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REVIEW

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Structure, governance and delivery of specialist training programs in periodontology and implant dentistry

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Abstract

Aim: To update the competences and learning outcomes and their evaluation, educational methods and education quality assurance for the training of contemporary specialists in periodontology, including the impact of the 2018 Classification of Periodontal and Peri-implant Diseases and Conditions (2018 Classification hereafter) and the European Federation of Periodontology (EFP) Clinical Practice Guidelines (CPGs).

Methods: Evidence was gathered through scientific databases and by searching for European policies on higher education. In addition, two surveys were designed and sent to program directors and graduates.

Results: Program directors reported that curricula were periodically adapted to incorporate advances in diagnosis, classification, treatment guidelines and clinical techniques, including the 2018 Classification and the EFP CPGs. Graduates evaluated their overall training positively, although satisfaction was limited for training in mucogingival and surgical procedures related to dental implants. Traditional educational methods, such as didactic lectures, are still commonly employed, but they are now often associated with more interactive methods such as case-based seminars and problem-based and simulation-based learning. The evaluation of competences/learning outcomes should employ multiple methods of assessment.

Conclusion: An update of competences and learning outcomes of specialist training in periodontology is proposed, including knowledge and practical application of the 2018 Classification and CPGs. Harmonizing specialist training in periodontology is a critical issue at the European level.

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KEYWORDS
competences, learning outcomes, periodontology, quality assurance, specialist training

Clinical Relevance

Scientific rationale for study: An update in terms of competences and learning outcomes, teaching methods, evaluation and quality assurance was needed in specialist training in periodontology.

Principal findings: Responses to a survey among graduates reflected overall satisfaction with their training; among program directors, necessary changes in competences were identified. Continuous changes for improvement in education are mandatory for achieving self-satisfaction of the graduates, quality service (including quality assurance processes) and patient needs and expectations.

Practical implications: European Federation of Periodontology (EFP)-accredited programs have made a step forward in conforming to common quality standards and shared competency-based curricula.

INTRODUCTION

Providing the population with high-quality and safe oral care is a process that requires proficient, skilled and highly trained dental professionals. In order to provide tools for acceptable standards in the general practice of dentistry, the Association for Dental Education in Europe (ADEE), the American Dental Association (ADA), the American Dental Education Association (ADEA), as well as other dental organizations have produced a series of guiding documents. In these documents, a minimum set of academic and clinical competences for undergraduate dental education have been defined (American Dental Education Association, 2017a, 2017b; Commission on Dental Accreditation, 2022; Sanz & Meyle, 2010). Although dental graduates may, thereby, be able to provide adequate care in the treatment of the majority of basic and most prevalent oral health problems, the expectation that any undergraduate dental curriculum should provide sufficient knowledge and experience to deal with more complex clinical situations is unmeetable. Such advanced treatments may require extended competences, which are obtained by postgraduate dental training in key areas of dentistry, in some cases aiming at the level of specialized training. A third and intermediate pillar of education, namely continuous education, including vocational education and training, is described in detail in another review (Meyle et al., 2024).

Similar to the field of general medicine, continuous professional development and specialization describes a focus on studying a specific sub-field of dentistry. A wide range of university-accredited postgraduate programs in different fields of dentistry, including periodontology, are currently available in Europe, including Master of Science (MS), Master in Clinical Dentistry (M.Clin.Dent.) and Doctorate in Clinical Dentistry (D.Clin.Dent.), which can be obtained with part-time or full-time attendance. Specifically, the goal of education at the specialist level in dentistry is to ensure that dentists become competent, and even proficient, to practice in their specific field of dentistry. Adequate specialist training should include a combination of academic, clinical and research activities endorsed by academic establishments (universities or hospitals) and implemented by the specific training programs. The European Directive 2005/36/EC defines, in article 35, the need for specialist dental training (The European Parliament and the Council of the European Union, 2005): 'Full-time specialist dental courses shall be of a minimum of three years' duration supervised by the competent authorities or bodies. It shall involve the personal participation of the dental practitioner training to be a specialist in the activity and in the responsibilities of the establishment concerned'. To avoid confusion with the terminology, we specifically focus on Level 8 of the European Qualifications Framework (EQF) (Council of the European Union, 2017), although in terms of training cycle of the Bologna process, it fits better within Cycle 2, Master level (Bologna Working Group on Qualifications Frameworks, 2005).

Specialist training is particularly relevant within the dental discipline of periodontology, in view of the diverse challenges that the treatment of severe periodontal and peri-implant conditions entail. These include patient management, a variety of non-surgical and surgical procedures and the complex management of complications related to Stage IV periodontitis, including multidisciplinary treatment approaches and advanced interventions in implant dentistry (Herrera et al., 2022). The need for the specialty of periodontology to be fully recognized at the European level was raised many years ago (Sanz et al., 2006). At a global level, the surveys of the Global Periodontal Health Project of the Word Dental Federation (FDI) found that periodontology was a formally recognized specialty in 42 countries in 2017 (68% of the 57 responses) (FDI Global Periodontal Health Project, 2017) and 47 countries in 2019 (FDI Global Periodontal Health Project, 2019).

During his/her training, a specialist in periodontology needs to achieve specific high-level knowledge and capabilities relevant to the specialty and be trained in a specific well-organized program, enabling continuous supervision and tutoring. The need to establish the scope, competences, proficiencies and learning outcomes in postgraduate periodontal education has been recognized by the European Federation of Periodontology (EFP). Following the 2009 Workshop on

Periodontal Education, a document was published that outlined these competences, proficiencies and learning outcomes (Van der Velden & Sanz, 2010). This consensus report was the basis for the EFP 'Quality Standards for Graduate Programs in Periodontology, Periodontics and Implant Dentistry', most recently updated in 2019 (European Federation of Periodontology, 2019), and served as a guide for the curricula of numerous EFP-accredited periodontal postgraduate programs in Europe and elsewhere.

In addition to the definition of the scope, competences, proficiencies and learning outcomes of specialist training programs in periodontology, the 1st European Consensus Workshop on Periodontal Education (Sanz & Chapple, 2010) also covered education methods, evaluation of competences and quality assurance. As recently highlighted by the position paper on the development of a renewed vision for oral health professional education across Europe, overall there has been greater emphasis on evidence-based medicine (Field et al., 2023). In addition, significant efforts have been made in developing integrated curricula and in promoting student-centred learning, while also trying to account for society needs and sustainability.

Finally, specialist training in periodontology has been impacted by many different factors since the publication of the consensus report of the 2009 Workshop on Periodontal Education. Among those factors, the development of the 2018 Classification of Periodontal and Peri-implant Diseases and Conditions (2018 Classification hereafter) at the 2017 World Workshop on the Classification of Periodontal and Peri-implant Diseases and Conditions (Caton et al., 2018) and the EFP S3-level CPGs (Herrera et al., 2022, 2023; Sanz et al., 2020) have greatly impacted clinical practice and, consequently, specialty education programs in periodontology. These programs must update their curricula to reflect the new classification and guidelines, possibly by adding new teaching and evaluation methods or providing additional training. Students should be taught and evaluated on this new knowledge and skills at a professional level.

Therefore, the present paper aims to assess and update the competences and learning outcomes (Section 1) and their evaluation, educational methods and education quality assurance (Section 2) for the training of a contemporary specialist in periodontology, aiming to promote a progressive harmonization and shared standards, and to examine the impact of the 2018 Classification and EFP CPGs on competencies and teaching and assessment methods (Section 3).

SECTION 1 – SPECIALIST TRAINING IN PERIODONTOLOGY: COMPETENCES AND LEARNING OUTCOMES

1 | OBJECTIVES

The aim of Section 1 (prepared by Moshe Goldstein, Jan Derks, Bahar Eren Kuru and David Herrera) of this paper is, within the context of the 19th European Workshop on Periodontology and 2nd European Consensus Workshop on Periodontal Education, to critically assess, with a view to update, the competences and learning outcomes that were established in the 2010 consensus report (Van der Velden & Sanz, 2010), within the framework of the 1st European Consensus Workshop on Periodontal Education, adapted for the training of a contemporary specialist in periodontology. An update is justified, as the field of periodontology has evolved, among many aspects, in terms of diagnosis, classification, treatment guidelines and clinical techniques.

2 | METHODS & SURVEYS

In the preparation of the current work, two major references were considered:

- The consensus report from the 2009 Workshop (Van der Velden & Sanz, 2010);
- The EFP Quality Standards for Graduate Programs in Periodontology (European Federation of Periodontology, 2019).

2.1 | Survey among program directors

In addition, information was obtained from program directors of the currently EFP-accredited periodontal postgraduate programs (22 programs as of June 2023). Some of that information was informally obtained by means of interviews and direct questions. In parallel, a structured questionnaire (Appendix S1) was distributed among all program directors by means of Google Forms. The survey addressed numerous questions in the context of the Education Workshop, some of them relevant to the topics of this paper. The questionnaire was sent to the 22 program directors on 22 June 2023, and reminders were sent twice, until 10 July, by which date all responses were available.

The questions to the program directors, relevant for Section 1, were the following:

- What were the major changes in the curriculum and management of their program since the consensus report from the 2009 Workshop (Van der Velden & Sanz, 2010), or since EFP accreditation if accredited later than 2010? What additions to an updated competences document would they expect, and which ones from the 2010 article are not required anymore?
- How were the 2018 Classifications, with a specific focus on the most recent versions (Caton et al., 2018), implemented in their program?
- How were the most recent clinical guidelines for treatment of periodontal and peri-implant diseases (Herrera et al., 2022, 2023; Sanz et al., 2020) implemented in their program?

The programs directors reported that the curricula were periodically adapted to advances in diagnosis, classification, treatment guidelines and clinical techniques. They proposed, for the updated document on competences, to focus on periodontology-related research projects,

to expand the expected clinical experience of the students in periodontology— especially in implant-related procedures. According to the survey, the 2018 Classification as well as the EFP treatment guidelines were already fully introduced and well implemented in the majority of programs. The directors expected these advances to be introduced in the present learning outcomes document.

2.2 | Survey among graduates of EFP-accredited periodontal postgraduate programs

Feedback from graduates from EFP-accredited periodontal postgraduate programs was obtained as well, also using a structured questionnaire (Appendix S2), disseminated through Google Forms. The digital link to the questionnaire was shared with the program directors, who forwarded the invitation to the graduates of their respective programs: the survey was accessible from 16 June to 9 July 2023, and 202 responses were recorded. The survey evaluated the relevance and quality of all aspects of the completed training (lectures, seminars, clinical activity, research) from the students' point of view and the training's relevance in relation to the professional activity after graduation.

Mostly, the graduates provided positive evaluations of the lecture and seminar content as well as the research projects. Former students also gave consistently positive scores for the training in surgical periodontal procedures. Satisfaction was limited, however, in terms of both the quantity and quality of training in mucogingival procedures, especially for older graduates. The graduates gave somewhat positive scores for the training in placement of dental implants. In general, older graduates gave lower scores when compared to younger graduates. Similar trends were observed for surgical procedures related to dental implants, such as sinus lifting or bone regeneration, but with overall lower satisfaction scores (Appendix S3).

In addition to the major references presented before, and the results of the surveys, the experience following evaluation of the developments and changes in postgraduate programs and the results of a multitude of final EFP exams in the last 10 years were also considered.

3 | REVIEW

3.1 | Competences and proficiencies in periodontal education at the specialist level

The 2010 consensus report on postgraduate periodontal education (Van der Velden & Sanz, 2010) defined *competence* and *proficiency* as follows.

A ***competent*** clinician is responsible for carrying out a given procedure while requiring little or no advice to complete the task. He/she should be able to complete such a procedure within a reasonable time period, given the individual circumstances. He/she displays understanding of the underlying rationale of a decision, and is able to discuss a range of possible treatment options and appropriately defend a treatment decision. He/she should be able to anticipate complications and unexpected treatment outcomes and to discuss and propose possible remedial action with patients and staff. He/she can maintain 'professional' contact with the patient and staff and display appropriate caring behaviour. He/she should be able to reflect on clinical experience and identify positive learning aspects unaided. These competences are a blend of knowledge, skills and attitudes, appropriate to the individual aspects of the profession. This level of performance requires some degree of speed and accuracy consistent with patient well-being but not necessarily performance at the highest level possible. For postgraduate advanced training, aiming at specialist training, there is a need for a higher level of performance in a specific area of dentistry, such as periodontology/periodontics, where this blend of knowledge, skills and attitudes is raised to be appropriate for the specialist level. In the competence-based curriculum, this higher level of performance is defined as proficiency.

A ***proficient*** clinician is responsible for carrying out the procedure, requiring no advice to complete the task, in a timely manner. He/she should be able to undertake competently some procedures that are beyond standard/basic level. He/she should be able to demonstrate an understanding of the indications, process and expected outcomes of the procedure to peers. He/she should be able to provide a logical, sequenced and integrated treatment plan, considering the patient's needs, wishes and level of co-operation. He/she should be able to reflect easily and accurately and identify future self-development needs.

