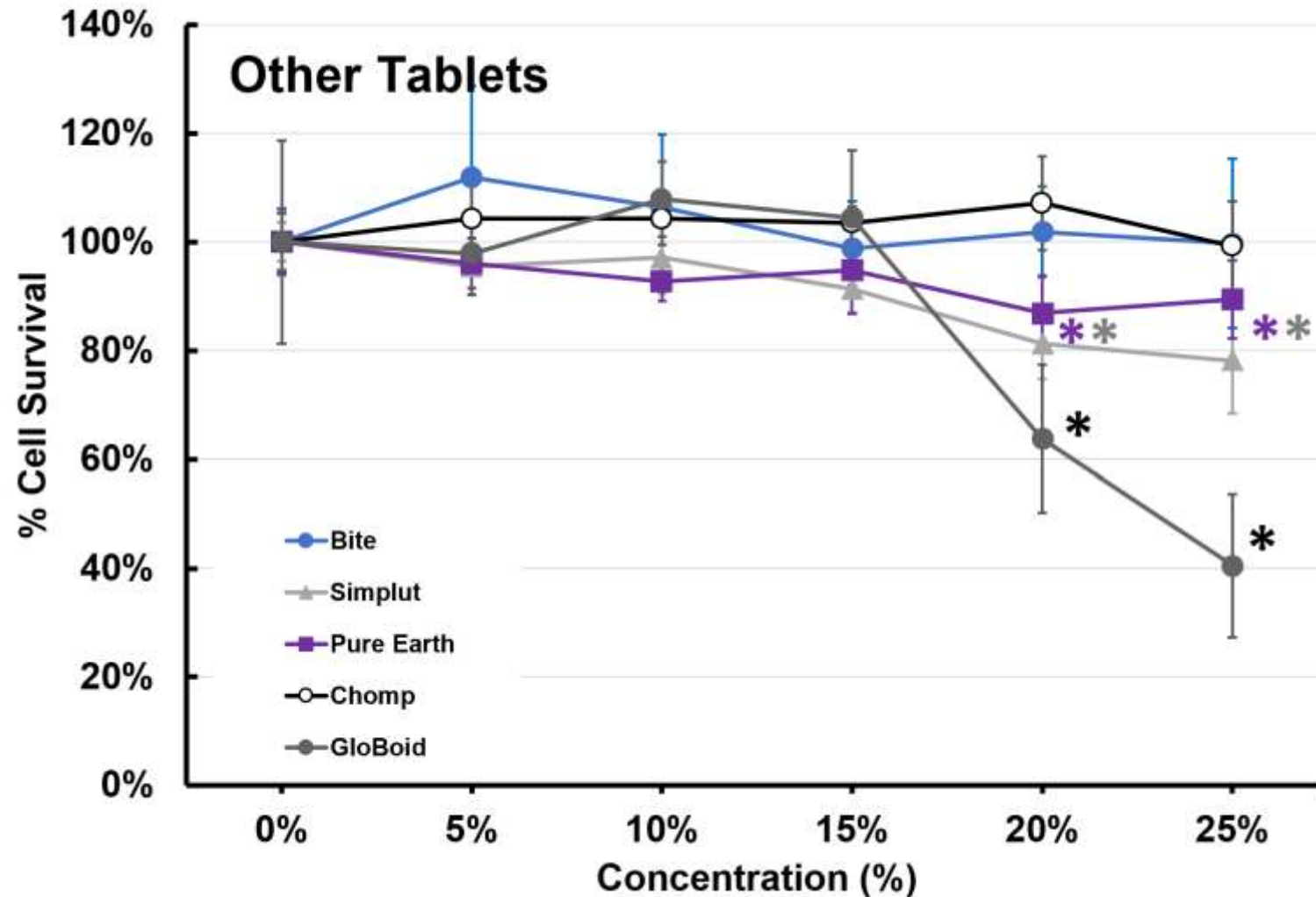
- * = $P < 0.05$

Results – Hello Products Survival



- Hello Whitening tablets had no effect
- Hello Charcoal tablets and AP Whitening paste significantly reduced cell survival
- N=8
- * = P < 0.05

