PERI EDU

UNDERSTANDING PERI-IMPLANTITIS

From biology to clinical reasoning

A PERI-EDU GUIDE FOR STUDENTS

PERI-EDU – Integrating peri-implantitis research into higher education curriculum

Co-funded by the European Union

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INTRODUCTION

Peri-implantitis is not only a complication around an implant. It is also a useful model for learning modern dentistry.

It connects microbiology, immunology, bone biology, systemic diseases, diagnostic data and clinical reasoning. For students, this makes peri-implantitis an important example of how basic science becomes relevant in real clinical situations.
This guide does not replace textbooks or clinical guidelines. Its aim is to help students understand why peri-implantitis should be seen as a multifactorial disease and how different types of knowledge can be connected when assessing an implant patient.

The key message is simple: to understand peri-implantitis, we need to look not only at the implant, but also at the tissues, the immune response and the patient as a whole.

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CHAPTER 1

PERI-IMPLANTITIS IS NOT ONLY ABOUT BIOFILM

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PERI-IMPLANTITIS IS NOT ONLY ABOUT BIOFILM

Biofilm is the starting point of peri-implant inflammation. Bacteria accumulating around the implant can trigger an inflammatory response in the surrounding tissues.
However, biofilm alone does not explain the whole disease. Some patients develop limited inflammation that can be controlled, while others experience faster bone loss and more difficult disease progression.

This difference is partly related to the host response. The patient's immune system determines how strong the inflammatory reaction will be, how long it will last and whether it will be effectively resolved.

For students, this is one of the most important lessons: peri-implantitis is not only about the presence of bacteria. It is about the interaction between bacteria, tissues and the patient's biological response.

Biofilm initiates inflammation, but the course of peri-implantitis depends on how the patient's organism responds to that challenge.

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STUDENT TAKEAWAY

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CHAPTER 2

WHY IS AN IMPLANT NOT THE SAME AS A TOOTH?

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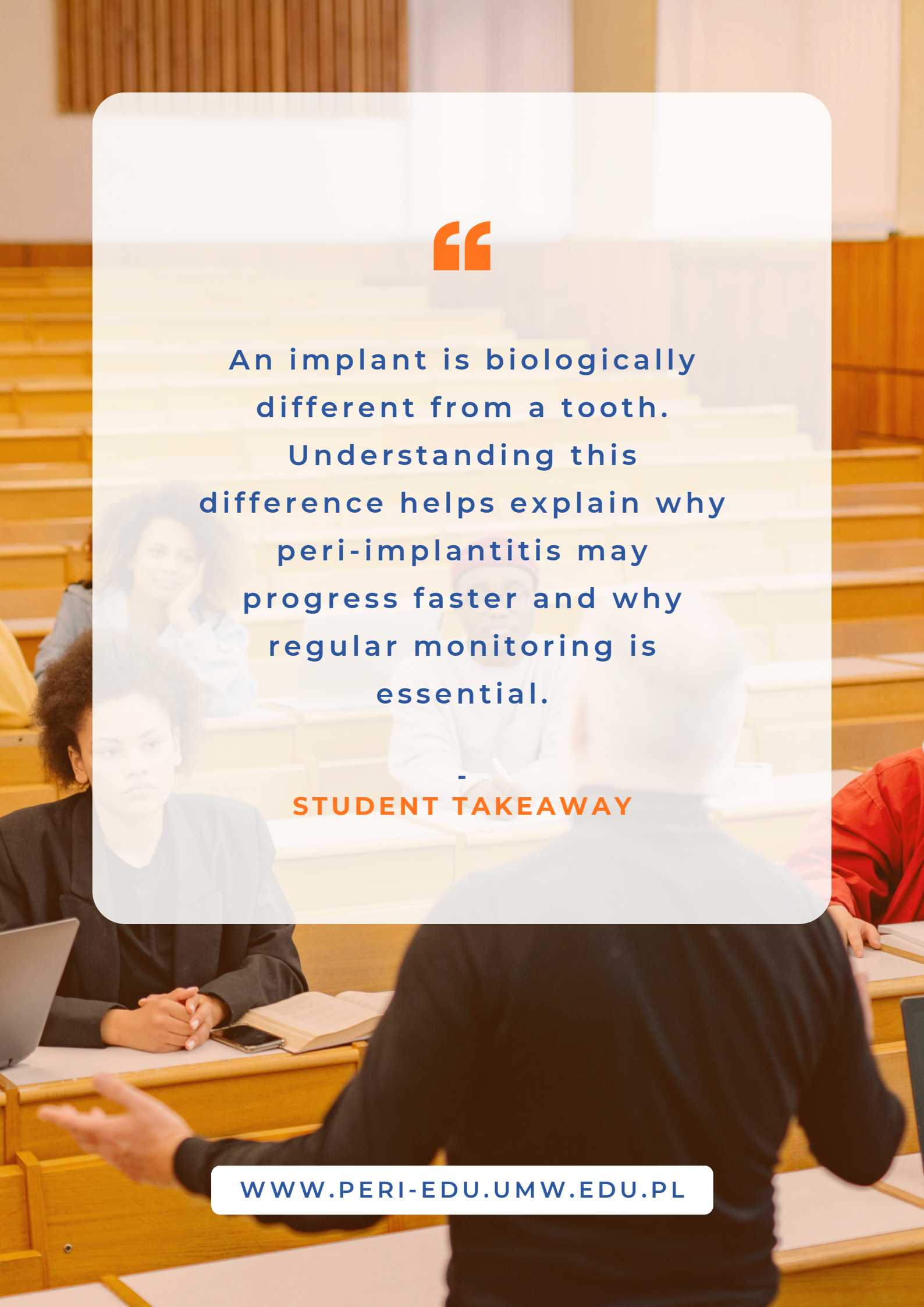
WHY IS AN IMPLANT NOT THE SAME AS A TOOTH?