3.2 | Scope of a postgraduate periodontal program aimed at training specialists in periodontology

During his/her training, a specialist in periodontology needs to achieve high-level knowledge, competences and clinical skills relevant to the specialty in a dedicated program within a supervised environment. A specialist training program in periodontology should comprise a minimum of 3 years of full-time studies, or its part-time equivalent, enabling the trainee to practice periodontics and implant dentistry at a specialist level upon completion. The curriculum must consist of a didactic, a clinical and a research component.

During training, the doctors need to be continuously mentored, monitored and assessed to ensure the level of acquired competences and proficiencies. At the end of the program, a final examination, including evaluation of clinical knowledge and performance, and defence of the research thesis should be performed by the academic institution. The addition of external examiners is strongly recommended.

3.3 | Requirements prior to specialist periodontal training

Before the dentist is enrolled in a specialist training program in periodontology, the fulfilment of different prerequisites is recommended, as detailed in Table 1.

TABLE 1 Requirements prior to specialist periodontal training.

Requirements prior to training	1. Have a university degree in dental medicine/surgery. 2. Have more than basic knowledge of the English language. As the vast majority of the scientific literature is written in English, the student should be able to read, understand and report the content of a scientific/clinical article. 3. For international students (not from the country of the training facility), have knowledge of the local language at a level that allows proper communication with patients in their mother language. 4. Have knowledge of the diverse anatomical features of the head and neck including the temporo-mandibular joints, maxillary sinuses, blood and nervous pathways, and their interrelated functional aspects. 5. Be competent in basic sciences and clinical aspects relevant to general dentistry. 6. Have knowledge of those aspects of general medicine relevant to clinical dentistry: a. Know how to measure blood pressure, pulse and use of a pulse-oximeter. b. Knowledge of basic parameters included in general blood tests. c. Basic knowledge of pharmacology and pharmacotherapy: types of antibiotics, their indications and contraindications, types of analgesics, their indications and contraindications, existing anticoagulants and their effects, etc., including possible drug interactions with local/systemic medications or local anaesthetics used in dental practice. d. Know how to obtain a medical anamnesis and thereby assess the degree of risk (using a modified version of the American Society of Anesthesiologists [ASA] score or other scientifically validated method, not including a general medical physical exam). 7. Be familiar with digital word processing, spreadsheet and presentation software. 8. Previous clinical experience, practising general dentistry after graduation.

3.4 | Learning outcomes in periodontal education at the specialist level

3.4.1 | Didactic components

The didactic component may be delivered using different learning methods but must include an extensive overview of the periodontal literature, both current and historical.

On completion of the course, the trainee is expected to have accomplished the learning outcomes presented in Table 2, within the didactic component of the course.

3.4.2 | Clinical performance components

The clinical component must include the treatment of patients referred for periodontal therapy at different levels of complexity and of patients in need of implant therapy. The trainee is required to fulfil the set of competences and proficiencies defined below.

Upon completion of the course, the trainee is expected to have accomplished the following skills, either as general learning outcomes (Table 3) or as specific learning outcomes (Tables 4a and 4b), within the clinical component of the course.

3.4.3 | Research components

The research component should include the undertaking of a research project by the trainee, and results should be presented in the form of a written report or publication.

Upon completion of the course, the trainee is expected to have accomplished the outcomes in the research component of the course, as presented in Table 5.

3.5 | Methods/requirements for the program for achieving the learning outcomes in periodontal education at the specialist level

In order to achieve the competences, proficiencies and learning outcomes expected at the specialist level, the program should meet different standards for the course, for the faculty, for the training facility and its clinical activity, for the monitoring system (Table 6) and for the curriculum and its different components (Tables 7a and 7b).

4 | DISCUSSION

The 1st European Consensus Workshop on Periodontal Education in 2009 established the scopes, competences, proficiencies and learning outcomes in postgraduate periodontal education, aimed at the training of contemporary specialists in periodontology. The competences and learning outcomes were subsequently published in the 2010 consensus report (Van der Velden & Sanz, 2010). This consensus was the basis for the quality standards for periodontal postgraduate programs aiming to obtain EFP accreditation (European Federation of Periodontology, 2019), and the learning outcomes were to serve as a framework for the respective curricula.

Although the general structure of postgraduate periodontal education remains unchanged, several critical advances within clinical periodontics (periodontology and implant dentistry) have taken place since the 2009 Workshop. These include, among others, the domains of diagnostics, disease classification and therapeutic procedures. The modern specialist in periodontology is expected to perform more complex and diverse therapies, dealing with periodontal and peri-implant diseases.

TABLE 2 Learning outcomes in periodontal education at the specialist level—Didactic component.

1. Be proficient in the basic sciences relevant to periodontology and implant dentistry
a. Understand the biology of cell function, cell-to-cell interactions, cell–matrix interaction, regulation of cellular function and the role of cytokines and growth factors.
b. Have comprehensive knowledge of the principles related to wound healing and regeneration.
c. Have comprehensive knowledge of the composition of dental biofilm and its chemical and microbial structure at teeth and implants. Be proficient in the literature pertaining to the relationship between dental biofilm and periodontal/peri-implant diseases, and have a basic understanding of culture techniques and tests to identify bacterial strains.
d. Have comprehensive knowledge of the microbial flora related to the oral environment (supra- and sub-gingival) in subjects with or without teeth/implants.
e. Have comprehensive knowledge of the effects of antibiotics on micro-organisms associated with periodontal and peri-implant diseases. Have comprehensive knowledge of the scientific evidence on the benefits and risks associated with the use of antibiotics in the management of these diseases.
f. Have comprehensive knowledge of antiseptic and antimicrobial products (e.g., mouth rinses, local application devices, etc.) and their role in the control of bacterial plaque as well as their effectiveness in the treatment of periodontal/peri-implant diseases.
g. Have comprehensive knowledge of the pathogenic mechanisms of inflammation, the pathogenesis of gingival inflammation and the effects of inflammation on periodontal and peri-implant tissues. Be competent in the histopathological development of periodontal and peri-implant diseases.
h. Know the (cellular) immunological mechanisms involved in the inflammatory response in periodontal and peri-implant soft tissues.
i. Know the various (cellular) mechanisms leading to loss of periodontal attachment.
j. Know the various (cellular) mechanisms leading to peri-implant bone loss.
k. Have comprehensive knowledge of bone biology and socket healing, including the cellular reactions in the process of bone formation and remodelling.
2. Be competent in all clinical aspects of periodontology and implant dentistry
a. Have comprehensive knowledge of the macro- and micro-anatomy and histology of periodontal and peri-implant structures.
b. Have comprehensive knowledge of the biological and clinical mechanisms related to bone formation, bone grafting and bone regeneration.
c. Have a complete understanding of the process of osseointegration as well as the biology of transmucosal soft-tissue integration.
d. Have a complete understanding on the integration of basic sciences with clinical aspects of periodontal/peri-implant health and disease.
e. Have knowledge of modern implant designs and systems. Have knowledge of the metallurgical and chemical structures of dental implants.
f. Know the types, advantages/disadvantages and clinical indications of reconstructive materials, including barrier membranes, bone substitute materials and biologically active agents.
g. Have comprehensive knowledge of the restorative, endodontic and orthodontic aspects related to periodontal and implant therapy.
h. Have comprehensive knowledge of the inter-relationship between periodontitis and pulpal diseases.
i. Understand the timing of adjunctive orthodontic, restorative and prosthetic therapy in all phases of multidisciplinary treatment.
j. Have a good understanding of the effect of prosthetic/restorative therapy on natural dentition and dental implants.
k. Have knowledge of possible interactions between occlusal discrepancies and periodontal or peri-implant disorders.
l. Have knowledge of how to evaluate and interpret both normal and pathological structures identified on two-dimensional (periapical/orthopantomogram) and three-dimensional (computerized tomography) technology.
3. Have comprehensive knowledge of clinical epidemiology with an emphasis on periodontal/peri-implant diseases, as well as the importance of public health service respecting the ethnicity, gender and cultural diversity of patients.
4. Have comprehensive knowledge of classifications of periodontal and peri-implant diseases/disorders with a specific focus on the most recent versions:
a. All forms of periodontal diseases in both adult and young patients and their differential diagnoses.
b. Clinical features and diagnosis of gingivitis.
c. Clinical features of the different stages and grades of periodontitis.
d. Clinical features and differential diagnoses of peri-implant diseases.
e. Clinical features and differential diagnoses of mucogingival defects and irregularities at teeth, implants and edentulous ridges.
f. Clinical manifestation and diagnoses of periodontal and peri-implant acute/emergency situations.
5. Have comprehensive knowledge of clinical guidelines pertaining to the management of periodontal and peri-implant diseases, following current guidelines.
a. Have comprehensive knowledge of the effects of patient-performed plaque control measures in cases of gingivitis and periodontitis.
b. Have comprehensive knowledge of the science behind and clinical effects of behavioural interventions (including tobacco cessation and life style and dietary advice).
c. Have comprehensive knowledge of the effects of professionally performed non-surgical therapy on periodontal diseases.
d. Have comprehensive knowledge of the effects of professionally performed non-surgical therapy of peri-implant mucositis and peri-implantitis.
e. Have comprehensive knowledge of the effects of systemic antibiotics in conjunction with non-surgical therapy of periodontal and peri-implant diseases.
f. Have comprehensive knowledge of the effects of antiseptic/antimicrobial oral rinses and locally delivered products in conjunction with non-surgical therapy of periodontal and peri-implant diseases.
g. Have comprehensive knowledge of the main groups of surgical techniques used in periodontics, their indications and contraindications, as well as their advantages and disadvantages.

TABLE 2 (Continued)

h. Have comprehensive knowledge of the effects of surgical therapy of peri-implantitis, including the possible use of adjunctive antiseptics/antibiotics and various decontamination procedures.
i. Have comprehensive knowledge of periodontal supportive therapy and be fully acquainted with the relevant research and clinical applications.
6. Understand possible interactions between oral and systemic diseases:
a. Be competent in managing periodontal pathologies in medically compromised patients and in communicating efficiently with these patients and medical professionals.
b. Have comprehensive knowledge of the possible interactions between systemic and periodontal diseases:
i. Be fully acquainted with systemic disorders that may influence the response of periodontal tissues to plaque-associated inflammatory disease.
ii. Understand systemic diseases for which periodontitis is a risk factor.
iii. Be aware of those systemic disorders that may manifest themselves in the periodontal tissues, with or without a pre-existing plaque-induced inflammatory response.
7. Have comprehensive knowledge of possible drug interactions, side effects, contraindications and identification of substance-use disorders.
8. Be proficient in searching, identifying and evaluating relevant scientific literature:
a. Have a good understanding of research methodology and the different types of study designs (in vitro/pre-clinical, in vivo/RCTs/cohort studies/case series).
b. Be able to analyse and communicate the content of a scientific article and critically evaluate a study's validity and impact.
9. Be proficient in preparing and presenting all stages of a treated clinical case presenting with periodontal/peri-implant disease. Be proficient in discussing decision-making, clinical procedures and their outcomes based on the scientific literature and general clinical knowledge.

Abbreviation: RCT, randomized clinical trial.

In this paper, we have tried to update the competences and learning outcomes that are to be achieved in specialist periodontal education in the context of several parameters:

- Changes in diagnosis and classification of periodontal and peri-implant diseases (Caton et al., 2018);
- Current guidelines for the treatment of periodontal (Herrera et al., 2022; Sanz et al., 2020) and peri-implant diseases (Herrera et al., 2023);
- The experience of the training centres following the 1st European Consensus Workshop on Periodontal Education (2009) and the expectations from the upcoming workshop;
- The feedback of graduates in terms of relevance, quality and content of their training in light of their professional activity after graduation.

Therefore, the present paper presents, in detail, the updated didactic, clinical performance and research learning outcomes required in a modern periodontal specialist training program. It also presents a detailed update of the methods for achieving the learning outcomes, with reference to the faculty qualifications, training facility requirements and the didactic and clinical activity as well as research components of the curriculum. Specific additions to the 2009 Consensus Workshop suggestions include the focus on implementation of current classifications systems and treatment guidelines in the programs' curricula. In the methods to achieve the expected clinical expertise at specialist level, and based on the former graduates' survey, detailed components were added, focusing on specific surgical skills related to all aspects of periodontal treatment and implant dentistry. Finally, specific recent prominent changes, including digital tools for diagnosis and treatment, and advanced surgical procedures and techniques in periodontology and implant dentistry, are included.

It was decided not to tackle several learning outcomes that were part of the expected competences of the 2009 Consensus Workshop and to keep them as they were presented in the publication in 2010 (Van der Velden & Sanz, 2010):

- Personal behaviour and ethics. These are basic, clear and unequivocal expectations that do not need to be discussed.
- No specific discussion on a proposal of specific examination systems and protocols, mentoring and tutoring methodology at the student or program level. Nor were evaluation of education methodology and concepts brought up. These elements are presented and discussed in Section 2 of this paper.
- No relation to specific time credits (such as ECTS), academic degrees or professional certificates. The 2010 consensus report focused on specific demands for European postgraduate programs. This paper aims to serve as a possible basis and guide for program directors and their faculty when organizing a modern, updated specialist training program anywhere, even outside of the EFP member countries.