Results – Other Tablets Survival



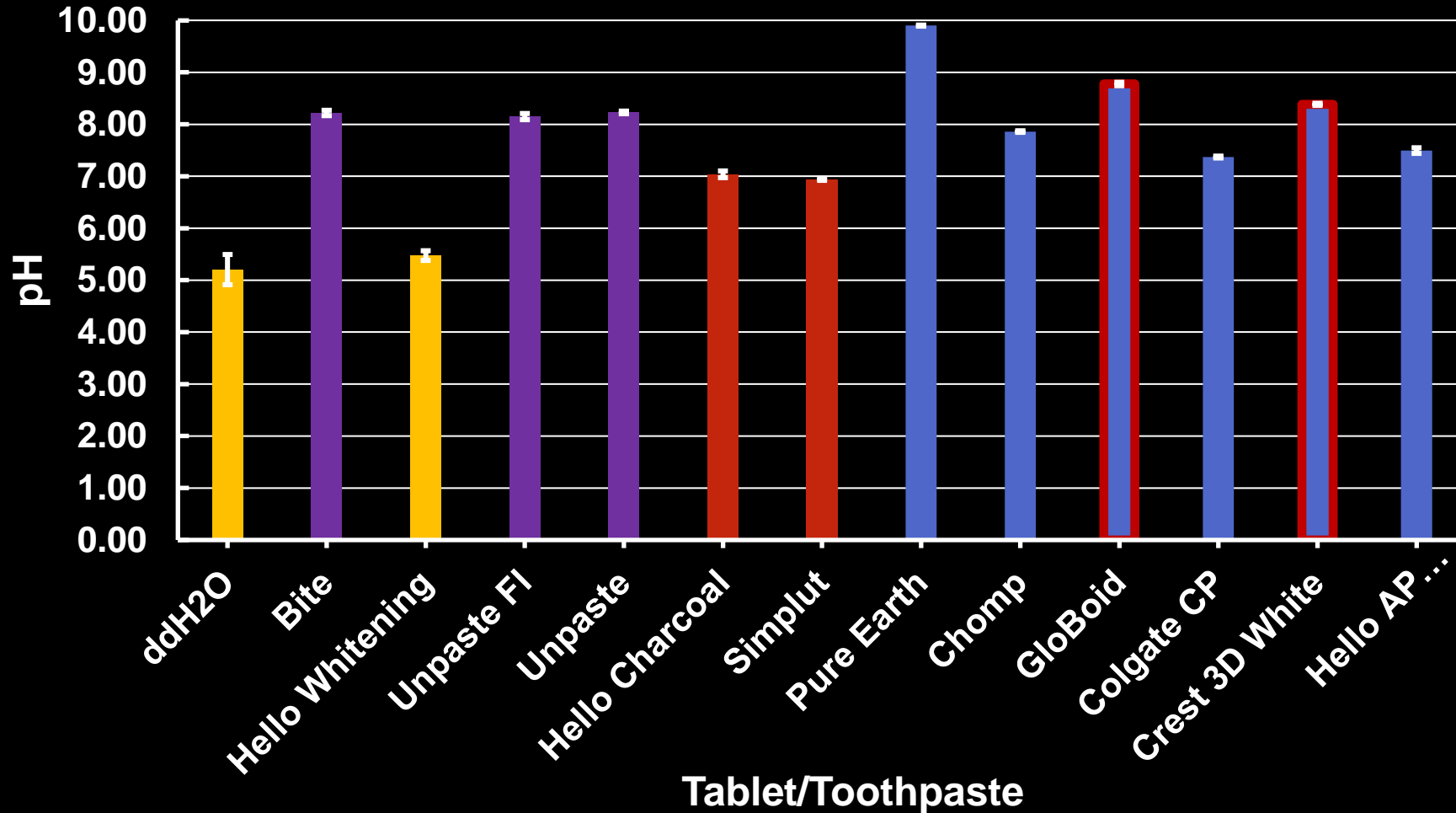
- Bite + Chomp had no effect
- Pure Earth + Simplut significantly reduced cell survival
- Globoid greatly reduced cell survival
- N=8
- * = $P < 0.05$