Peri-implantitis is often compared with periodontitis. This comparison is useful, but it can also be misleading.

A natural tooth is surrounded by the periodontal ligament. An implant is not. Its connection with bone is based on osseointegration, and the soft tissues around an implant are organized differently from tissues around a tooth.

These differences matter. Inflammation around an implant may spread differently, bone loss may progress more rapidly and tissue regeneration may be less predictable.

This is why implants require systematic long-term monitoring. Even mild inflammation around an implant should be taken seriously, because the disease may progress without strong symptoms.



An implant is biologically different from a tooth. Understanding this difference helps explain why peri-implantitis may progress faster and why regular monitoring is essential.

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CHAPTER 3

FROM INFLAMMATION TO BONE LOSS

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FROM INFLAMMATION TO BONE LOSS

Peri-implantitis is an inflammatory disease, but inflammation is not just a word. It is a biological process involving cells, mediators and tissue reactions.

When biofilm triggers inflammation, immune cells release pro-inflammatory cytokines such as IL-1β, IL-6 and TNF-α. These mediators may contribute to the activation of osteoclasts, the cells responsible for bone resorption.

For the clinician, bone loss is seen in radiological images. For the student, it is important to understand that this image is the visible result of a biological process.

Learning peri-implantitis therefore requires connecting basic science with clinical signs. Cytokines, immune response and bone resorption are not abstract topics. They help explain what happens around a failing implant.

Radiological bone loss is not only an image. It reflects biological mechanisms involving inflammation, immune mediators and bone resorption.

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CHAPTER 4

THE PATIENT BEHIND THE IMPLANT

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THE PATIENT BEHIND THE IMPLANT

An implant does not function in isolation. It functions in a patient with a medical history, immune profile, metabolism and lifestyle.

Systemic conditions such as diabetes, obesity, metabolic syndrome, cardiovascular disease, osteoporosis and autoimmune disorders may influence inflammation, healing and bone metabolism. They are not always direct causes of peri-implantitis, but they may modify the patient's risk.
A history of periodontitis is also important. A patient who lost teeth due to periodontal disease does not become biologically "new" after implant placement. The susceptibility to dysbiosis and excessive inflammatory response may still be relevant.