Finally, the present work has some limitations, the most important being that the survey for graduates was not sent directly to the target persons due to data protection; it was instead sent via the program directors. In addition, because current program directors were involved in the preparation of the survey and the interpretation of its results, the possibility of some bias cannot be excluded.

5 | CONCLUSIONS

Different academic facilities may have different approaches to postgraduate education and training, influenced by governmental and/or

TABLE 3 Learning outcomes in periodontal education at the specialist level—clinical component: general learning outcomes.

Clinical component general learning outcomes	1. Be proficient in applying appropriate interpersonal and communication skills and effectively communicating with individuals from diverse social backgrounds. 2. Be proficient in carrying out appropriate examination, diagnosis, prognosis, treatment planning and treatment of diseases and disorders affecting the periodontium and peri-implant tissues. 3. Be proficient in carrying out appropriate examination, diagnosis, case selection, treatment planning and surgical procedures for the successful placement and maintenance of dental implants. 4. Be proficient in diagnosing and managing advanced multidisciplinary cases (combined problems of periodontal disease in addition to systemic, restorative and/or prosthetic considerations) and be able to carry out the periodontal component of such treatments. Be proficient in performing interdisciplinary treatment in cooperation with other dental disciplines and evaluating the change in overall prognosis. 5. Be competent in digital examination and evaluation tools: a. The use of intra-oral digital scanners. b. The use of imaging and treatment-planning software. c. Evaluation of computerized tomography scans of tooth structures, periodontal anatomy and/or dental implants. 6. Be proficient in collecting and interpreting high-quality clinical documentation: a. Precise and detailed clinical assessments (with emphasis on periodontal parameters) at all stages of treatment. b. Periapical and bite-wing roentgenograms. c. Intra- and extra-oral photography.

academic policies, structures and resources. Nevertheless, the curricular structure of a training program in periodontology at the specialist level should be organized in modules that directly or indirectly contribute to the acquisition of competences, proficiencies and learning outcomes described above. Within this context of a competence-based curriculum, there should be a strong emphasis on learning. With this aim, different learning methods and criteria-based assessments may be used. However, student-based approaches, such as problem-based, project-based or case-based learning, should preferably be adopted. The trainee should take full responsibility for his/her training and acquire professional characteristics, such as critical thinking, proficient decision-making as well as autonomous learning and problem-solving.

The goal of modern specialist postgraduate education is to produce a caring, knowledgeable, proficient and skilful specialist in periodontology, who is able, upon graduation, to accept professional responsibility for the ethical, effective and safe care of all patients with a special emphasis on those in need of specialist care. It is the obligation of the respective training facilities and professional faculties to provide the tools towards achieving these goals.

SECTION 2 – EDUCATIONAL METHODS, EVALUATION OF COMPETENCES/LEARNING OUTCOMES AND EDUCATIONAL QUALITY ASSURANCE IN SPECIALIST TRAINING IN PERIODONTOLOGY

1 | OBJECTIVES

In this section (prepared by Nikolaos Donos, Nikolaos Gkranias, Maria Clotilde Carra, Xanthippi Dereka and Elena Calciolari), we aim to critically review and report on the current methods to evaluate competences and learning outcomes in postgraduate/specialist education, as well as on the processes in place for quality assurance.

2 | METHODS & SURVEYS

We gathered evidence through scientific databases (PubMed, Embase) but also searched for international (mainly European) guidelines and policies on education (mainly higher education) related to teaching methods, assessment of competences/learning outcomes and quality assurance.

Moreover, a multiple-choice questionnaire was circulated to EFP postgraduate directors to enquire about the current assessment methods and quality assurance policies carried out within their programs (Appendix S1).

Since the UK system is well structured and well regulated in relation to the evaluation of postgraduate education/clinical specialty training, we also referred to it in more detail, as it served as a 'case study' to discuss the need for national evaluation systems.

3 | REVIEW

3.1 | Overview of education methods in postgraduate/specialist periodontal education

One of the main challenges associated with postgraduate/specialist periodontal education is the need to combine theoretical and

TABLE 4a Learning outcomes in periodontal education at the specialist level—Clinical component: specific learning outcomes 1–5.

Clinical component specific learning outcomes 1–5	1. Be proficient in the examination and treatment planning of patients demonstrating periodontal disease and/or patients in need of mucogingival repair, and/or patients in need of tooth replacement (including dental implant therapy). Be proficient in applying clinical guidelines to patient care. 2. Be proficient in recognizing the various forms of periodontal and peri-implant diseases in order to make a diagnosis, evaluate prognosis and prepare an adequate treatment plan: a. Be proficient in diagnosing cases of gingivitis. b. Be proficient in diagnosing and classifying cases of periodontitis. c. Be proficient in diagnosing peri-implant complications, such as peri-implant mucositis and peri-implantitis. d. Be proficient in recognizing muco-cutaneous disorders or oral manifestations of systemic diseases and know when to refer the patients for further examination. 3. Be proficient in the implementation of guidelines for assessment and control of periodontal and peri-implant risk factors: a. Oral hygiene motivation, patient-performed dental plaque/biofilm control and elimination of predisposing local factors (i.e., iatrogenic and occlusal factors). b. Smoking cessation, life style and dietary recommendations. 4. Be proficient in performing (and documenting) non-surgical therapy of periodontal and peri-implant diseases: a. Supra- and sub-gingival mechanical or power-driven instrumentation. b. Adequate use of antiseptic/antimicrobial agents. c. Adequate and controlled use of systemic antibiotics. 5. Be proficient in performing (and documenting) a wide range of periodontal surgical procedures, including the following: a. Gingivectomy/gingivoplasty/local excision procedures. b. Periodontal flap surgery, including access flaps and resective surgery, with or without concomitant osseous surgery. Know the indications and contraindications of and be competent in different techniques. c. Root resection/hemisection/tunnelling procedures. d. Muco-gingival and plastic periodontal surgical procedures. Know the indications and contraindications of and be competent in different techniques. Acquire knowledge in the application of different micro- and macro-surgical instruments and related techniques in terms of efficacy and efficiency. Be familiar with autogenous and soft-tissue substitute materials. e. Reconstructive periodontal surgery procedures. Know the indications and contraindications of and be competent in different techniques. Acquire knowledge in the use of different bone substitute materials, barrier membranes and biologically active materials.

evidence-based knowledge with practical operative skills and research competences. Considering the umbrella of different competences to be covered, it becomes clear that a blend of different education methods should be employed.

3.1.1 | Theoretical teaching

The main goal of theoretical teaching is to transfer evidence-based knowledge and to allow future clinicians to develop their own ability to reflect (Sanz et al., 2009). As per Bloom's taxonomy (Bloom, 1956), knowledge and comprehension are the foundational levels to organize development of any curricula.

The primary source of evidence-based knowledge is the scientific literature, and postgraduate students must be proficient in searching, retrieving and critically evaluating current, relevant and accurate evidence (Dorsch et al., 2004).

To further develop the evidence-based knowledge of postgraduate students and their ability to autonomously retrieve and critically appraise the scientific literature, several methods can be applied. First, it is advocated to opt for small-group teaching, in which direct and dynamic interactions with the mentor(s) and the peers can be easily promoted (Koole, Christiaens, et al., 2016; Koole, Fine, & De Bruyn, 2016). This is easily achievable in postgraduate programs in periodontology, since they normally have one to eight students per year. Moreover, small groups facilitate discussion and critical reflections, which increase the participants' area of awareness, introduce additional perspectives and create a stimulating and critical environment based on questions and reactions (Gathu, 2022; Subramanian et al., 2013).

This reflects the need for faculty staff not only to be competent in clinical aspects but also to develop didactic skills and facilitate student reflections and reflective practice (Driessen et al., 2008). Reflection is considered a critical component of learning in medical education; by reflecting on experiences, students, residents and fellows identify their learning needs, develop self-regulated learning skills and stimulate comprehension and understanding, which can lead to enhanced competence, humanism and professionalism (Friedlander et al., 2019). A study investigating the attitude towards reflection in postgraduate implant dentistry education in the United Kingdom and Belgium has indicated that using group discussions along with supervision/guidance in how to reflect expanded clinical reasoning into

TABLE 4b Learning outcomes in periodontal education at the specialist level—Clinical component: specific learning outcomes 6–11.

Clinical component specific learning outcomes 6–11	6. Be proficient in performing (and documenting) periodontal pre-prosthetic procedures: a. Clinical crown-lengthening. b. Treatment of excessive gummy smile. c. Reconstruction of soft and hard tissues of deficient residual ridges towards prosthetic rehabilitation. 7. Be proficient in the different aspects of surgical implant therapy, including surgical placement of dental implants in all areas of the dentition, in both full and partially edentulous patients: a. Be proficient in planning and placing implants in healed edentulous ridges. b. Be proficient in the management of extraction sites, including bone regeneration and/or soft-tissue augmentation procedures concomitant with or prior to implant placement. c. Be competent in the reconstruction of deficient edentulous ridges by lateral or vertical ridge reconstruction. Know the indications, contraindications and limitations of different techniques. Be competent in the use of different bone substitute materials, barrier membranes and application of adequate flap techniques and soft-tissue augmentation procedures, concomitant with or prior to implant placement. d. Have experience in sinus floor augmentation procedures, by both trans-crestal and lateral window techniques, concomitant with or prior to implant placement. e. Be proficient in the planning of implant placement in consideration of prosthetic management and function, and overall aesthetic and maintainability aspects. Be able to plan flap design, implant position and direction, and healing time. 8. Be proficient in surgical techniques for the management of peri-implant diseases: a. Flap surgery, including access, resective and reconstructive procedures. Know their indications, contraindications and limitations. b. Soft-tissue mucogingival surgical procedures. Know the indications and contraindications and be competent in different techniques. Be familiar with autogenous and soft-tissue substitute materials. 9. Be proficient in critically evaluating results of each step of therapy. Be able to interpret the final results of the performed treatment and to evaluate future prognosis, and carry out any additional procedures required to improve treatment outcomes and/or to successfully maintain treatment results. 10. Be proficient in planning and performing periodontal supportive therapy (maintenance) as related to the treatment performed and to patient-related risk factors. 11. Be proficient in complete documentation during each phase of treatment (medical records, charts, analog and digital models, clinical photographs) in order to chronologically follow and, if required, to present clinical cases for evaluation.

TABLE 5 Learning outcomes in periodontal education at the specialist level—research component.

Research component	1. Be proficient in the methodology of literature search for a scientific project and report. 2. Be competent in posing pertinent research questions and in formulating hypotheses. Be knowledgeable in research design and in the undertaking and communication of a research project. 3. Have basic understanding of scientific statistical methodology. 4. Have the competence to actively participate in and critically contribute to a research project. 5. Know how to analyse raw data of a scientific study and evaluate its results. 6. Be competent in reporting outcomes of a research project in the form of a manuscript fit for publication in an international, peer-reviewed scientific journal in English language. 7. Be proficient in orally communicating, presenting and defending all aspects of a research project: scientific background, hypothesis, design, material and methods, statistical methodology, results and conclusions.

reflections about postgraduate students' clinical actions and professional growth (Koole, Christiaens, et al., 2016).

Teaching should always be learner-centred and emphasize a real-time learning approach. To obtain this, more traditional educational methods, such as didactic lectures, are often replaced by/associated with case-based seminars, journal club sessions, problem-based learning, simulation-based learning, e-learning, peer-assisted learning, observational learning, flipped classroom and team-based learning (Chapple et al., 2010; Lee & Kim, 2018; Mattheos et al., 2010; Sultan, 2018; Vanka et al., 2020). In these educational methods, the engagement of the student (collaborative learning), as well as teacher–learner interaction, is maximized, whereas the amount of information is restrained and focused on a specific topic.

Backward design is a less traditional approach that can also be employed, where instead of starting with the content to be covered or the textbook to be used, one begins with the goals to be achieved (Wiggins & McTighe, 2005). This backward approach encourages teachers to think first like assessors before designing lectures and modules, and thus to consider upfront how they will determine whether students have obtained the desired goals.

TABLE 6 Methods/requirements for the program: (1) course, (2) faculty, (3) training facility, (4) monitoring system of students.

1. Course	The course should be organized over a minimum of 3 years (full time) or its part-time equivalent: 5 days and minimum 35 h/week, 6 semesters, minimum 40 weeks/year, in a dedicated program within a supervised environment, in an ethical and humanistic environment providing quality education, research and oral and periodontal/peri-implant health care and services.
2. Faculty	a. The program director should have completed a specialist program in periodontology and have several years of administrative and clinical experience as a practising periodontist after graduation. He/she should have a prominent professional profile in the field of periodontology, including significant track records, both within academia and clinical practice, and have the desire and aptitude to teach. b. Additional clinical teaching staff should have completed a specialist program in periodontology, and have sufficient experience as practising periodontists. The additional clinical teaching staff should contribute significantly to the didactic teaching in the program.
3. Training facility and clinical activity	a. A dental clinic specialized in periodontics should serve as the principal teaching facility for the students and should be adequate to meet the objectives set forth in the program description and requirements. b. The clinic should have a sufficient number of treatment units available for the training of all students in the program, compatible with the required clinical time. c. The training facility should offer a complete and up-to-date library and on-line facilities that should be accessible for all students. Subscriptions of periodontal journals as well as the general dental and medical journals should be made available. d. The principal goal of the periodontal services rendered in the clinic should be to ensure quality-assured, safe, appropriate and cost-effective treatment of all patients.
4. Monitoring system of students	The program must have a system of tutoring, mentoring and monitoring for each student. The criteria-based evaluation/assessment methodology performed by the calibrated teaching staff and the specific tutoring must be clear and well organized.