pH Test

1 tablet or 1.3g toothpaste in 40mL sterile saline

- pH taken 3x using pH meter
- Mean of 3 values calculated

pH Test



- Bars of same color: statistically the same
- Bars different colors: statistically different
- Red outline: greatly reduced cell survival
- N=3
- * = P < 0.05

Interpretation:

pH values did not correlate with differences in
cell survival

Ingredients

No obvious correlation with ingredients

- Globoid: microcrystalline cellulose, xylitol, erythritol, natural fresh mint flavor, sodium fluoride, calcium carbonate, sodium cocoyl isethionate, sodium bicarbonate, guar gum
- Crest 3D White: sodium fluoride 0.243%, water, sorbitol, hydrated silica, disodium pyrophosphate, sodium lauryl sulfate, flavor, sodium hydroxide, cellulose gum, sodium saccharin, carbomer, polysorbate 80, mica, titanium dioxide
- No common ingredient(s)
- No unique ingredient(s)

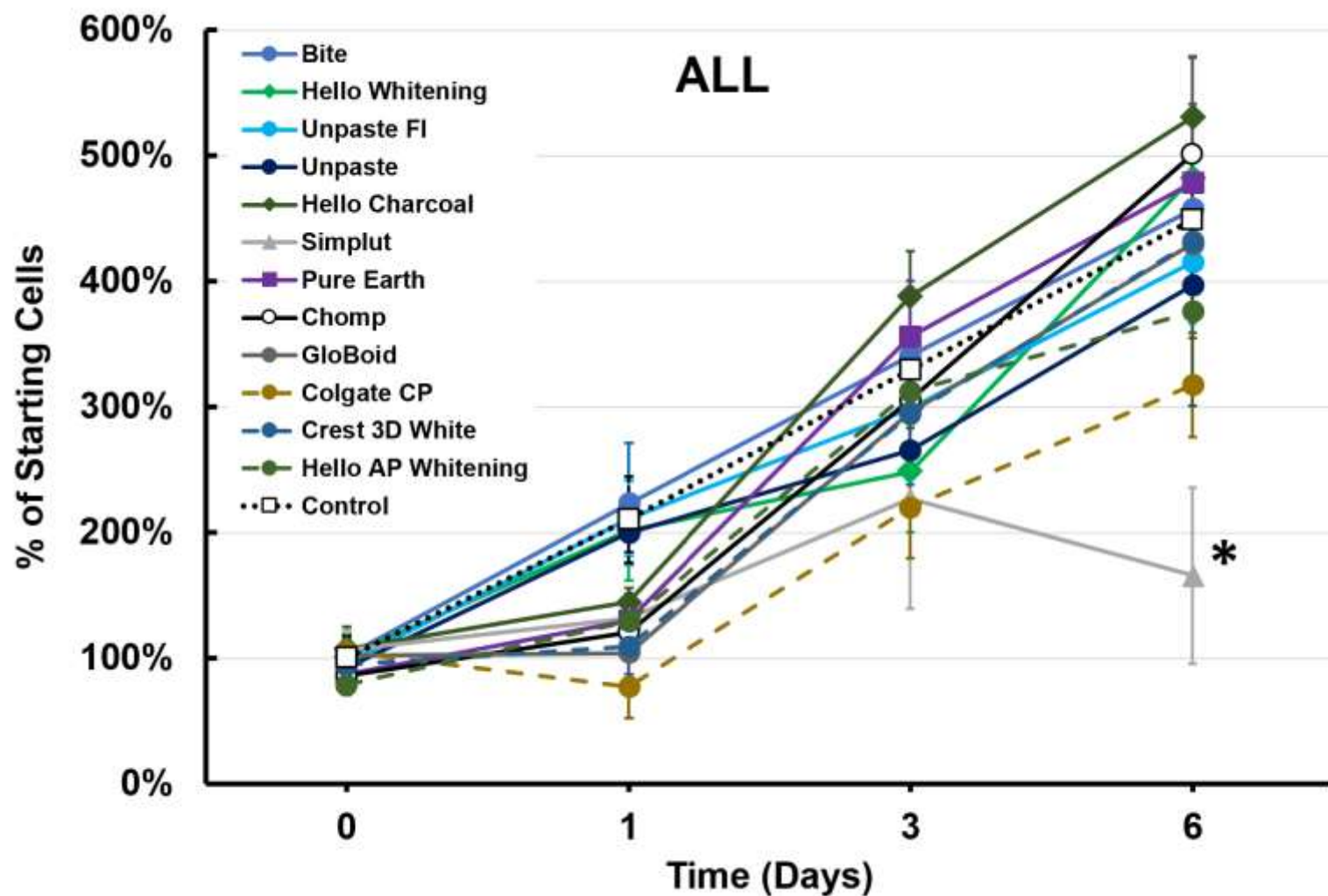
Cell Proliferation

Methods

Cell proliferation assay

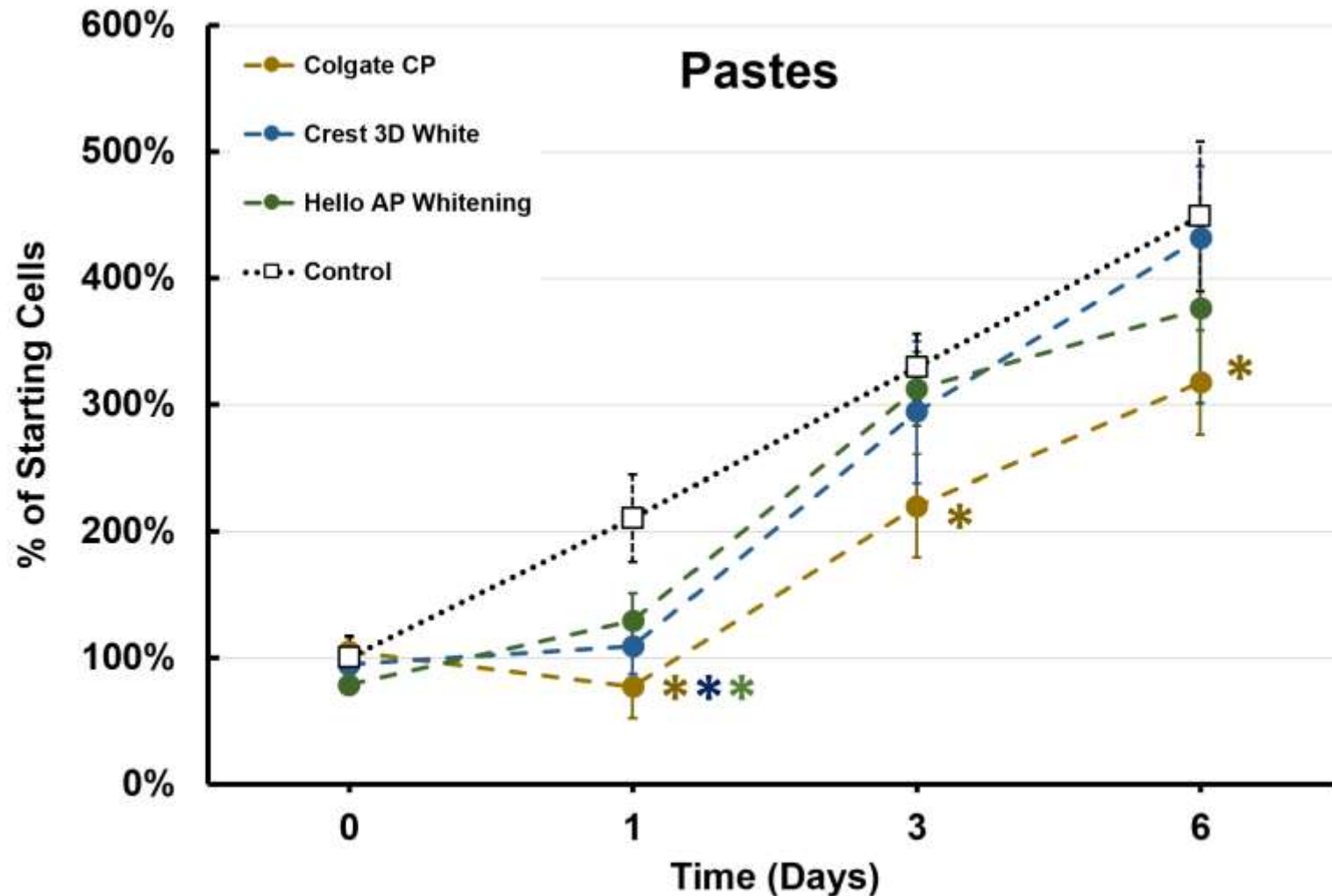
- 25% concentration
- 8 samples of each
- 3-minute exposure
- Observed days 1, 3, 6
- Quantified with fluorescent dye
- Read with plate reader