For students, this changes the way an implant patient should be understood. The question is not only whether the implant is placed correctly, but whether the patient's biological environment supports long-term stability.

The implant patient should be assessed as a whole. Systemic health, periodontal history, smoking, metabolic control and supportive care may all influence peri-implant risk.

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CHAPTER 5

HOW TO READ CLINICAL DATA

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HOW TO READ CLINICAL DATA

Peri-implantitis diagnostics is based mainly on clinical and radiological assessment. Important parameters include bleeding on probing, probing depth, suppuration, soft tissue condition, implant mobility in advanced cases and radiological bone loss.

However, these data should not be interpreted separately. A single parameter rarely tells the whole story.

Bleeding on probing may indicate inflammation. Increased probing depth may suggest tissue breakdown. Radiological bone loss shows structural damage. But the meaning of these findings depends on the patient's history, prosthetic design, hygiene, systemic risk and changes over time.

Students should learn not only how to collect data, but how to connect them. Clinical reasoning begins when different pieces of information are interpreted together.

Clinical parameters are meaningful only in context. Good diagnostics requires connecting signs, history, imaging and risk factors.

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CHAPTER 6

BLOOD MARKERS AND INDICES: PROMISE AND CAUTION

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BLOOD MARKERS AND INDICES: PROMISE AND CAUTION

Blood tests may help describe the systemic inflammatory background of a patient, but they do not diagnose peri-implantitis on their own.

Single markers such as CRP, WBC, IL-6, TNF-α and IL-1β can provide information about inflammatory activity. Their limitation is that they are nonspecific. They may change because of infection, chronic disease, medication, metabolic disorders or other inflammatory processes.

Aggregated indices such as NLR, PLR, MLR, SII, SIRI and AISI/PIV try to describe relationships between different elements of the immune response. They may offer a broader view of systemic inflammation than a single marker.

For students, these markers and indices are important not because they are ready-made answers, but because they teach critical thinking. A new parameter can be promising, but it must always be interpreted carefully and in clinical context.

Inflammatory markers and indices may support understanding of the patient, but they cannot replace clinical and radiological assessment

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CHAPTER 7

SIMREX: A RESEARCH CONCEPT, NOT A READY TEST

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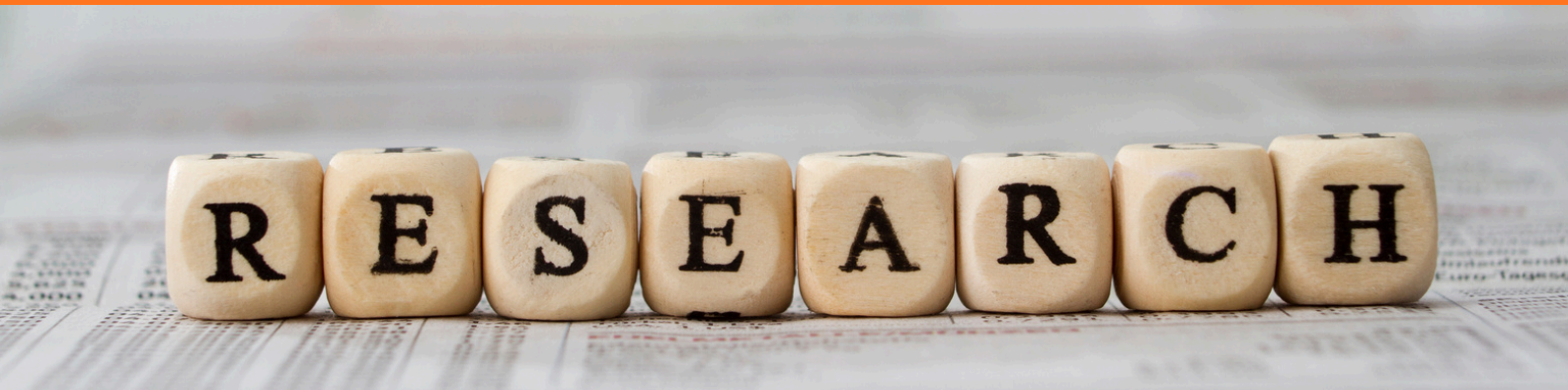
SIMREX: A RESEARCH CONCEPT, NOT A READY TEST

PERI-EDU introduces the concept of SIMREX, the Systemic Implant Immune Response Index.