3.1.2 | Operative clinical skill teaching

Theoretical and practical learning should progress in parallel and complement each other. There are several theories that can be applied to

TABLE 7a Methods/requirements for the program: (5) Curriculum: (a) learning outcomes, (b) didactic component and (c) research component.

a. Learning outcomes	Clearly defined criteria for the learning outcomes should be communicated to the trainees. They will be expected to fulfil the described learning outcomes mainly through self-study and directed seminars, clinical work, research activities and by passing formative assessment exercises throughout the course of the program.
b. Didactic component	The didactic component of the program should be designed to provide a structured content that the trainee should acquire. This is to be accomplished through seminars, tutorials and mainly through discussion of the literature related to the various topics. It should include the following: i. Subject-oriented classic literature seminars ii. Current literature seminars iii. Surgical seminars and hands-on training iv. Clinical case presentations.
c. Research component	Within the research component, the trainees should prepare and perform their own projects or participate in and critically contribute to an ongoing research project (at the clinic/Department of Periodontology or a relevant collaborating department). i. Acceptable research projects: 1. Original in vitro, pre-clinical in vivo or clinical studies. 2. Systematic reviews, provided that the topic is relevant to the field of periodontology and that the search resulted in the inclusion of a minimum of 15 relevant studies. Narrative reviews are not acceptable. ii. An academic faculty member from the clinic/Department of Periodontology should be responsible for tutoring the student during the course of the research project. iii. The tasks of the trainee in the research component of the program should include the following: 1. Participate in the project planning or join the planning of an ongoing research project. 2. Perform a thorough literature review with the necessary background to support the hypothesis and objectives of the proposed research. 3. Actively participate in data acquisition pertaining to the laboratory or clinical research project. For systematic reviews, perform the literature search and inclusion/exclusion decision process. 4. Perform or critically participate in statistical/data analysis. 5. Critically contribute to the analysis and interpretation of the results. 6. Be one of the principal authors of the manuscript and have a major role in its preparation.

TABLE 7b Methods/requirements for the program: (5) curriculum: (d) clinical component.

The clinical part of the program should be designed to enable the trainee to obtain the required clinical competences and proficiencies. At least one-third of the weekly activity should consist of clinical work. At the end of the program, the trainees must have achieved the learning outcomes relevant to the treatment of cases involving periodontal and peri-implant diseases, as well as the surgical component of dental implant therapy. The following components are to be included:
i. Clinical examination protocols:
1. Required: plaque, gingival and bleeding indices, full periodontal charting, occlusal analysis and digital/analog study models, photographic records, radiographs. 2. Advised when relevant: microbiological tests, additional tests.
ii. Diagnosis and prognosis:
1. Diagnosis/classification according to the most recent recommendations. 2. Prognosis according to one of the more extensive methods (at the tooth and dentition levels).
iii. Non-surgical therapy of periodontal diseases:
Planning and treatment strategies must be according to the most recent clinical guidelines.
iv. Periodontal surgical therapy, according to the most recent clinical guidelines:
1. Periodontitis: access flaps, resective surgery, papilla preservation techniques, minimally invasive procedures, reconstructive therapy. 2. Various techniques of mucogingival surgery, including reconstruction of edentulous segments of the ridge prior to fixed prosthetic rehabilitation. 3. Pre-prosthetic surgery, including crown lengthening and gummy smile treatment.
v. Training in surgery for implant placement including the following:
1. Treatment planning (CT evaluation, analog and digital planning, prosthetic aspects). 2. Implant placement in healed edentulous ridges. 3. Removal of teeth and failing implants with subsequent ridge preservation. 4. Implant placement with different post-extraction timings (immediate, immediate-delayed, delayed, late). 5. Reconstruction of deficient edentulous ridges using various techniques (GBR, blocks). 6. Sinus floor augmentation (lateral window and trans-crestal techniques). 7. Soft-tissue management at all surgical stages.
vi. Training in treatment of peri-implant diseases:
1. Non-surgical treatment of peri-implant diseases. 2. Surgical therapy of peri-implantitis.
vii. Treatment of interdisciplinary cases in cooperation with dental professionals from other disciplines.
viii. Treatment of medically compromised patients.

Abbreviations: CT, computed tomography; GBR, guided bone regeneration.

the teaching of operative clinical skills, but one of the most widely adopted is the experiential learning described by Kolb (1984), which is an engaged learning process whereby students 'learn by doing' and by reflecting on the experience. Reflection, critical analysis and

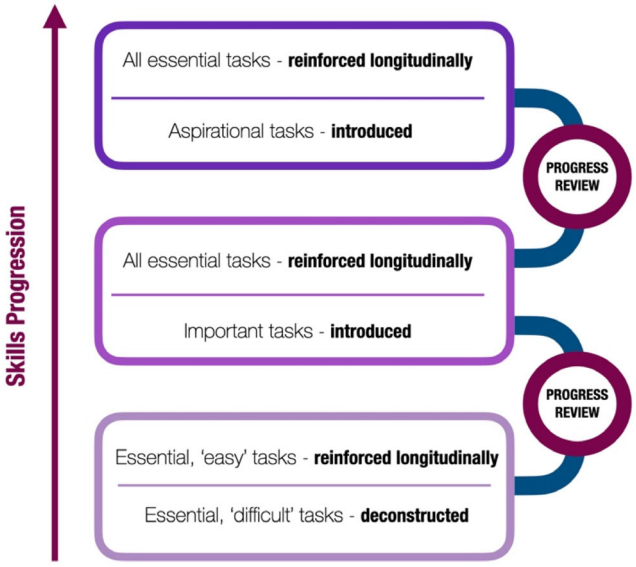

FIGURE 1 The learning cycle (adapted from Field et al., 2021).

synthesis are essential elements of experiential learning, as well as the opportunities for students to take initiative, make decisions and be accountable for the results (Yardley et al., 2012). Students should follow a 'learning cycle', which includes a practical exercise in which they are also encouraged to critically appraise their work (Field et al., 2021). Remarkably, within the 'learning cycle' (Figure 1), it is possible to accommodate a range of different learning styles, such as self-directed, practical and problem-based. Considering the complexity of technical skills that the student will need to acquire at the end of the program, it is also advised to reduce the cognitive load by teaching clinical skills longitudinally and breaking them down into more manageable and easier tasks (Field et al., 2021).

It is also common practice within postgraduate programs to provide both a basic and a more advanced skills course as students progress through their teaching journey.

Experiential learning activities applied to clinical education in periodontology include, but are not limited to, hands-on laboratory experiments, internships, practicums, field exercises and study abroad, where students practice and learn under the supervision of an accredited practitioner/specialist.

A specific learning curve is expected for periodontal and dental implant treatments (Chambers, 2012; Franceschetti et al., 2015; Jerjes & Hopper, 2018). Previous experience, knowledge of surgical anatomy and techniques, dexterity and the presence of mentoring are all elements that influence the learning curve. After an initial phase of learning—a stationary stage ('plateau')—is usually reached, where no apparent progress in learning is recorded. However, further improvement occurs when reaching the proficiency and level of expertise.

Hands-on experience on animal models or in the cadaver lab and simulation-based learning have an important role in skill acquisition before clinical practice. Indeed, this training will help shortening the learning curve, reinforcing clinical knowledge and skills.

In summary, education is a dynamic process requiring periodical updates/assessments and integration of multiple teaching strategies. As part of the learning cycle, the importance of student's self-reflection is also emphasized.

3.1.3 | The advent of digital methods/education

More conventional and traditional methods of teaching and learning (e.g., lecturing) are progressively replaced by new, multiple and alternative strategies that must be developed, adapted and changed over time (Han et al., 2019).

During the COVID-19 pandemic, academic institutions were forced to identify teaching methods that applied to the unexpected situation of prolonged lockdown and restricted access to academic buildings. Therefore, the use of online pedagogical software tools, including live or streamed videos, virtual meetings, small-scale working groups, social media groups and journal clubs, was implemented together with online examination and formative/summative assessments, which was well accepted by dental students (Goldstein et al., 2021; Schlenz et al., 2020).

New practices, such as tele-dentistry and tele-monitoring, have also emerged (Goriuc et al., 2022). They represent valuable tools not only in the delivery of care but also in the academic and research training of dental health professionals. Their initial scope (i.e., limiting the risk of contamination) has been expanded, and these technologies are currently implemented as an effective complementary tool to on-site conventional educational and training strategies (Schlenz et al., 2023).

However, a word of warning should be mentioned regarding the huge increase of educational sources that have developed in recent years. Online courses, lectures and webinars are user-friendly sources of information, but they bring potential risks regarding the distribution of poor-quality information, non-evidence-based practice, damage to professional image, breaches of patient privacy, violation of personal–professional boundaries and licensing or legal issues (Ali et al., 2023; Hakimi et al., 2023; Nahidh et al., 2023). In the absence of formal guidelines and regulation, dental students and trainees are advised to critically choose the source of information. A typical example is the recourse to available online videos as learning tools. While videos are undoubtedly a useful and appropriate learning and training tool for operational procedures, the quality of the educational videos available, for instance on the World Wide Web, is questionable because videos are uploaded without any peer-review process or quality assessment (Besmens et al., 2021; Rodriguez et al., 2018; Seo et al., 2018) and are ranked based on popularity, number of visualizations and comments, which are not valid criteria for educational purposes.

As a result, useless or even misleading videos circulate, representing unvetted educational resources (Abukaraky et al., 2018; Hamdan et al., 2019; Yildirim & Kocaelli, 2023; Yüce et al., 2021).

In general surgery, quality standards for surgical videos with educational purposes have been proposed by developing Practice Guidelines for Reporting of Educational Videos with a specific checklist for authors (Celentano et al., 2018, 2021). This should be also developed for videos dedicated to periodontal and implant dentistry procedures.

In summary, digital technology offers educational advantages but there is a need for proper quality control and quality assurance of the available digital sources of information.

3.1.4 | Future innovative methods

Proficiency-based progression (PBP) training is a robust methodology where an operative procedure is subject to a task analysis to identify performance metrics essential to the completion of the task (Kehily et al., 2022; Mazzone et al., 2021). These performance metrics are then subjected to a validation procedure and can be used to establish an objectively pre-defined proficiency benchmark performance to which trainees are trained. A recent systematic review concluded that PBP training is a valuable method, as it improves trainees' performances compared to standard conventional training by decreasing procedural errors by 62% (Kehily et al., 2022). We envisage that this type of training method will become more popular also within postgraduate/specialist education in the coming years.

Virtual simulation applications offer top-up information to the real environment, and thus open novel opportunities to train postgraduate students in both clinically operational skills and communication. These include augmented reality (AR) and virtual reality (VR). AR is a technology that superimposes a computer-generated virtual scenario atop an existing reality in order to create a sensory perception through the ability to interact with it. VR is an artificial computer-generated simulation of a real-life environment or situation (Joda et al., 2019). Currently, their application is blunted by several limitations, such as equipment availability, costs and training of the trainers, as well as the lack of technological standards and education protocols to ensure high-quality teaching with dental AR/VR devices (Joda et al., 2019).

Artificial intelligence (AI) is a powerful reality in the existing world (Khan et al., 2023). Large language models, such as ChatGPT (by OpenAI), may have the potential to assist with medical education and eventually clinical decision-making (Dave et al., 2023; Kung et al., 2023), but they also raise several concerns related to the risks of malicious use (i.e., plagiarism, cheating) and serious limitations, including the potential for misinformation (Eggmann & Blatz, 2023; Eggmann et al., 2023).

AI can also play several helpful roles such as automatic scoring of student's papers and essays, teaching assistance in generating exercises, quizzes and clinical case scenarios, language assistance in translations, explanations and summaries and also research assistance (e.g., literature reviews and data analysis) (Khan et al., 2023). However, for its best use, strict policies and regulations should be implemented and users should be educated on the importance of ethical behaviours when using these technologies (Cascella et al., 2023; Eggmann & Blatz, 2023; Kung et al., 2023; Sallam, 2023; World Health Organization, 2023).

3.2 | Evaluation of competences and learning outcomes in postgraduate/specialist periodontal education

Competency details the knowledge and skills of students who complete a course or program. Therefore, it provides faculty the structure for the course and the content to cover. Conversely, a learning outcome articulates what students will be able to do upon completion of the training program (Kennedy et al., 2006).

The successful evaluation of competences and learning outcomes must be in line with the availability of human and material resources, time as well as the cultural and professional characteristics of the institution, the students and the patients (Mattheos et al., 2009).

We recognize that a wide variety of assessment methods and strategies exist. For theoretical and clinical competences, we refer to the Miller Pyramid for assessing knowledge and skills in medical education (Miller, 1990) (Figure 2). We will also link the Miller Pyramid to Bloom's taxonomy (Anderson et al., 2001; Bloom, 1956), which has been used across all educational grades and disciplines as a helpful tool to design learning objectives and associated assessments.