Results – Cell Proliferation



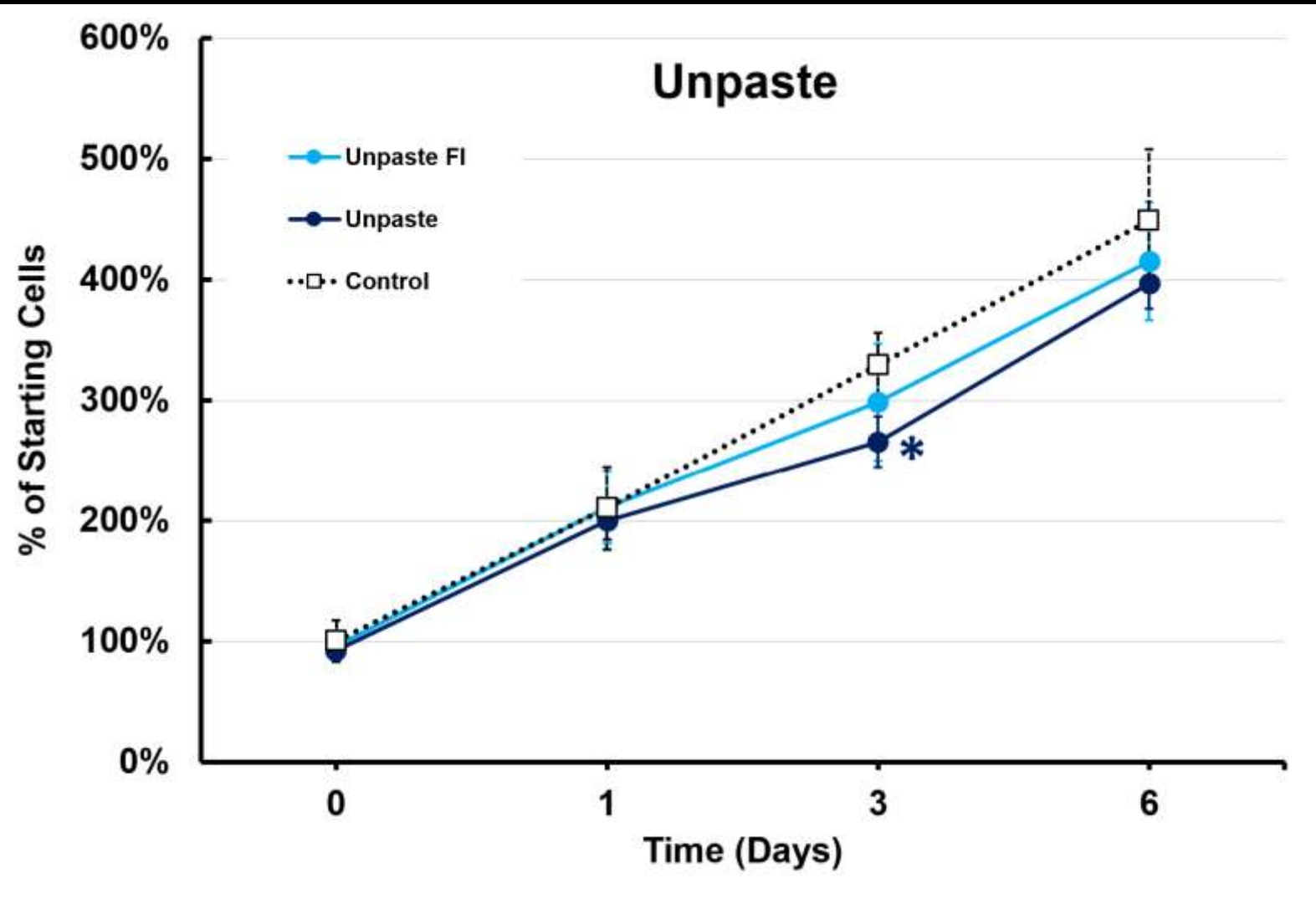
- Tablets and toothpastes differentially effected cell proliferation

