



# Integrating salivary proteomics and the oral microbiome into dental education: Improving Clinical Reasoning in Gingivitis

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Association for Dental Education in Europe (ADEE) – Selected Oral Presentation

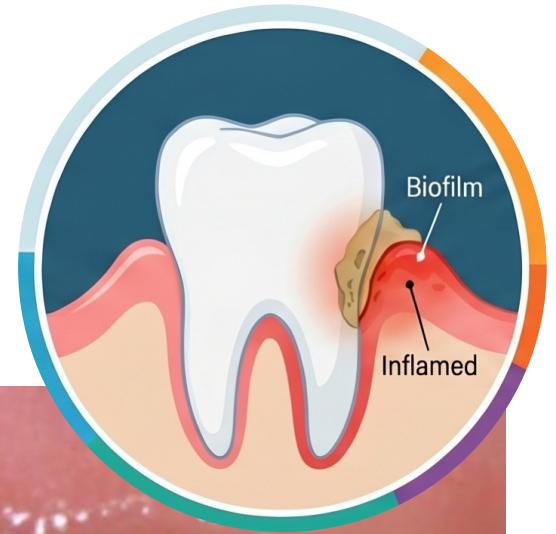


# Periodontal disease

**Periodontitis** is a chronic, multifactorial, host-mediated inflammatory disease associated with dysbiotic microbial biofilms. Its impact is profound and multidimensional, ranging from the destruction of the periodontal support structures to systemic and public health consequences.

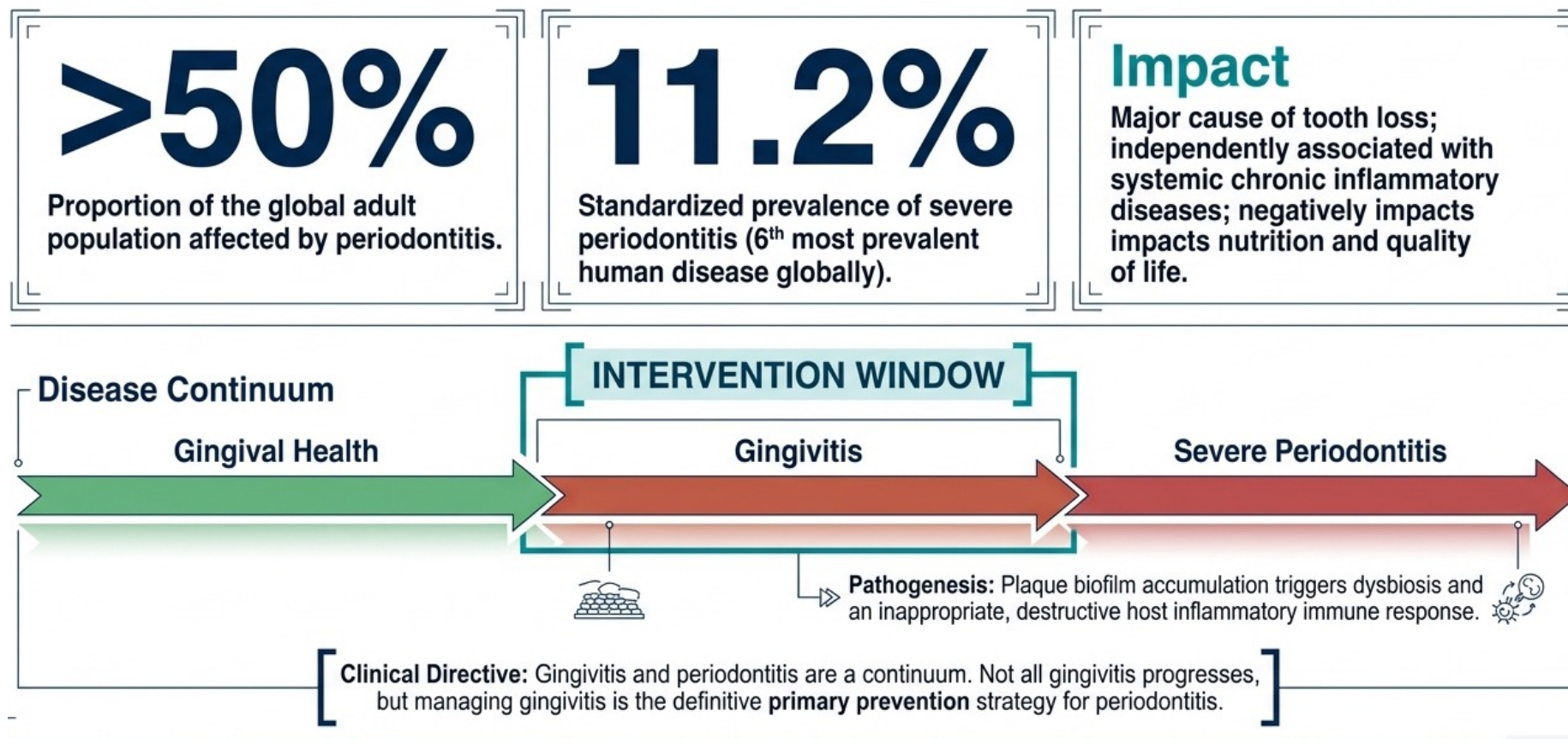
Chapple, I. L., et al. *Journal of clinical periodontology* 2015, 42, S71-S76.