3.2.1 | Assessment of theoretical and clinical competences

As stated during the 1st European Consensus Workshop on Periodontal Education, the assessment needs to be aligned with the curriculum content and the learning outcomes of the program in order to make it valid, reliable, reproducible and feasible (Van der Velden & Sanz, 2010). The main requirements for assessment procedures and performance criteria remain the same:

1. Clearly defined criteria for the learning outcomes, which should be communicated to the students;
2. Use of multiple methods of assessments and multiple samples of performance;
3. Employment of both formative and summative assessments;
4. Clear and demonstrable alignment of the learning content, method of teaching and learning, as well as the assessment.

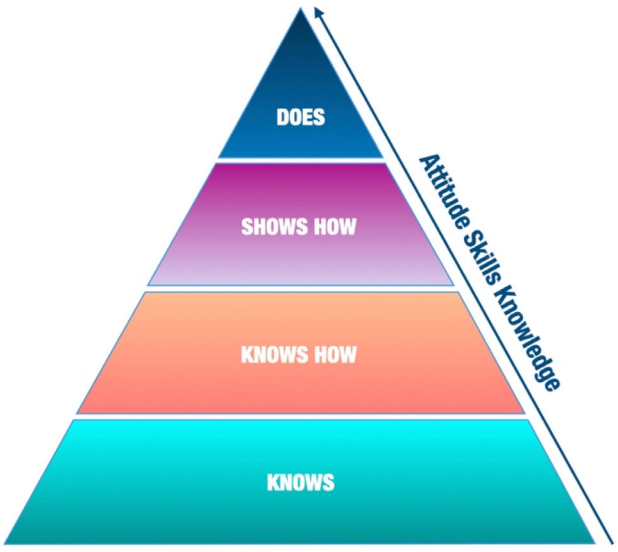

FIGURE 2 Pyramid of Evidence for assessing knowledge and skills in medical education.

Although each university may have different approaches, in each EFP-accredited program the minimum requirement is that after each course/series of seminars, an examination is held to assess the competences/learning outcomes achieved by the student. Moreover, at the end of each academic year, a pass grade must be obtained for all examinations and assessments to allow students to proceed to the following year. In each academic year, a failed examination can be repeated (usually) only once. In case the clinical performance of a student is inadequate, additional time may be allocated to that specific student.

In countries like the United Kingdom where the qualification leads to the inclusion in a 'Specialist List', it is also emphasized that the assessment(s) should overall safeguard that the candidate is capable of delivering high-quality, safe and patient- and public-centred care at the moment of qualification (General Dental Council, 2023).

3.2.2 | Assessment of 'know' level

At the base of Miller Pyramid is the 'know level' (cognition zone), which represents the need for the trainee to develop theoretical knowledge on the subject. We could also link this level to the 'knowledge' and 'comprehension' levels of Bloom's taxonomy (Bloom, 1956) (later revised as 'remembering' and 'understanding'; Anderson et al., 2001).

It is important that advanced dental education programs include learning experiences in evidence-based practice and that they prompt graduates to develop a problem-based approach. The assessment of this first level of knowledge is usually done by written (including multiple-choice, single best answer [SBA], short answers or essay-based) and/or oral exams.

Within the 'know level', one can also map the initial elements of a trainee' ability to critically appraise and interpret the scientific/academic literature. The assessment for these competences can be achieved through journal clubs, literature seminars and other learning activities involving the systematic or critical review of the literature. For instance, in the current UK national curriculum, it is proposed that a series of supervised learning events (SLEs) be used to monitor, assess and evidence the achievement of the outlined higher learning outcomes (General Dental Council, 2023).

3.2.3 | Assessment of 'know how' level

After the 'passive' acquisition of theoretical knowledge, the trainee should be able to actively demonstrate its implementation and deep understanding to the examiner. The assessment of the 'know how' is also usually performed by written (including multiple-choice, SBA, short answers or essay-based) and/or oral exams.

3.2.4 | Assessment of 'show how'

Before testing the trainee's skills in a real-life clinical setting, assessors need to ensure that the postgraduate student can perform clinical procedures satisfactorily in a simulated environment. Traditionally, pre-clinical assessment is performed on extracted teeth, plastic teeth and phantom heads. As part of the acquisition and assessment of surgical skills, the use of different animal jaws is also widely popular, as they resemble human hard and soft tissues.

In recent years, advancements in information technology have introduced the possibility to realistically simulate the clinical environment thanks to computer-based technologies such as VR and AR (Li et al., 2021). While these systems are currently not available in all postgraduate programs, we envisage that in the future they will play a predominant role both for teaching and assessment purposes.

An objective structured clinical examination (OSCE) is another validated practical test to assess competences/skills in a simulated clinical environment (Harden et al., 1975). Typically, OSCE consists of different stations, each with a specific simulated clinical scenario to test different competences and skills (e.g., periodontal diagnosis, development of a treatment plan and delivery of oral hygiene instructions). Students move between stations performing specific tasks, which usually involve interaction with patients. The main advantage of OSCE is that it not only allows the assessment of the ability of the student to perform an assessment, place a diagnosis or suggest a treatment plan (decision-making process), but also the observation of the student's interactions with the patient, empathy and communication skills (Cidoncha et al., 2023; Hijazi & Downing, 2008).

A study of undergraduate dental students showed that its implementation stimulated learning, resulting in greater achievement of specific clinical competences and a greater level of realistic self-assessment (Schoonheim-Klein et al., 2006). A more recent study documented high satisfaction for year-5 dental students, where a periodontology station and the use of a simulated patient were tested (Cidoncha et al., 2023).

3.2.5 | Assessment of 'does'

Finally, assessors will need to look for evidence of how the theoretical knowledge is applied into practice ('application' level; Anderson et al., 2001; Bloom, 1956). Six months after the start of the program and at the end of each academic year, it is expected that an assessment of each student's clinical performance be performed to meet the EFP standards.

A. Workplace-based assessment.

Workplace-based assessment (WPBA) is one of the most commonly applied systems to assess clinical performance in the medical field, and it has been adopted by the UK General Medical Council (GMC) and the Academy of Medical Royal Colleges for the assessment of performance in postgraduate medical education. The term WPBA refers to different practices, which involve assessment of an episode of patient care that the trainee carries out in the daily working environment (Norcini & Burch, 2007); hence, it allows gaining insights into how the student operates and behaves in the workplace in a real-world setting (Miller, 1990; Tahim et al., 2023). Moreover, it has a recognized formative potential and can positively change the trainee's clinical performance, particularly when it is associated with constructive feedback from an authoritative and credible assessor (Veloski et al., 2006).

A plethora of different strategies can be applied within WPBA to allow a more comprehensive assessment of the student' performance (Figure 3) (Guraya, 2015).

- Observation of clinical performance

As part of the direct observation of the trainee's clinical performance, the main tools that can be employed include the following.

Mini-clinical evaluation exercises (mini-CEXs). They represent a snapshot of a clinician–patient interaction in a clinical environment and allow the evaluation of the trainee in relation to a particular aspect of a clinical encounter. For instance, graduates will be assessed

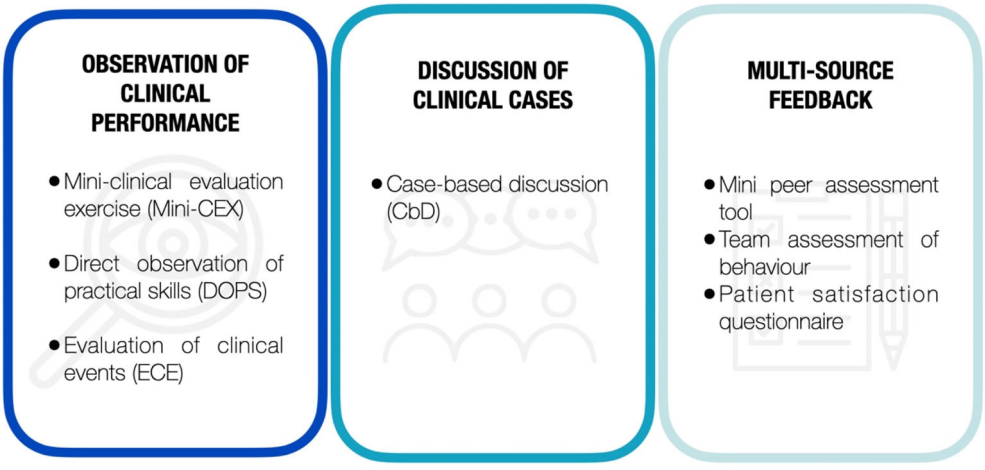

FIGURE 3 Categories of workplace-based assessment and their main tools.

on how they perform a periodontal examination, including how they conduct a thorough medical and dental history and record a periodontal chart. At the end of the visit, the trainee will suggest a diagnosis and treatment plan, and his/her performance will be graded through a structured evaluation form.

Direct observation of practical skills (DOP). This method consists of a supervisor observing a trainee performing a procedure (e.g., probing, scaling and root planing), usually in a one-to-one setting. DOP was originally developed and evaluated by The Royal College of Physicians. The most important part of DOP is the structured feedback given by the supervisor, which should focus on the agreed specific tasks/skills rather than on the trainee's general performance and that should highlight the strengths and identify areas for development.

Evaluation of clinical events (ECE). ECE is a new tool introduced by the Royal College of Pathologists to assess trainees in the performance of their duties during complex tasks, often involving teamwork or interaction with other professional staff. An example of ECE for a postgraduate program in periodontology could be the presentation and discussion of a case at a multidisciplinary team meeting, or the contribution to quality assurance and audit processes.

- Discussion of clinical cases/case-based discussions

Case-based discussions (CbDs) are designed to assess the decision-making process and the application of medical knowledge in relation to the care of treated patients. It has been demonstrated that CbDs promote active learning and encourage the development of critical thinking (Popil, 2011). CbD evaluates what the trainees actually did rather than what they think they might do, which differentiates it from OSCE, which evaluates the trainee's performance under examination conditions (see Section 2.3.2.4) (Guraya et al., 2010).

As part of the postgraduate/specialist program, trainees are expected to build up their own portfolio of clinical cases, which should be documented according to the EFP Directive for Clinical Documentation (see EFP website www.efp.org) and should be regularly assessed throughout the program and by the EFP Examination Board before the obtainment of the EFP 'Certificate of Completion of Specialized Training in Periodontology' (Table 8). While this may vary among programs, assessments of such documented cases are performed at least yearly.

- Multi-source feedback

Multi-source feedback (MSF) is a structured method to obtain feedback from peers, co-workers and patients. Many countries have adopted this concept in higher education; for instance, all UK foundation doctors are now required to complete at least two mini-peer assessment tools (mPATs) per year (Archer et al., 2008). While mPATs are well established for clinical doctor trainees, they are far less documented in dentistry. However, a study by Gotouda et al. (2018) has documented the use of MSF in trainee dentists and shown positive correlation between scores assigned by the supervisor dentist, dental hygienist and dental receptionist.

TABLE 8 Summary of the steps necessary to obtain the EFP Certificate of Completion of Specialized Training in Periodontology.

Requirements	• Completion of EFP-accredited program (all regular examinations passed and clinical performance assessed as proficient) • Five fully documented clinical cases encompassing different aspects of periodontal therapy, including at least one case of implant therapy • Research report in the format of a manuscript eligible for publication in an international peer-reviewed journal
Panel	Examination Board (at least one external examiner appointed by EFP)
Interview	• Clinical case presentation (60–75 min): this part encompasses the whole field of periodontology and implant dentistry. The student should be able to engage in a discussion on the diagnostic elements and treatment stages of at least one of the five documented cases. The student must be prepared to answer questions related to the general subject of periodontology and Implant dentistry; • Research project presentation (60–75 min), where the candidate discusses the research project performed during postgraduate training. The presentation should include an introduction to demonstrate the background knowledge in relation to the research subject. The student must be prepared to answer questions related to the literature review, methodology and results of the research project.
Outcome	EFP Certificate of Completion of Specialized Training in Periodontology (Periodontics and Implant Dentistry)

Team assessment of behaviours (TAB) is another type of MSF assessment developed for trainee doctors in the UK Foundation Curriculum (Wall et al., 2012) and later applied in the UK Dental Foundation Training, which could be considered in the future as a valuable instrument to implement also in periodontology postgraduate training.

As part of a comprehensive MSF, it is also recommended to gather patients' perspective of the trainee's performance. In this respect, *patient satisfaction questionnaires (PSQs)* can provide a structured and formative feedback within an appraisal process (Campbell et al., 2008).

While WPBA is a widely codified and applied assessment methodology in dental undergraduate and postgraduate education (Manekar & Radke, 2018), it also brings a unique set of challenges, as it is perceived as often excessive and onerous and therefore unvalued by trainees (Collins, 2010); also, the generic rating scales applied within WPBAs, such as in the Mini-CEX, may introduce artificiality into the assessment (Yeates et al., 2013). A systematic review concluded that there is no robust evidence that WPBA tools lead to improvement in performance, although subjective reports on their educational impact are definitely positive (Miller & Archer, 2010).