Results – Toothpastes Proliferation



- Toothpastes significantly reduced proliferation day 1
- Crest 3D White + Hello AP Whitening recovered by day 3
- Colgate CP reduced proliferation days 3 + 6
- N=8
- * = P < 0.05

Results – Unpaste Tablets Proliferation

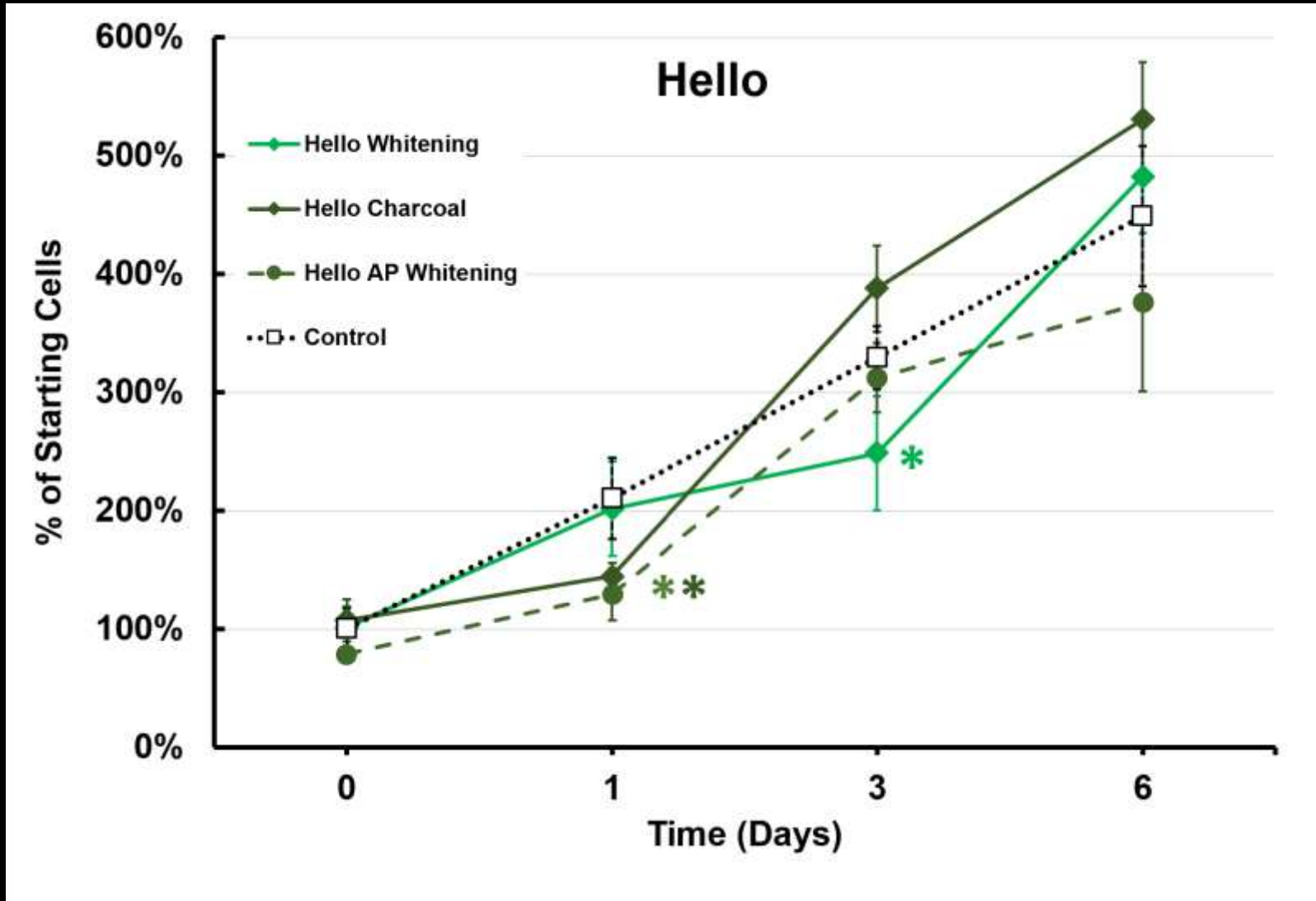


- Unpaste tablets had minimal effects on cell proliferation

- N=8

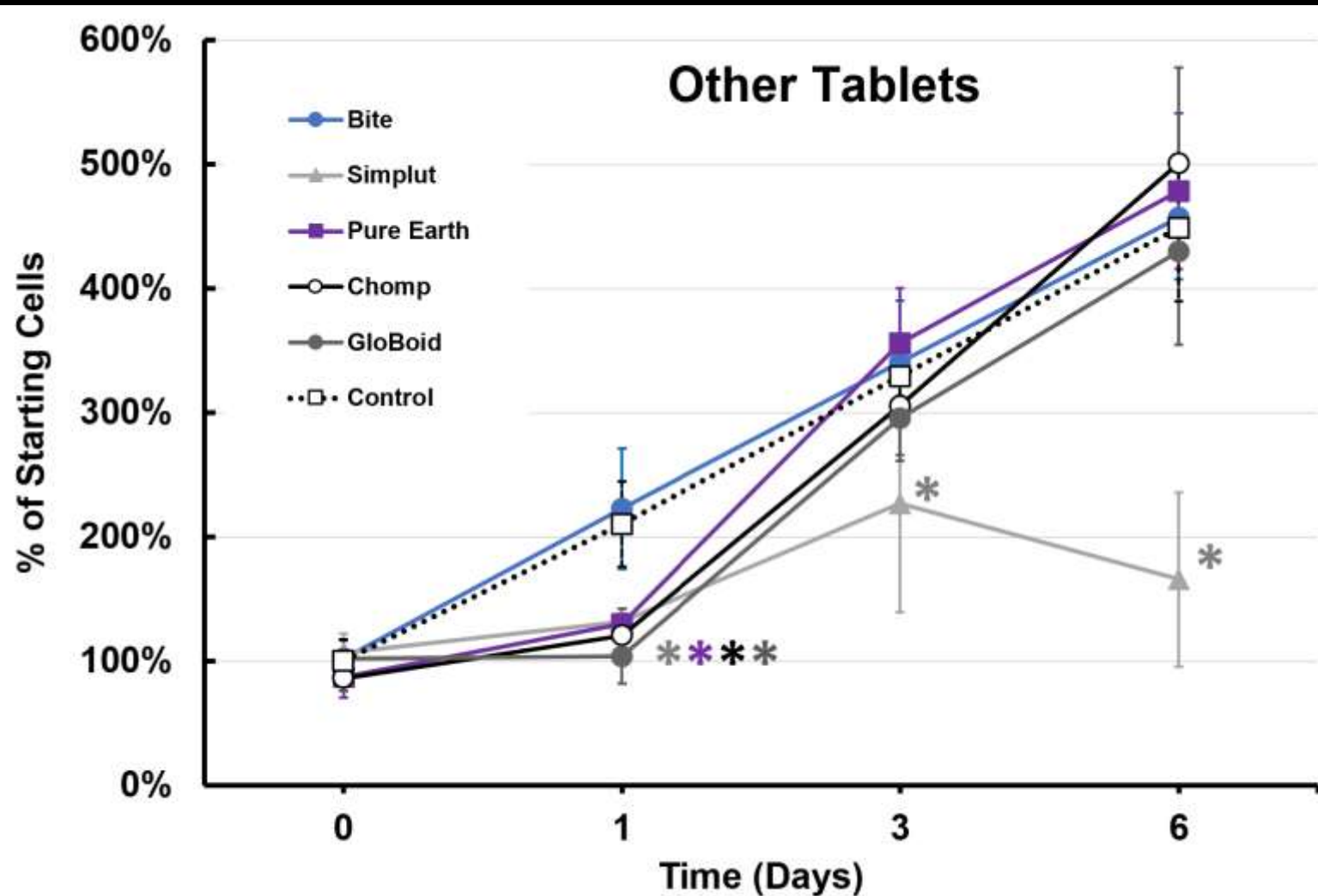
- * = $P < 0.05$

Results – Hello Products Proliferation



- Hello Whitening reduced proliferation day 3 only
- Hello Charcoal and AP Whitening Paste reduced proliferation day 1, recovered by day 3
- N=8
- * = P < 0.05

Results – Other Tablets Proliferation



- Bite had no effect