The illustrations in this presentation were generated using AI (Gemini)





# Epidemiological burden

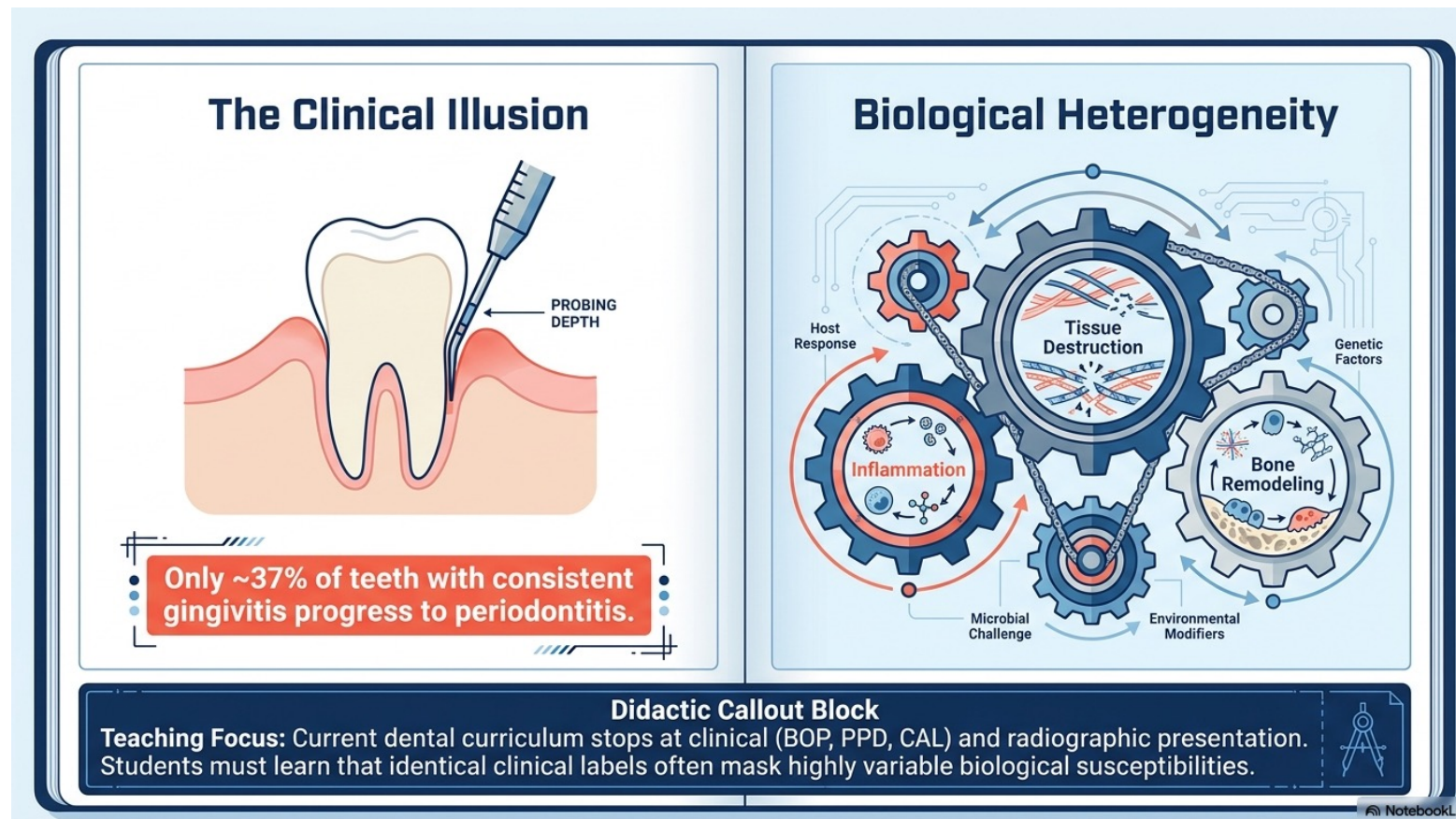






# Contemporary periodontal diagnosis:

## A comprehensive biological approach

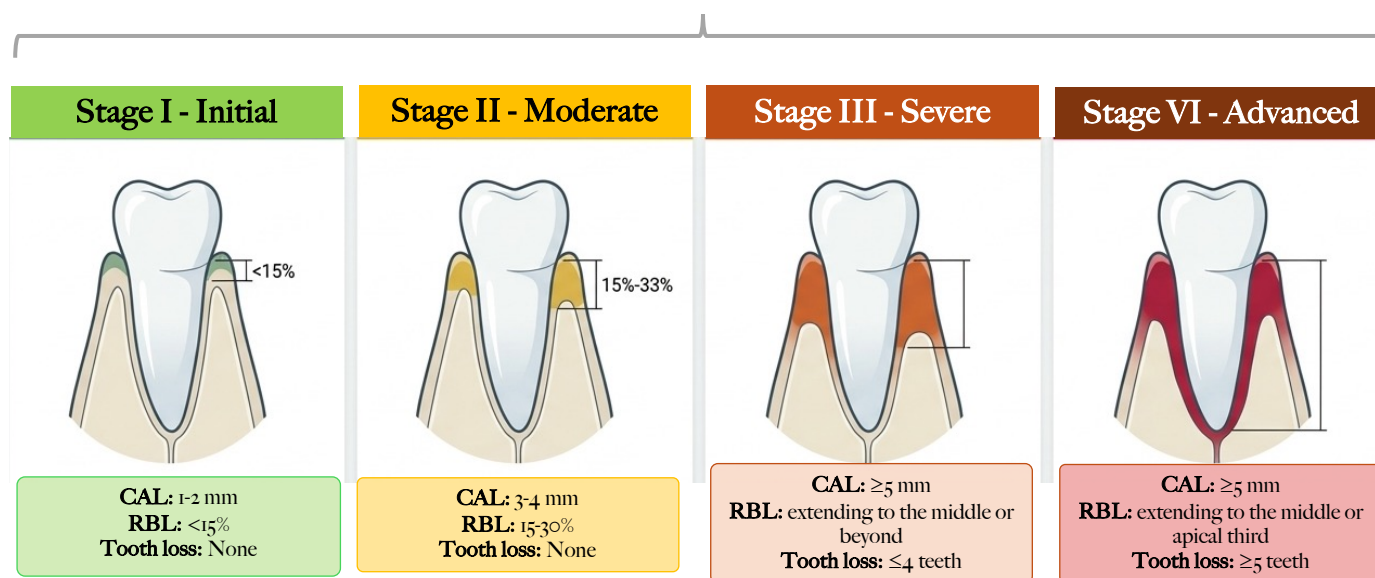




# Contemporary periodontal diagnosis

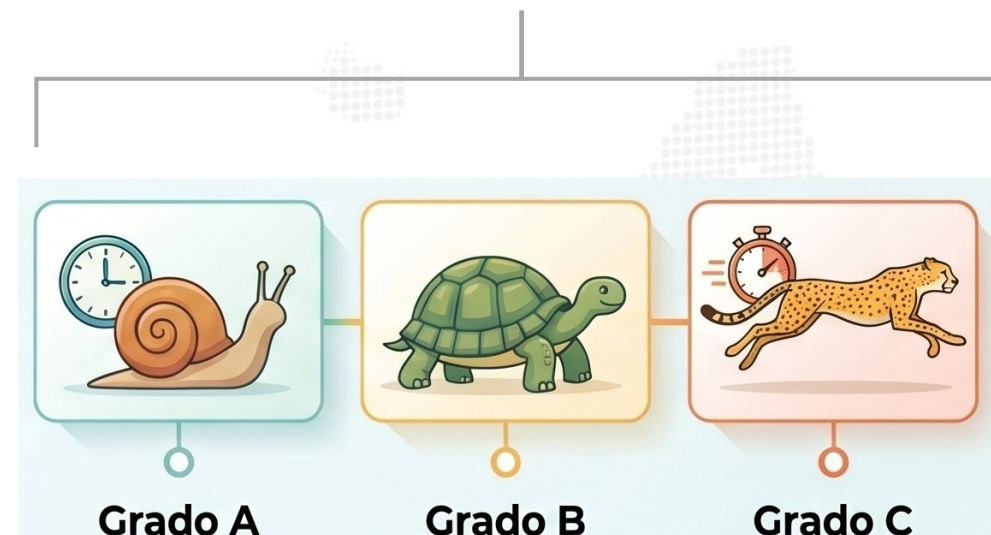