B. Alternative assessments.

In 2005, ten Cate developed the concept of *entrustable professional activities (EPAs)* (ten Cate, 2005), which refer to tasks/skills that are considered as crucial for that specific profession and that a trainee needs to master at the end of the program. Examples of EPAs within a periodontology postgraduate training may include performing and suturing a papilla preservation flap, harvesting a connective tissue graft or performing a root resection. While many postgraduate medical programs are redesigning education and assessment procedures to incorporate EPAs in clinical training, dentistry has only recently begun to explore EPAs (Ehlinger et al., 2023; Ramaswamy et al., 2021). In the future, it might be useful to define clear and specific EPAs for periodontology training, each connected to a mini-curriculum with its own WPBA.

The principle of *supervised learning events (SLEs)* could also be a valid integration to WPBAs. SLEs implicates a shift from summative assessment (i.e., assessment of what a learner can/cannot do or knows) to a formative assessment, meaning that it shows the gap between the trainee's actual performance and the desired standard, while at the same time providing an indication of how the performance could be improved to reach the required standard (Rees et al., 2014).

It is possible to speculate that SLEs might better motivate trainees to 'mastery goals' such as understanding, rather than to simply achieve 'performance goals' like passing an exam (Driessen & Scheele, 2013), although an interview study raised concerns about trainees' and trainers' understanding of SLEs (Rees et al., 2014).

In the United Kingdom, the current national curriculum (General Dental Council, 2023) proposed a series of SLEs/WBPAs to be used to map, monitor and assess competences.

C. Self-reflection.

It is important that trainees develop the skill to *self-reflect* on their practice, thus fostering their ability to objectively look back at their clinical performance and identify the strengths and areas of improvement as part of their training journey. Traditional methods that can be employed to assess reflective practice in postgraduate students include (Campbell & Rogers, 2022) structured written reflections, logbooks and portfolios, reflective essays and mentor groups.

A study investigating the attitude towards reflection in postgraduate implant dentistry students suggested that using group discussions along with supervision on how to reflect can expand clinical reasoning into reflections about students' clinical actions and professional growth (Koole, Fine, & De Bruyn, 2016). It has also been shown that learners are more likely to develop a culture of reflection if they see their faculty reflecting regularly and benefitting from this work practice daily (Chetcuti et al., 2011).

Other less standardized ways to promote reflective learning may include the use of journals, diaries or blogs (Wetherell & Mullins, 1996; Wetmore et al., 2010).

The aforementioned assessments methods can be linked to the 'analysis', 'synthesis' and 'evaluation' of Bloom's taxonomy (later revised as 'analysing' and 'evaluating', 'creating'), which involve the ability of the student in drawing connections among ideas, justifying their own decision and developing/formulating new original work (Anderson et al., 2001; Bloom, 1956).

3.2.6 | Assessment of research competences

At the completion of the specialist program, the graduate must have accomplished the following learning outcomes (Van der Velden & Sanz, 2010): perform a thorough literature review with the necessary background to define the hypothesis and objectives of a research project; carry out a research project; and perform the appropriate statistical analyses and interpret the research data (European Federation of Periodontology, 2019).

Acceptable research projects include original in vitro, in vivo or human clinical studies.

The assessment of the obtained research competences is usually performed yearly by monitoring the progression of the research project through written and oral exams. Moreover, at the end of the training the graduate is expected to produce a research thesis, which will be marked and also assessed in a Viva (Table 8).

3.2.7 | Results of the questionnaire circulated to the program directors of EFP-recognized programs in terms of competence evaluation and learning outcomes

Twenty-three program directors returned complete answers (Appendix S1) that could be analysed (Figure 4a).

The acquisition of theoretical knowledge by the postgraduate students is mainly assessed through a mix of oral exams and essays (78.26%). In a minority of cases, only written exams/essays (4.35%) or oral exams/vivas (4.35%) are employed, while 13.04% of the programs ('Other') reported the use of either weekly seminars and periodical written exams or daily evaluations in the clinics and seminars, along with annual written exams.

The acquisition of clinical skills/competences is predominantly assessed through a combination of direct observation in a clinical setting, use of a simulated environment (e.g., manikin, dental model) and a case portfolio (60.87%).

Remarkably, only one centre specifically reported that, within the different methods used, there are also reflection forms and EPAs.

For the assessment of research competences, 73.91% of the programs require a written thesis, which is often combined with an oral exam/viva (65.22%) and the production of a scientific article (60.87%).

Overall, postgraduates are formally assessed quarterly in 43.48% of the programs and yearly in 26.09% of the programs. The mechanisms to support postgraduate students who have not reached the required level of competence include, in almost all programs, tutoring and mentoring (95.65%), which are often associated with dedicated training (69.57%) and less frequently with reflective learning (26.09%).

FIGURE 4 Results of the questionnaire on (a) evaluation of competences/learning outcomes filled in by program directors and (b) educational quality assurance filled in by program directors.

Few programs indicated the possibility to re-sit written exams, mentoring or access to additional clinics.

3.3 | Educational quality assurance

Quality assurance involves the 'systematic review of educational provision to maintain and improve its quality, equity and efficiency. It encompasses school self-evaluation, external evaluation (including inspection), the evaluation of teachers and school leaders, and student assessments' (from European Education Area—European Commission).

Quality assurance processes are fundamentally important for the delivery of effective, high-quality and inclusive education and for patient-centred care.

The European Commission has identified six specific areas (Figure 5) that all school systems need to address in creating their overall quality assurance strategy (European Commission, 2018). It

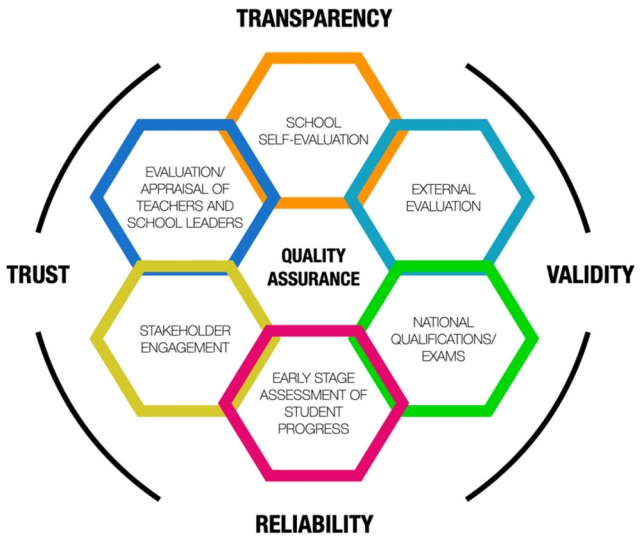

FIGURE 5 Six areas for school quality assurance, as suggested by the European Commission (adapted from European Commission, 2018).

also emphasized that quality assurance should fulfil the overarching principles of reliability, transparency, trust and validity. While the six areas mentioned in this document apply to all education systems, for higher education the European ministers of education adopted in 2005 the 'Standards and Guidelines for Quality Assurance in the European Higher Education Area' (ESG), which was subsequently reviewed (European Union, 2015) (Table 9).

The EFP has published a detailed list of quality standards that should be met by all certified programs (Appendix S4). They have been grouped into four main categories: (1) Qualifications of the director of the periodontology training program; (2) Qualifications of the periodontology training program; (3) Qualifications of the periodontology training facility; (4) Qualifications of the periodontal service. This set of standards will be discussed in more detail in the following sections trying to link them to the ESGs.

3.3.1 | Internal quality assurance

Ten standards for internal quality assurance have been defined by the ESG (European Union, 2015) (Table 9).

1. *Policy for quality assurance*: This represents the fundamental pillar to ensure the accountability of the institution and to provide patient-centred care in a safe learning environment. It should take into account the national context in which the institution operates, as well as its strategic approach and institutional context.
   In the United Kingdom, a well-established system is in place for internal quality assurance (Dental Gold Guide 2023). A Specialty Training Committee (STC) acts on behalf of the Postgraduate Dental Dean and is involved in implementing policies, standards and regulations for specialty training, facilitating the delivery of specialty programs and reviewing and monitoring trainees' progresses. On the other hand, the Postgraduate Dental Dean manages the quality of the specialist program, appoints trainees, assesses their progress and recommends the award of the Certificate of Completion of Specialist Training (CCST) to the GDC.
2. *Design and approval of programs*: A codified system should be in place for the design and approval of the specialty program to ensure that it meets the learning outcomes and that it is in line with the institutional strategy. The EFP requires that the periodontology training program is organized in accordance with sound educational principles (Appendix S4).
   As recommended by the ESG (European Union, 2015), the program design should account for trainees' and other stakeholders' opinions. This can be achieved through simple surveys or questionnaires. For instance, in the United Kingdom, the *Postgraduate Research Experience Survey* (PRES) provides robust benchmark data from a large number of institutions across the country and beyond to drive enhancement of the postgraduate research experience.
3. *Student-centred learning (SCL), teaching and assessment*: A key principle of SCL is the realization that every higher education institution is different and unique. Hence, a certain level of adaptation of the learning and teaching style to the context is required. In this respect, it is also important to recognize that trainees may have different pedagogical needs and learning styles that need to be accommodated up to a certain extent.
   In the quality standards published by the EFP (Appendix S4), it is indicated that different learning methods may be used, but preferably those that are student-centred, such as problem-based, project-based or case-based learning. It is also mentioned that postgraduates should take full responsibility for their learning and acquire learning characteristics such as critical thinking, decision-making, active learning and autonomous learning and problem-solving during their specialist training.
4. *Student admission, progression, recognition and certification*: The EFP only mentions that a candidate for a postgraduate program must be a dentist graduated from an accredited dental school with significant experience in general dentistry (Appendix S4).
   Nevertheless, institutions should have in place specific regulations covering all steps of the student's 'life cycle', from admission, to progression, recognition and certification. For instance, in the United Kingdom, all assessors involved in the recruitment of trainees must have completed the appropriate Quality and Diversity training within the past 3 years (Dental Gold Guide 2023, https://www.copdend.org/postgraduate-training/header-dental-specialty-training/new-edition-dental-gold-guide-2023/). Moreover, it is highlighted that candidates should receive their scores for each domain of the recruitment process, as this would provide them feedback on their performance.
5. *Teaching staff*: Starting from the program director, it is crucial that the whole staff involved in the postgraduate program have adequate competences and keep updated by attending continuing

TABLE 9 List of Standards for Quality Assurance in the European Higher Education Area (ESG).

Internal quality assurance	External quality assurance	Quality assurance agencies
• Policy for quality assurance Institutions should have a policy for quality assurance that is made public and forms part of their strategic management. Internal stakeholders should develop and implement this policy through appropriate structures and processes while involving external stakeholders.	• Consideration of internal quality assurance External quality assurance should address the effectiveness of the internal quality assurance described in Part 1 of the ESG.	• Activities, policy and processes for quality assurance Agencies should undertake external quality assurance activities as defined in Part 2 of the ESG on a regular basis. They should have clear and explicit goals and objectives that are part of their publicly available mission statement. These should translate into the daily work of the agency. Agencies should ensure the involvement of stakeholders in their governance and work.
• Design and approval of programs Institutions should have processes for the design and approval of their programs. The programs should be designed so that they meet the objectives set for them, including the intended learning outcomes. The qualification resulting from a program should be clearly specified and communicated and refer to the correct level of the national qualifications framework for higher education and, consequently, to the Framework for Qualifications of the European Higher Education Area.	• Designing methodologies fit for purpose External quality assurance should be defined and designed specifically to ensure its fitness to achieve the aims and objectives set for it while taking into account relevant regulations. Stakeholders should be involved in its design and continuous improvement.	• Official status Agencies should have an established legal basis and should be formally recognized as quality assurance agencies by competent public authorities.
• Student-centred learning, teaching and assessment Institutions should ensure that the programs are delivered in a way that encourages students to take an active role in creating the learning process, and that the assessment of students reflects this approach.	• Implementing processes External quality assurance processes should be reliable, useful, pre-defined, implemented consistently and published. They include • a self-assessment or equivalent; • an external assessment normally including a site visit; • a report resulting from the external assessment; • a consistent follow-up.	• Independence Agencies should be independent and act autonomously. They should have full responsibility for their operations and the outcomes of those operations without third-party influence.
• Student admission, progression, recognition and certification Institutions should consistently apply pre-defined and published regulations covering all phases of the student 'life cycle', for example, student admission, progression, recognition and certification.	• Peer-review experts External quality assurance should be carried out by groups of external experts that include a student member(s).	• Thematic analysis Agencies should regularly publish reports that describe and analyse the general findings of their external quality assurance activities.
• Teaching staff Institutions should assure themselves of the competence of their teachers. They should apply fair and transparent processes for the recruitment and development of the staff.	• Criteria for outcomes Any outcomes or judgements made as the result of external quality assurance should be based on explicit and published criteria that are applied consistently, irrespective of whether the process leads to a formal decision.	• Resources Agencies should have adequate and appropriate resources, both human and financial, to carry out their work.
• Learning resources and student support Institutions should have appropriate funding for learning and teaching activities and ensure that adequate and readily accessible learning resources and student support are provided.	• Reporting Full reports by the experts should be published, clear and accessible to the academic community, external partners and other interested individuals. If the agency takes any formal decision based on the reports, the decision should be published together with the report.	• Internal quality assurance and professional conduct Agencies should have in place processes for internal quality assurance related to defining, assuring and enhancing the quality and integrity of their activities.
• Information management Institutions should ensure that they collect, analyse and use relevant information for the effective management of their programs and other activities.	• Complaints and appeals Complaint and appeal processes should be clearly defined as part of the design of external quality assurance processes and communicated to the institutions.	• Cyclical external review of agencies Agencies should undergo an external review at least once every 5 years in order to demonstrate their compliance with the ESGs.