- Pure Earth, Chomp, Globoid reduced proliferation day 1 only
- Simplut significantly reduced proliferation days 1-6
- N=8
- * = P < 0.05

Simplut Ingredients



Silicon dioxide, sodium fluoride, tetrasodium, pyrophosphate, pyridoxine, hydrochloride, D-sorbitol, microcrystalline Cellulose, sodium cocoyl glutamate, magnesium stearate, **vitamin C**, **vitamin E**, xylitol, **enzymatically modified stevia**, **bamboo salt**, xanthan gum, sodium bicarbonate, **sage extract**, flavor

Simplut Tablets

- Vitamin C: ↑ fibroblast proliferation
- Vitamin E: ↑ wound healing + collagen production; isoforms may have different effects
- EM Stevia: improved sweetener quality
- Bamboo salt: protective against fibroblast deterioration
- Sage: anti-inflammatory and anti-microbial

Conclusions

- Of those tested, toothpaste tablets had no more effect on gingival fibroblasts than traditional toothpastes
 - No effect on cell survival
 - Except **Globoid**
 - No association with pH
 - No effect on cell proliferation
 - Except **Simplut**
- No obvious association of effects with specific ingredients

Future Investigations

- Examine effects of specific ingredients
- Efficacy in reducing caries or gingivitis
- Efficacy in reducing plaque/tartar
- Efficacy in tooth whitening

References

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Thank you!

Questions?