## Staging

Severity based on the worst site



## Grading

Progression rate and risk



Tonetti, M. S., et al. Journal of clinical periodontology 2017, 44(5), 456-462.

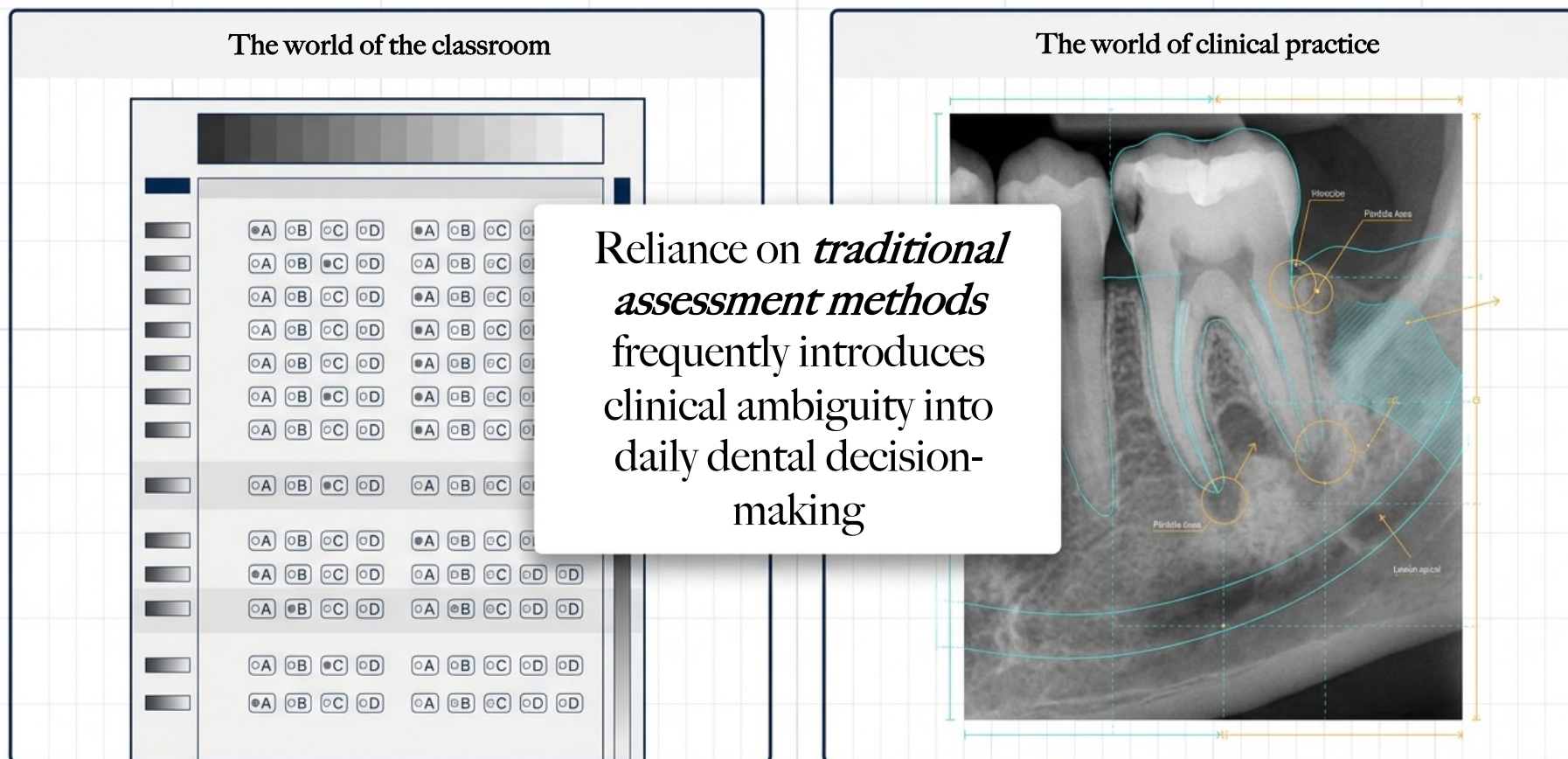
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# The gap between the classroom and the clinic