TABLE 9 (Continued)

Internal quality assurance	External quality assurance	Quality assurance agencies
• Public information Institutions should publish information about their activities, including programs, which is clear, accurate, objective, up-to date and readily accessible.		
• Ongoing monitoring and periodic review of programs Institutions should monitor and periodically review their programs to ensure that they achieve the objectives set for them and respond to the needs of students and the society. These reviews should lead to continuous improvement of the program. Any action planned or taken as a result should be communicated to all those concerned.		
• Cyclic external quality assurance Institutions should undergo external quality assurance in line with the ESGs on a cyclical basis.		

education activities and reading the relevant scientific literature (Appendix S4). It is the duty of the program director to ensure that all policies, procedures and protocols are updated and based on evidence and that the teaching staff adopt a professional attitude in adhering to these requirements.

6. *Learning resources and student support*: Institutions hosting a specialist program need to ensure a range of resources to support student learning, including libraries (with subscriptions to the main periodontal and medical journals), study facilities and IT infrastructures. Moreover, 'human' support in the form of tutors, counsellors and advisers, as well as administrative staff, should be able to support the students throughout their training.
7. *Information management*: Based on ESG (European Union, 2015), institutions should regularly gather data on key performance indicator profiles of the student population: student progression, success and drop-out rates, students' satisfaction with the program, learning resources and student support available and career paths of graduates.
8. *Public information*: Institutions should regularly update their online and off-line materials to provide correct information for prospective and current students, the public and other stakeholders.
9. *Ongoing monitoring and periodic review of programs*: The periodontology/specialist program should be regularly reviewed to ensure that it meets the students' needs and is updated with the most recent scientific advancements in the field.
10. *Cyclic external quality assurance*: Various forms of external quality assurance should be regularly pursued to verify the quality of the program, faculty and institution. In the United Kingdom, this includes the role of external examiners and program assessors who need to be familiar with GDC-approved curriculum/latest learning outcomes and their context (General Dental Council, 2019).

3.3.2 | External quality assurance

External quality assessments are valuable to an institution because they allow programs and student cohorts to be compared with the wider educational community, ensure the fairness of the assessment processes and provide students information on the objective quality of the institution/program.

EFP accreditation can be seen as a form of external quality assurance of a specialist program.

3.3.3 | Quality assurance agencies

The ESG (European Union, 2015) recommends that trustful and independent agencies should undertake external quality assurance activities (Table 9).

For instance, in the United Kingdom, the GDC and the Joint Committee for Postgraduate Training in Dentistry (JCPTD) and the Specialty Training Committees (STC) have an important role in managing the specialty training and ensuring quality standards (The Dental Gold Guide, 2021). The Royal College of Surgeons (England, Edinburgh) have their own internal standards for eligibility, training, validation and revalidation of their examiners and require membership or affiliation of the relevant college and membership in good standing of GDC (https://www.rcsed.ac.uk/professional-support-development-resources/grants-jobs-and-placements/professional-appointments/examiner-vacancies).

Likewise, other countries are progressively implementing external quality assessments. For instance, in France, Université Paris Cité is undergoing certification with Qualiopi to evaluate and certify the quality of all educational programs offered by all faculties.

3.3.4 | Results of the questionnaire circulated to the program directors of EFP-recognized programs in terms of educational quality assurance

The questionnaire was completed by 20 program directors of EFP-accredited programs and the results are presented in Figure 4b.

The quality of the teaching staff involved in the program is mainly ensured by processes that include feedback from staff, patients and specialty trainees (69.57%), regular appraisals (52.17%), structured mandatory training (34.78%) and assessor calibration (34.78%). Moreover, surveys from the students and reports by the Chairman or external examiners have also been reported, while no specific system for this kind of evaluation was indicated in 8.70% of the programs.

Almost all programs ensure that trainees have achieved the full range of learning outcomes/competences through specialty trainee portfolio and clinical treatment records (95.65%), although training progression statistics, a central recording system and competency sign-off policies have also been reported in >30% of the programs. The presence of an exit strategy was reported by only 8.70% of the programs.

The students in almost all programs are involved and engaged in the process of planning and implementing improvements (78.26%), where the student feedback is mainly collected through regular appraisals combined with anonymized questionnaires.

Interestingly, external assessors are not involved in quality management procedures in approximately half of the programs. When external assessors participate, they are usually delegated tasks that may include periodical re-accreditation of the dental school and national scientific council, external quality assessment commission, program accreditation/assessment, annual meetings with the students, evaluation of marking descriptors, exam questions, observation of a range of answers to exam questions and obtaining feedback from students.

In all programs, the selection for future students entails an interview, and most often the other parameters considered are the CV of the candidate (95.65%), the personal statement (65.22%) and the recommendation letter (56.52%).

A variable number of students are admitted yearly in the different programs, but in the majority of the cases a maximum of four students are enrolled. Likewise, the number of teachers regularly (on a weekly basis) involved in the programs varies significantly, with approximately half of the training centres involving up to 10 teachers, while up to 5 teachers are involved in 21.74% of the centres and up to 15 teachers in 17.39% of the centres.

4 | DISCUSSION

This review supports the ambition to strengthen cooperation on postgraduate education systems in periodontology among European countries and to provide common standards.

While efforts to harmonize programs should be pursued, every higher education institution is different and unique. Hence, a certain flexibility in the learning and teaching style that should adapt to the context and to the different pedagogical needs of the trainees should be applied (The European Students' Union, 2010).

Over the past years, digital technologies have remarkably simplified the delivery of education content, especially since the COVID-19 pandemic. While certain digital tools and new fascinating realities such as tele-dentistry and AI certainly carry an enormous potential and should be further explored in the future, they are also associated with numerous challenges, particularly in relation to the lack of control on what is available on the Internet and what the student can access and use for educational purposes, with the risk that non-evidence-based practices are implemented.

The evaluation of competences and learning outcomes should take into account several aspects, including the availability of human and material resources, time, the cultural and professional characteristics of the institution as well as the students and the patients (Mattheos et al., 2009). The main requirements for assessment procedures and performance criteria remain the ones indicated during the 1st European Consensus Workshop in Periodontal Education (Van der Velden & Sanz, 2010), which stressed the importance of using multiple methods of assessments to accommodate the multicomponent nature of reflections and to record multiple samples of performance. Both formative and summative assessments should be employed.

Based on the results of the questionnaire (Figure 4), the great majority of specialty programs still use traditional evaluation methods to assess the acquisition of competencies. It is recommended, however, that in the future additional workplace-based assessments (WPBAs) such as SLEs and EPAs should be implemented.

Furthermore, a crucial skill that students should develop during their specialty program is self-reflection on their practice. Relational factors such as motivation, coaching and role modelling may facilitate such reflective practices (Gathu, 2022).

The EFP has published a detailed list of quality standards that should be met by all certified programs (Appendix S4). When linking those standards to the ESG, it is clear that the different internal and external quality assurance components are closely related, so that decisions/policies in one area can enable or constraint policies in another area. The key aspects in relation to quality assurance processes are that students, patients and other key stakeholder are actively involved and that an external quality assurance process that is reliable, objective and fair is in place.

It is reassuring to report that in most of specialty programs, students are regularly involved and engaged in the process of planning and implementing improvements (78.26%, Figure 5).

The EFP accreditation process (and the re-validation) can be considered as a form of external quality assurance of a specialist program, as it ensures that common high standards and harmonized policies are followed. Nevertheless, it is important that external agencies and bodies are also regularly involved to ensure fairness and objectivity in the assessment processes.

SECTION 3 – IMPLEMENTATION AND IMPACT OF THE 2018 CLASSIFICATION AND THE EFP CLINICAL PRACTICE GUIDELINES ON SPECIALIST TRAINING IN PERIODONTOLOGY

1 | OBJECTIVES

This section (prepared by Wim Teughels, Andy Temmerman, Nikolaos Donos, Moshe Goldstein, Ana Belen Castro, Christel Dekeyser and Katleen Vandamme) examines how the 2018 Classification and the EFP S3-level CPGs have affected periodontal specialist training, focusing on competencies as well as teaching and assessment methods. The results of a survey on how specialist programs implement the new classification and CPGs and how they affect postgraduate competencies, teaching and assessment are also presented.

2 | METHODS & SURVEYS

This position paper is based on

- a narrative literature review on how changes in disease classification and clinical practice guidelines affect specialist training program design in general;
- a narrative literature review on how the 2018 Classification and EFP S3-level CPGs affect periodontal specialist training design;
- a comparison of the updated classification system (Caton et al., 2018; Papapanou et al., 2018; Tonetti et al., 2018) and CPGs (Herrera et al., 2022, 2023; Sanz et al., 2020), with the 2009 Workshop EFP consensus report's competences, proficiencies and learning outcomes (Van der Velden & Sanz, 2010); and
- a survey among the program directors of the EFP-accredited training programs in 2023 regarding the implementation of the 2018 Classification and the EFP S3-level CPGs in these training programs (Appendix S1).

2.1 | Narrative review

A comprehensive literature search was conducted to identify any information regarding the influence of changes in disease classification and CPGs on competencies/learning outcomes, education methods and evaluation in specialist training programs, particularly in periodontology/periodontics.

The search strategy employed both MeSH and free-text terms. Because of time constraints, no manual searches were conducted, and only English-language publications were included.

Three databases were searched: PubMed, Scopus/Embase and WoS:

- MEDLINE: searched via PubMed (www.ncbi.nlm.nih.gov/sites/entrez/)
- Embase (www.embase.com)
- Web of Science (www.webofscience.com)

Search terms used were disease classification, clinical practice guidelines, competency(ies), learning outcome(s), education, education methods, evaluation, evaluation methods, specialist training, periodontology, periodontics, medicine, curriculum and competency-based education.

2.2 | Comparative analysis

A comparative analysis was conducted to determine whether the updated classification system and CPGs (Caton et al., 2018; Papapanou et al., 2018; Tonetti et al., 2018) necessitate changes to the 2010-established core skills, competencies, proficiencies, learning outcomes and teaching and assessment methods (Van der Velden & Sanz, 2010). Five clinical and educational experts (W.T., K.V., C.D.K., A.C., A.T.) compared the 2018 Classification system and CPGs to the 2010 framework's educational goals. They examined differences and alignment between the frameworks.

2.3 | Survey

The 22 EFP-accredited periodontology specialist program directors were surveyed online to determine whether and how the 2018 Classification and CPGs are implemented (Supporting Information – Appendix S1). On 22 June 2023, 22 program directors received a 14-question open-ended survey. Eight non-responders received a reminder on 3 July 2023 and three on 9 July. All invited program directors represented their postgraduate periodontology programs.

3 | RESULTS

3.1 | Roles of disease classification and clinical practice guidelines on designing a medical specialist training

The classification of diseases and CPGs play a significant role in the design of medical specialty education and curriculum development. It provides a standardized framework for understanding, diagnosing, treating and investigating diseases and conditions, improved healthcare quality, communication, evidence-based practice and specialty training program construction and optimization. Table 10 shows some examples on how disease classifications can contribute to medical specialty training and its learning outcomes. As disease classifications are frequently updated to reflect new research findings and advancements in the field, it is crucial that specialist training programs emphasize the significance of lifelong learning and professional development. This commitment ensures that medical specialists provide their patients with the most current and evidence-based care available.

Also integral to medical specialty training are CPGs derived from disease classification systems. CPGs help medical specialty trainees to learn how to provide high-quality care. Table 11 exemplifies how CPGs can contribute to medical specialty training and its learning outcomes.

Incorporating CPGs into postgraduate periodontal education has numerous advantages for dental professionals (Table 12). However,

TABLE 10 Contribution of disease classification systems on specialty education and training.