SIMREX is intended as a project-based immune-inflammatory index related to peri-implant tissue inflammation. It aims to integrate selected blood count parameters in order to better understand the systemic inflammatory background of patients with peri-implantitis.

At this stage, SIMREX should be understood as a research concept, not as a ready clinical diagnostic tool. It requires further development, validation and standardization before any routine clinical use can be considered.

For students, SIMREX is a valuable example of science in progress. It shows how clinical observation can lead to a research question, and how research may eventually influence education and future diagnostic thinking.



SIMREX should be treated as a research direction. Its educational value lies in showing how new ideas move from hypothesis to validation.

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CHAPTER 8

CLINICAL THINKING: CONNECTING THE DOTS

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CLINICAL THINKING: CONNECTING THE DOTS

Understanding peri-implantitis means connecting different levels of information.

A student should be able to move from biofilm to inflammation, from inflammation to bone loss, from bone loss to clinical diagnosis, and from diagnosis to patient-specific risk assessment.

This requires more than memorizing definitions. It requires asking good questions.

Why did inflammation develop?
Why is bone loss progressing?
Is the patient systemically healthy?
Is there a history of periodontitis?
Does the prosthetic design support hygiene?
Are laboratory markers relevant, or are they influenced by other conditions?

Clinical reasoning is the ability to connect these questions into one responsible interpretation of the patient.

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Peri-implantitis teaches that diagnosis is not only about recognizing signs. It is about understanding relationships between biology, clinical data and patient context.

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STUDENT TAKEAWAY

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KEY LEARNING POINTS

- Peri-implantitis is a multifactorial disease.
- Biofilm is essential, but it does not explain everything.
- The host immune response influences disease progression.
- Implants and teeth differ biologically.
- Systemic diseases may modify inflammation, healing and risk.
- Clinical and radiological assessment remains the foundation of diagnosis.
- Blood markers and indices may be useful educational and research tools, but they require cautious interpretation.
- SIMREX is a **PERI-EDU** research concept, not a ready diagnostic test.
- Modern implant education should teach students how to connect biology with clinical reasoning.

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EDUCATIONAL RECOMMENDATIONS

- Teach peri-implantitis as a multifactorial disease, not only as a local bacterial complication.
- Connect basic sciences with clinical practice, especially immunology, microbiology and bone biology.
- Use clinical cases to show how biofilm, host response, systemic disease and prosthetic factors interact.
- Teach students to interpret clinical, radiological and laboratory data in context.
- Present new markers and indices critically, distinguishing between research concepts and validated clinical tools.

FINAL SUMMARY

Peri-implantitis is a valuable model for learning modern dentistry because it connects biology with clinical decision-making.

For students, the most important lesson is not only how to recognize peri-implantitis, but how to understand why it develops, why it progresses differently in different patients and how multiple types of data should be interpreted together.

The **PERI-EDU** project supports this educational perspective by translating current peri-implantitis research into teaching resources that help future dental professionals think more critically, biologically and clinically.

Education should reflect the complexity of the disease.

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EDUCATIONAL NOTE

This material is educational in nature and does not replace individual diagnostics, therapeutic decision-making or current clinical guidelines.

Inflammatory markers, aggregated indices and the SIMREX concept should be interpreted as elements of research and education developed within the **PERI-EDU** project, not as standalone diagnostic tools ready for routine clinical use.

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PERI-EDU
INTEGRATING PERI-IMPLANTITIS RESEARCH INTO HIGHER EDUCATION CURRICULUM

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