# Entrustable Professional Activities (EPAs) model

| Traditional periodontal diagnosis                                                                                                                                               | Contemporary periodontal diagnosis                                                                                                                                                                       |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <p><b>Focus:</b> Exclusively macroscopic clinical parameters (e.g., bleeding on probing).</p> |  <p><b>Focus:</b> The complex ecological and molecular etiology of periodontal disease.</p>                           |
|  <p><b>Focus:</b> Superficial standardization that ignores the molecular etiology.</p>         |  <p><b>Update:</b> Ongoing identification of dysbiotic signatures and salivary inflammatory biomarkers.</p>           |
|  <p><b>Result:</b> Students treat patients as abstract clinical exercises.</p>                 |  <p><b>Challenge:</b> Findings from primary research rarely make their way into the classroom in a usable format.</p> |
| <p>Translating fundamental biomedical sciences into applied clinical decision-making remains a persistent challenge in medical education</p>                                    |                                                                                                                                                                                                          |

In dental education, formulating a comprehensive periodontal diagnosis and developing a treatment plan based on biological risk is a critical clinical skill that future dental surgeons must master before graduation

Ten Cate, O. Medical education 2005, 39, 1176-1177.



# Study design

Type of science: Applied (translational educational research)  
Study design: Quasi-experimental (single-group pre- and post-test design)  
Event occurrence: Prospective  
Event sequence: Longitudinal  
Variable control: With intervention

## CARAIPER framework: A schema for situated learning



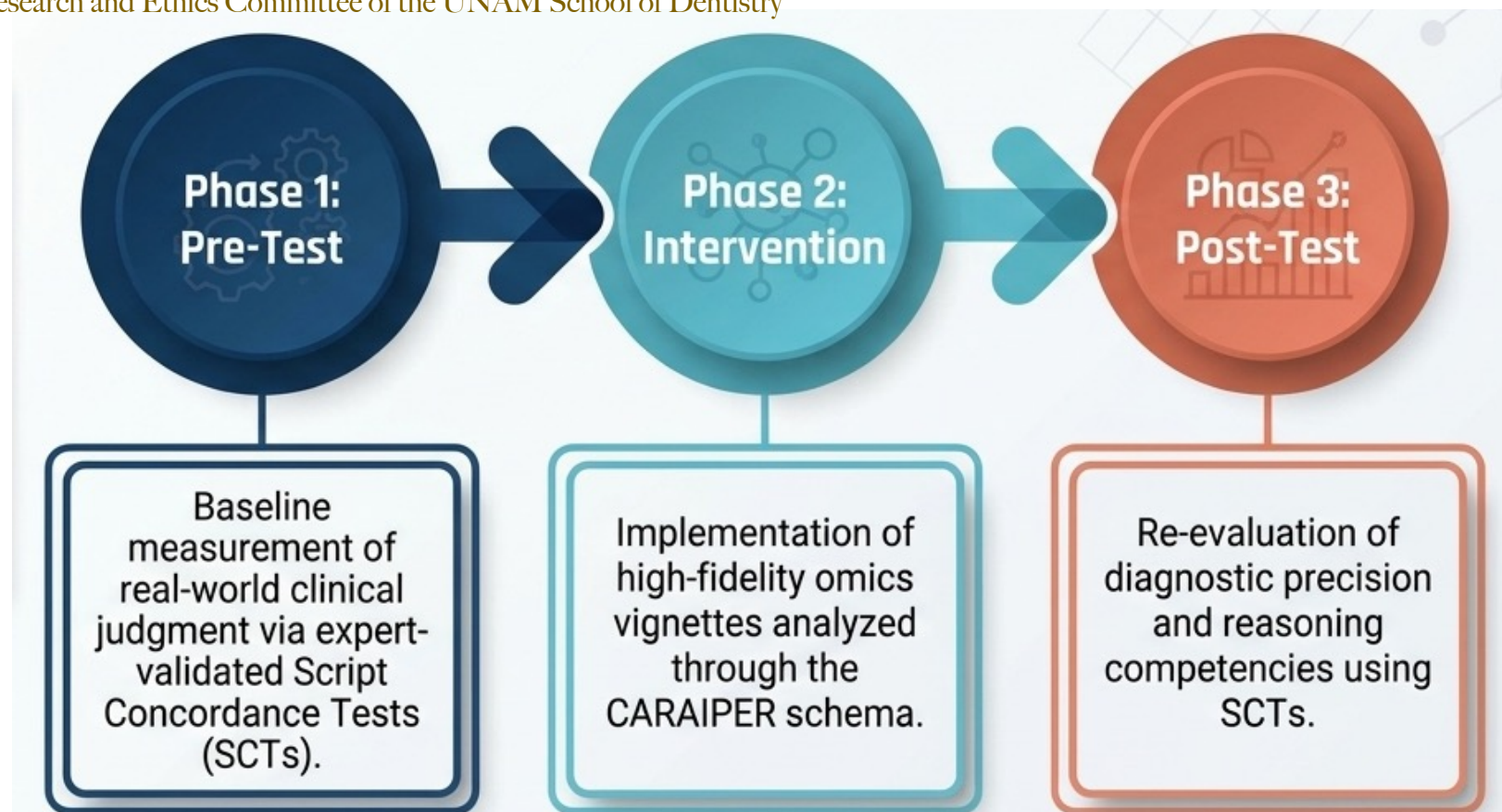
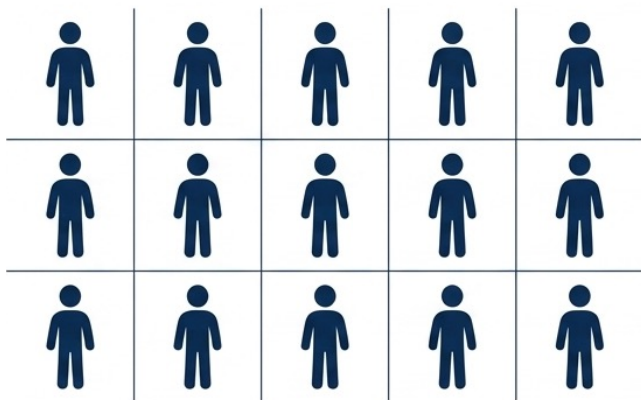


# Study design

CIE/0304/05/2026

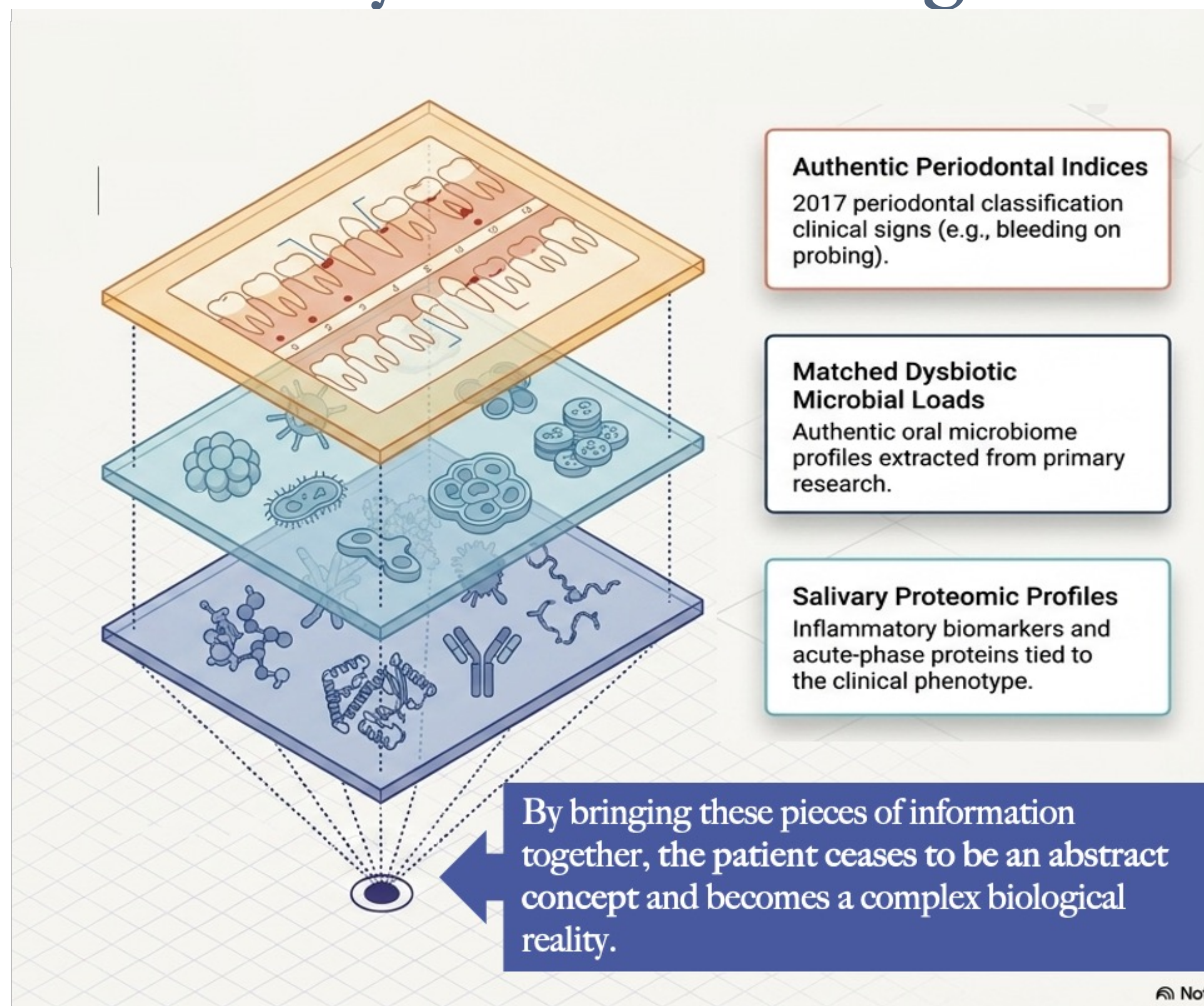
Registration number and approval by the Research and Ethics Committee of the UNAM School of Dentistry

Purposive sample of 15 undergraduate dental students from southern Mexico City (UNAM).





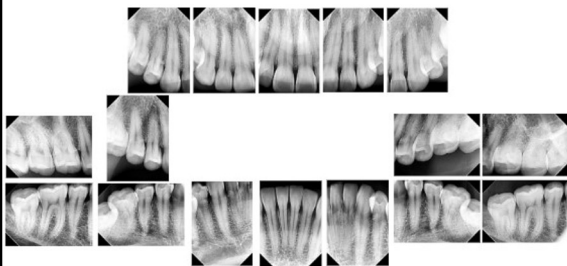
# Anatomy of the clinical vignette







# Clinical vignette



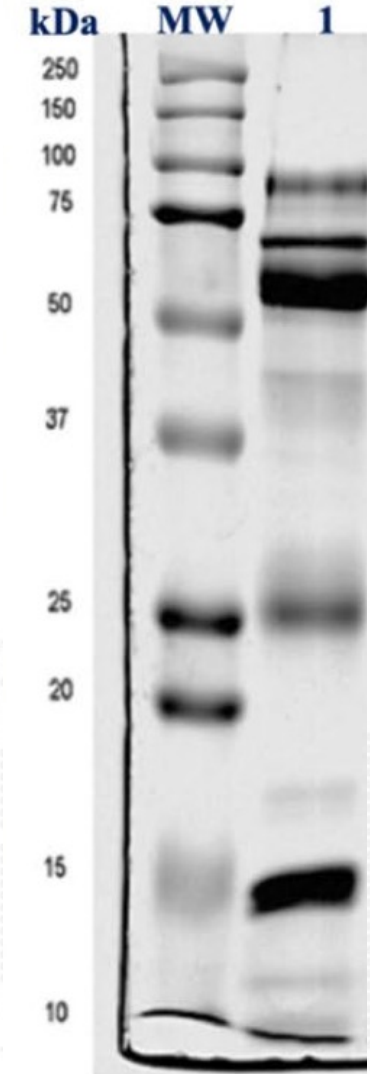
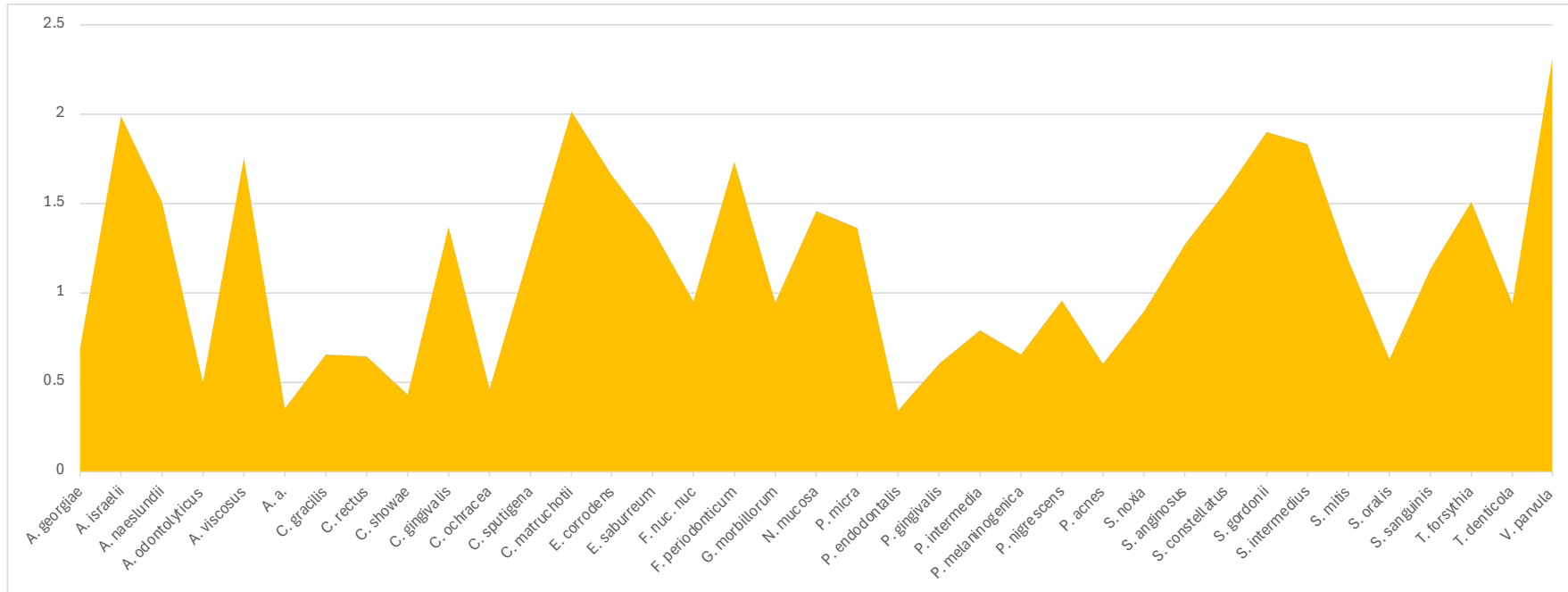
| 168                 | Mean  | SD   | EEM  |
|---------------------|-------|------|------|
| PD                  | 1.98  | 0.46 | 0.04 |
| CAL                 | 1.15  | 0.31 | 0.02 |
| CAL ≥ 5             | 0     |      |      |
| Plaque              | 64.29 | 0.48 | 0.04 |
| Redness             | 8.33  | 0.28 | 0.02 |
| Bleeding on probing | 20.83 | 0.41 | 0.03 |
| Suppuration         | 0.00  | 0.00 | 0.00 |







# Clinical vignette





A 22-year-old patient presents to the dental clinic for a routine periodontal evaluation. The clinical examination reveals inadequate oral hygiene, evidenced by a plaque index of 64%. Periodontal charting demonstrates an intact periodontium with physiological probing depths of  $\leq 2$  mm and no clinical attachment loss.

If you were thinking

Generalized plaque-induced gingivitis on an intact periodontium.

And then you find



| 168                 | Mean  | SD   | EEM  |
|---------------------|-------|------|------|
| PD                  | 1.98  | 0.46 | 0.04 |
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| Bleeding on probing | 20.83 | 0.41 | 0.03 |
| Suppuration         | 0.00  | 0.00 | 0.00 |

The diagnosis becomes

- ☐ Ruled out or almost ruled out
- ☐ Less likely
- ☐ Neither more nor less likely
- ☐ More likely
- ☐ Certain or almost certain

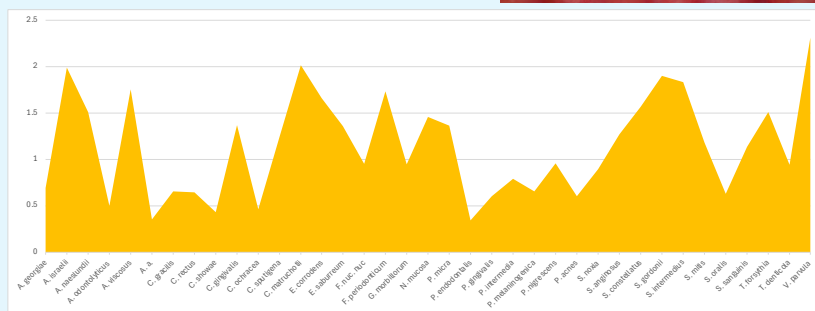
Comments

A 28-year-old female patient presents for a routine periodontal assessment. Clinical examination reveals an intact periodontium with probing depths within physiological limits ( $\leq 3$  mm) and no clinical attachment loss (CAL). Pronounced gingival inflammation is noted, evidenced by a Bleeding on Probing (BOP) score of 40%.

## If you were thinking

# Generalized dental plaque-induced gingivitis on an intact periodontium.

## And then you find



## The diagnosis becomes

- |                                                     |
|-----------------------------------------------------|
| <input type="radio"/> Ruled out or almost ruled out |
| <input type="radio"/> Less likely                   |
| <input type="radio"/> Neither more nor less likely  |
| <input type="radio"/> More likely                   |
| <input type="radio"/> Certain or almost certain     |

## Comments





A 26-year-old male patient, a former heavy smoker with a history of two previous orthodontic treatments, presents for a periodontal evaluation. Clinical examination reveals a generalized and severe inflammatory response, evidenced by a Bleeding on Probing (BOP) score of 60%. Probing depths are within physiological limits ( $\leq 3$  mm); however, a localized Clinical Attachment Loss (CAL) of 1.1 mm is noted, which is attributed to the prior orthodontic therapy rather than periodontitis.

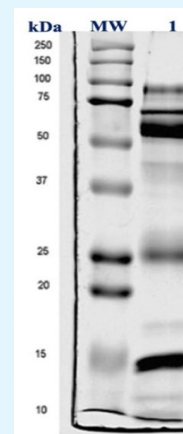
If you were thinking

Periodontitis Stage I

And then you find



Radiographs show intact interproximal crestal bone, but salivary proteomic analysis shows a twofold increase in total hemoglobin concentration and a significant decrease in total salivary alpha-amylase.



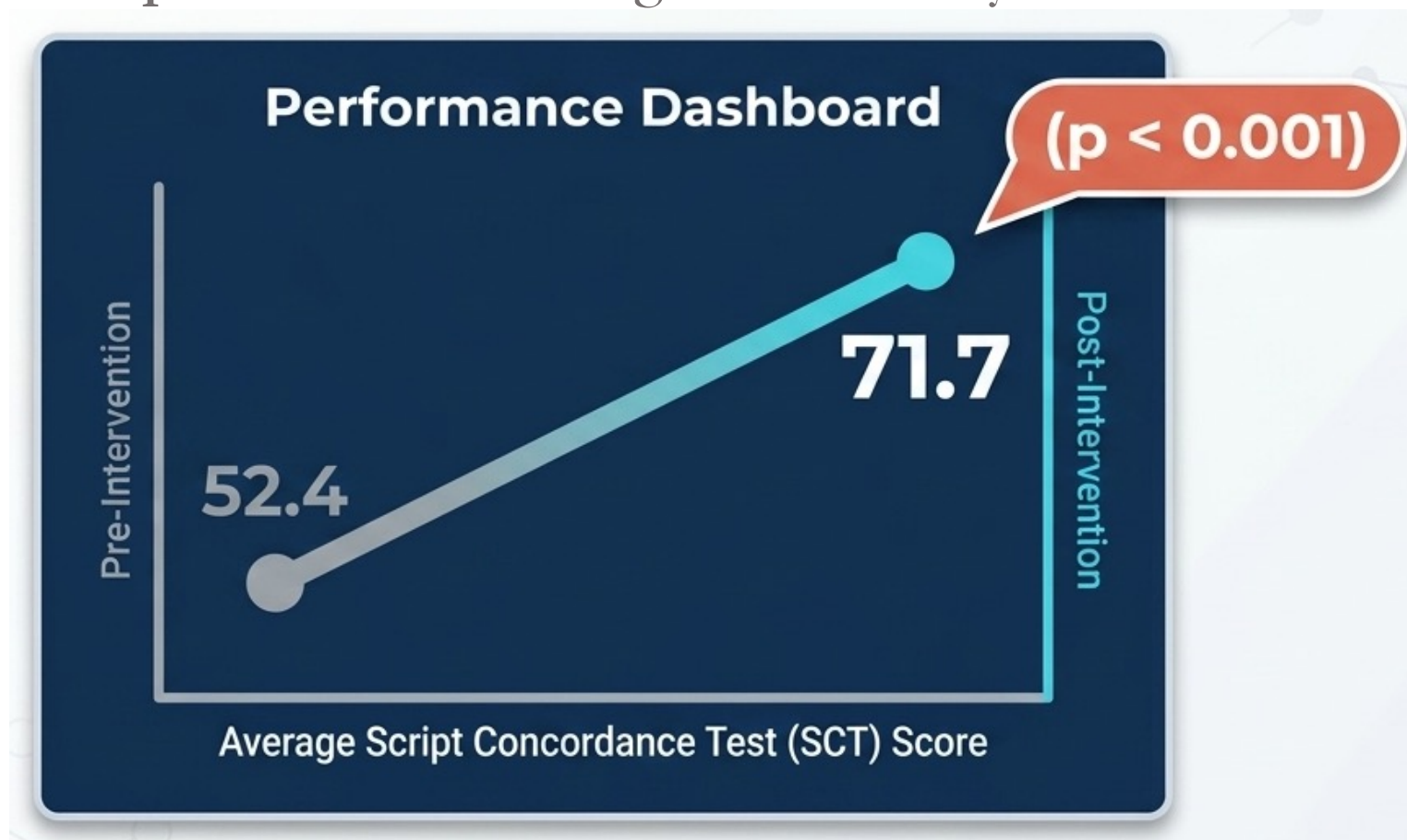
The diagnosis becomes

- ☐ Ruled out or almost ruled out
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Comments

# Results

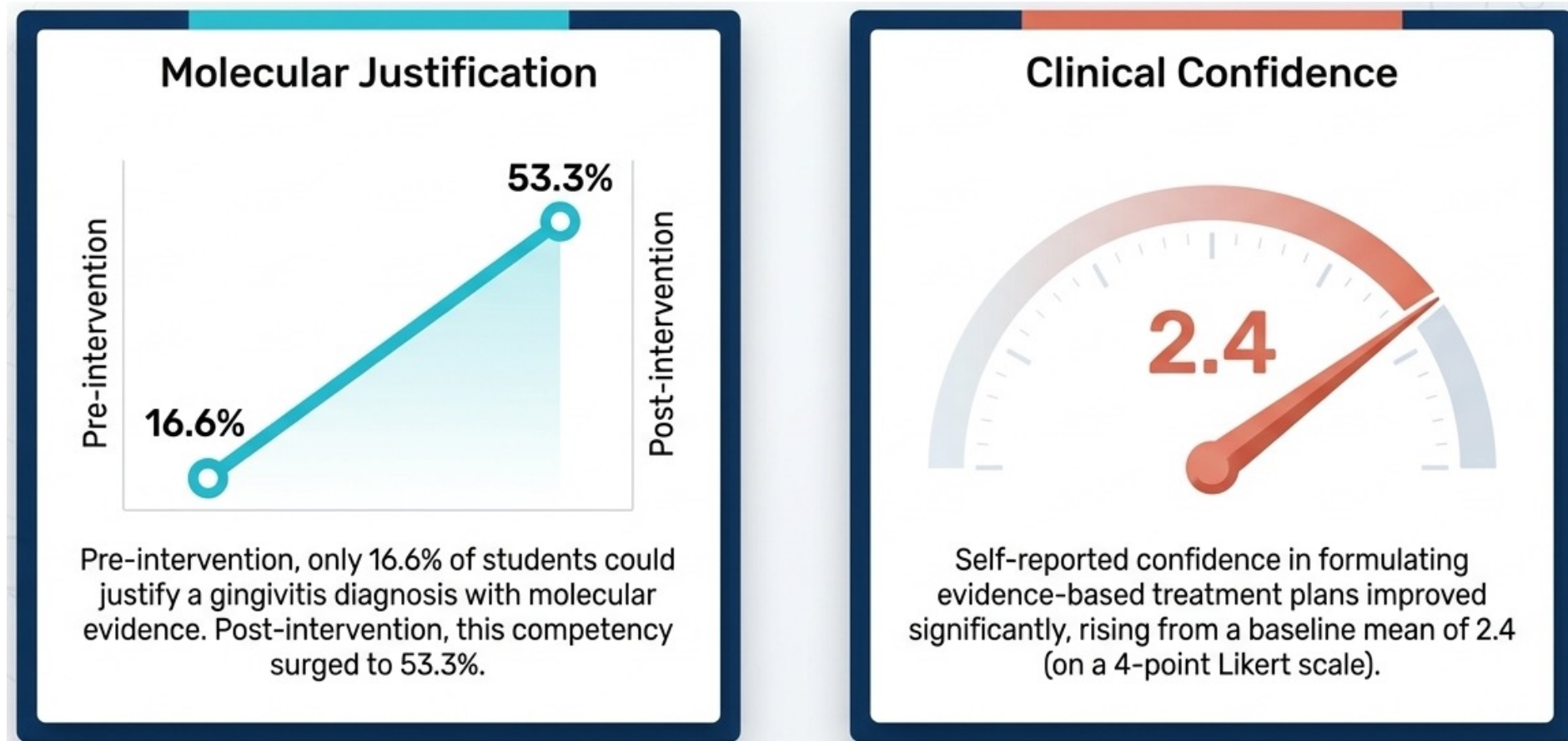
Quantitative impact: Advances in diagnostic accuracy





# Results

## Qualitative impact: Improving molecular justification





# Conclusions

- Integrating primary multi-omic research, specifically salivary proteomics and oral microbiome profiles, into undergraduated dental education through structured pedagogical tools like the **CARAIPER** framework successfully bridges the gap between basic biomedical science and clinical practice.
- Grounding high-fidelity clinical vignettes in authentic molecular data moves dental education beyond superficial diagnostic standardization, driving statistically significant, measurable gains in students' diagnostic precision, ability to justify clinical diagnoses with biological evidence, and overall decision-making confidence as measured by **Script Concordance Testing**.
- Ultimately, this translational approach transforms primary biomedical research into high-impact educational assets, maximizing the educational and social return on research investments while shaping a new generation of biologically grounded dental practitioners.

# References

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# Thank You!

Open for Questions & Discussion



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