Contribution to	Role Disease classification	Learning outcome Specialty trainees learn to
Diagnostic accuracy[a]	Contributes to accurate diagnosis by providing clear criteria for a variety of health and disease states.	• Utilize the classification system • Identify the disease and distinguish it from other oral diseases • Quantify the disease's severity
Evidence-based practice	Should be based on the most recent scientific evidence and the consensus of field experts.	• Use the most current and accurate knowledge for evaluating patients • Develop evidence-based practice in a medical discipline
Treatment planning[b]	Allows • Constructing appropriate treatment plans • Proposing different treatment options • Framing the treatment planning within time (evolution of the disease)	• Develop a treatment strategy, taking into account patient-specific factors and individualized care • Implement treatment modalities, in accordance with the disease classification and severity
Research[c]	Provides • A common language for biomedical researchers to share information • Ease of conducting clinical trials • Ideas in line with the needs of future patients and service models, particularly in the context of international coordination	• Evaluate disease classification critically • Utilize disease classification systems • Contribute to the improvement of classification systems • Advance medical knowledge in a specific medical field
Communication and collaboration	Serves as • A universal language in healthcare, facilitating effective communication and collaboration between healthcare professionals and the patient.	• Easily communicate patient information • Share findings • Consult with the oral healthcare team • Foster interdisciplinary collaboration • Understand the interface between different medical specialties • Ensure coordinated patient care
Quality assurance and monitoring	Helps in • Assessing disease prevalence • Observing trends • Evaluating treatment efficacy • Monitoring patient outcomes	• Utilize disease classification systems • Participate in quality improvement initiatives • Monitor patient populations • Identify areas for improvement in healthcare delivery in a specific medical field

[a]Abrahamian et al. (2022), Ravida et al. (2021), Tonetti and Sanz (2019), and Walter et al. (2019).
[b]Gandhi et al. (2022), Rosen et al. (2022), and Schwendicke et al. (2020).
[c]Wadmann (2023).

CPGs are not recipe books and they may have limitations, including conflicts of interest. Thus, CPGs must be tailored to the health professional's practice as well as patients' values, preferences and multimorbidity (Franco et al., 2020; Guerra-Farfan et al., 2023).

The 2018 Classification and CPGs can affect periodontology specialist training program design directly and indirectly (Table 13).

3.2 | Impact of the 2018 classification and the EFP CPGs on the competencies and teaching and assessment methods of specialist training programs

An updated classification system, such as the 2018 Classification for periodontal and peri-implant diseases and conditions (Caton et al., 2018), which differs significantly from the previous one, may challenge periodontists' and dentists' diagnostic methods (Graetz et al., 2019) and may confuse them when applying the new nomenclature to their patients' clinical diagnosis (Milward & Chapple, 2003). In the study by Ravida et al. (2021), a group of periodontics-trained clinicians were asked to apply the new classification to cases of periodontitis in order to investigate the practical application of the new classification. This group of clinicians was chosen because of their crucial role as educators and the importance of their calibration to accurate and reliable dental professional training. The study also sought to identify non-defined grey areas in world workshop papers (Papapanou et al., 2018; Tonetti et al., 2018). Clinicians with adequate training in periodontal disease management showed moderate agreement in diagnosing periodontitis cases using the 2018 Classification system. Although severe periodontitis with well-defined characteristics was consistently rated,

TABLE 11 Contribution of clinical practice guidelines (CPGs) to medical specialty education and training.

Contribution to	Role CPGs	Learning outcome Specialty trainees learn to
Standardization of care	Provide • A standardized approach to medical practice • Offer clear recommendations and protocols for diagnosing, treating, and managing of diseases and conditions	• Establish a standardized approach to medical care • Employ well-established best practices
Evidence-based practice	• Synthesize the latest research findings • Provide recommendations supported by high-quality evidence • Help to develop the generic components of the curricula	• Critically appraise disease-related literature • Apply evidence in clinical decision-making • Promote an evidence-based approach to medical care
Learning process	• Assist in learning • Transform the learner's view when new CPGs emerge, when CPGs disappear or when CPGs are updated	• To progress in learning • Reflect on their process of learning
Decision support	Provide a structured framework to • Evaluate patient conditions • Select appropriate diagnostic techniques and parameters for assessment of diseases • Determine the most effective treatment options • Approach clinical decision-making	• Navigate complex medical scenarios • Use CPGs as a tool for formulating comprehensive decisions about periodontal care • Align decisions with the best available evidence • Consider patient preferences, values, and expectations • Incorporate patient's preferences into the treatment planning
Continuity of care	Promote continuity of care by providing consistent and standardized recommendations across healthcare settings	• Align their practice with the medical community as a whole • Facilitate seamless patient care transitions • - Deliver consistent care regardless of the healthcare setting
Patient safety and quality Improvement	Prioritize patient safety and quality improvement by • Directing medical practice towards the most effective and evidence-based interventions • Minimizing variations in care • Reducing errors • Improving patient outcomes	• Enhance patient safety • Contribute to ongoing quality improvement initiatives
Interdisciplinary training	Promote • Interdisciplinary collaboration with other specialties	• Provide comprehensive care to patients • Collaborate with healthcare professionals involved in multidisciplinary treatment planning and execution
Legal and regulatory implications	Facilitate communication in regulatory and insurance affairs as CPGs can be a prerequisite for authorization, payment or liability insurance	• Take into account the demands of legal and regulatory affairs

grey zones that complicated interpretation reduced inter-rater agreement. The authors concluded that continuous identification, refinement and incorporation of diagnostic challenges are needed to guide the training of a wide range of clinicians and predictably improve periodontitis classification agreement. Abrahamian et al. (2022), however, evaluated the inter-examiner reliability of the new periodontitis classification among a group of specialists composed of university professors, specialist clinicians and postgraduate students. They discovered, albeit with caution due to the low response rate and the potential for selection bias, that the 2018 periodontitis classification resulted in high inter-examiner reliability when used by a specialist group of clinicians, postgraduate students and academics, regardless of their current position or level of experience. In addition, it is important to note that new or revised classification systems and CPGs should be implemented with patient engagement and shared decision-making to reduce treatment variation, improve patient outcomes and lower healthcare costs (Meiyappan et al., 2020).

Therefore, educational programs must constantly update their resources and teaching methods to ensure that trainees receive the latest information when a CPG is updated to include new disease management recommendations (Abou-Arraj et al., 2021; Gandhi et al., 2022; Kakar et al., 2022). Modifications include new cases, virtual simulations and educational tools. AR, VR and AI are already used in education. However, these new technologies cannot yet replace human skill and knowledge (Section 3). More information on the use of new technologies in dental education can be found in another review prepared for the 2023 Workshop (Preshaw et al., 2024).

Changes in disease classification and GPGs may require adjustments to clinical rotations, specialized clinics and patient

TABLE 12 Advantages of incorporating clinical practice guidelines (CPGs) into specialist education in periodontology.

Advantage	Explanation
Promotes establishing a solid foundation for evidence-based practice.	Students are exposed to the most recent research findings and recommendations, supported by the strongest scientific evidence currently available.
Promotes uniformity across educational programs.	It reduces unwarranted variations in education.
Promotes critical appraisal skills.	Helps postgraduate students to develop skills in critically evaluating research studies, understanding study design and methodology and assessing the quality and applicability of evidence. These skills are essential for learning how to adapt to advancements in dental research.
Promotes patient-centred care and shared decision-making.	CPGs frequently take into account patient preferences and values. Therefore, it encourages postgraduate students to consider patient preferences, values and unique circumstances when applying clinical guidelines.
Promotes quality of dental care and patient safety.	Postgraduate students are trained to prioritize patient safety, minimize risks and optimize treatment outcomes
Promotes a dedication to lifelong learning and continuous professional development.	It reinforces the obligation of dental professionals to remain current on the most recent evidence and best practices.
Promotes understanding of the decision-making process.	CPGs offer the opportunity to discuss in depth the evidence and the decision-making process that has been gathered. This allows students to fully understand the evidence, its limitations and their clinical translation—in particular, the exceptions that may be important for personalized decision-making. The importance is not only in terms of focus on outcome (what to do, how, and when) but also on the process since students will practice through many versions of CPGs.

populations for trainees. Trainees must be given opportunities to diagnose, treat and monitor patients using the revised disease classification. Graduates and specialists may benefit from self-directed learning resources and guidance during disease classification changes. CPG changes emphasize specialists' continuing education.

Specialist training program evaluations can be affected by disease classification and CPG changes. To assess trainees on CPG-relevant competencies, assessment methods may need to be modified to reflect the new knowledge and skills needed. Further elaboration on this topic can be found in Section 2.

3.3 | How are the 2018 Classification and CPGs implemented in specialist programs?

3.3.1 | The 2018 Classification

The survey results are shown in Figure 6. All training programs teach and use the 2018 classification. Twelve training programs teach or use other classification systems, including the 1999 classification. The other 10 training programs use or teach the 2018 Classification exclusively. In 5 of the 12 training programs that do not exclusively teach the 2018 Classification, students must be familiar with other classification systems for historical reasons but are not expected to use them clinically. Two training programs teach and use nation-specific adaptations. Since the first day of training, all 22 programs teach the 2018 classification.

Programs use different teaching methods. In general, the 2018 Classification is taught through a combination of lectures, literature reviews, journal clubs, seminars and clinical case discussions. Some difficulties were encountered in the implementation of the 2018 Classification. The majority of these difficulties relate to (i) the knowledge of the new classification by healthcare professionals in other fields; (ii) difficulties in the interpretation of the classification (e.g., differences between stages III and IV; differences between staff); (iii) differences between the 1999 and 2018 classifications, making it more difficult to translate older literature to the current patient; (iv) nation-specific adaptations of the classification; and (v) hospital or government reimbursement regulations for treatment that were based on the 1999 classification. These were resolved by (i) providing seminars and updates for healthcare workers in other fields; (ii) discussions between and among faculty members and graduate students during clinical case presentations; and (iii) using different classification systems depending on the setting. Most programs ($n = 15$) reported no program-level issues. Some programs noted that perfect standardization is impossible and that EFP and AAP can help clarify staging (better distinguishing Stages III and IV, rapid Stage III, clinical consequences of Stages III vs. IV) by providing additional guidance on debatable cases.

Twenty-one of 22 course directors thought that the 2018 Classification was better for periodontal specialist training than the 1999 classification. In essence, the new classification system is considered by them useful for a better understanding of severity, complexity and prognosis; it improves communication between students and specialists and overcomes some problems related to the older classification system. In addition, the 2018 Classification offers a more comprehensive approach to diagnosing periodontal diseases, focusing on clinical steps and a structured, clear process. This approach is more formalized, unlike the 1999 classification. The new classification emphasizes disease-modifying periodontal

TABLE 13 Impact of the 2018 Classification of Periodontal and Peri-implant Diseases and Conditions and clinical practice guidelines (CPGs) on various aspects of the design of periodontology specialist training programs.

Aspect	Role	Impact
Curriculum development	The classification and CPGs assist in identifying the essential knowledge and abilities that trainees must acquire during their training.	The classification and CPGs should serve as the basis for curriculum development in periodontology specialist training programs. The curriculum should be designed to ensure that trainees receive a comprehensive education on the guidelines' outlined principles, diagnostic criteria, treatment modalities and management strategies.
Diagnostic criteria	The newly revised diagnostic criteria for periodontal and peri-implant diseases and conditions are based on the most recent scientific evidence and the consensus of field experts.	These updated diagnostic criteria should be incorporated into periodontology specialist training programs to ensure that trainees are equipped with the most current and accurate knowledge for evaluating patients.
Treatment planning and management	The CPGs provide treatment planning and management recommendations for periodontal and peri-implant diseases and conditions.	These CPGs should be utilized by specialist training programs to teach periodontology trainees about evidence-based treatment approaches, including non-surgical and surgical interventions, maintenance protocols and implant-related considerations. Trainees should learn how to use the classification and CPGs to develop comprehensive treatment plans for their patients, taking into account patient-specific factors and individualized care.
Case discussions and treatment decision-making	The classification promotes a case-based learning approach.	Based on the classification, specialist training programs should incorporate case discussions and treatment decision-making exercises. Trainees should be exposed to real-world patient scenarios and instructed in the evaluation and classification of periodontal and peri-implant diseases and conditions. This practical application of the classification system aids in the development of trainees' critical thinking and clinical judgement.
Interdisciplinary collaboration	The classification and CPGs emphasize the value of interdisciplinary collaboration in the management of complex cases.	Specialist training programs should foster collaboration between periodontists and other (dental) specialists, such as prosthodontists, oral and maxillofacial surgeons, restorative dentists and other healthcare workers. Trainees should gain a comprehensive understanding of how the classification influences interdisciplinary treatment planning and patient care by studying the interface between periodontics, implantology and other specialties.
Research	Classification and CPGs promote ongoing research in the field.	Specialist training programs should encourage trainees to contribute to the evidence base for periodontal and peri-implant diseases and conditions. Trainees should be encouraged to evaluate the classification critically and contribute to its improvement via research and scholarly work.
Continuing education and professional development	The classification and CPGs will be regularly updated to reflect new research findings and developments in the field.	Specialist training programs in periodontology should emphasize the importance of lifelong learning and professional development because periodontology specialists are expected to remain current with the most recent revisions and modifications to the classification and CPGs through continuing education courses, conferences and independent study. This dedication to staying up to date ensures that periodontology specialists provide the most current and evidence-based care to their patients.

parameters, forcing students to consider furcation, bone loss morphology, missing teeth, smoking and diabetes during periodontal diagnosis. A less convinced director remarked that the 2018 Classification is complex and that many patients are diagnosed with Stage III grade C periodontitis even though they need different treatment.

3.3.2 | Clinical practice guidelines

The survey found that all specialist training programs use CPGs. Five of 22 training programs use guidelines other than EFP CPGs (e.g., national guidelines, adapted EFP CPGs). CPGs are taught in all training programs from year 1. Lectures, literature reviews, journal

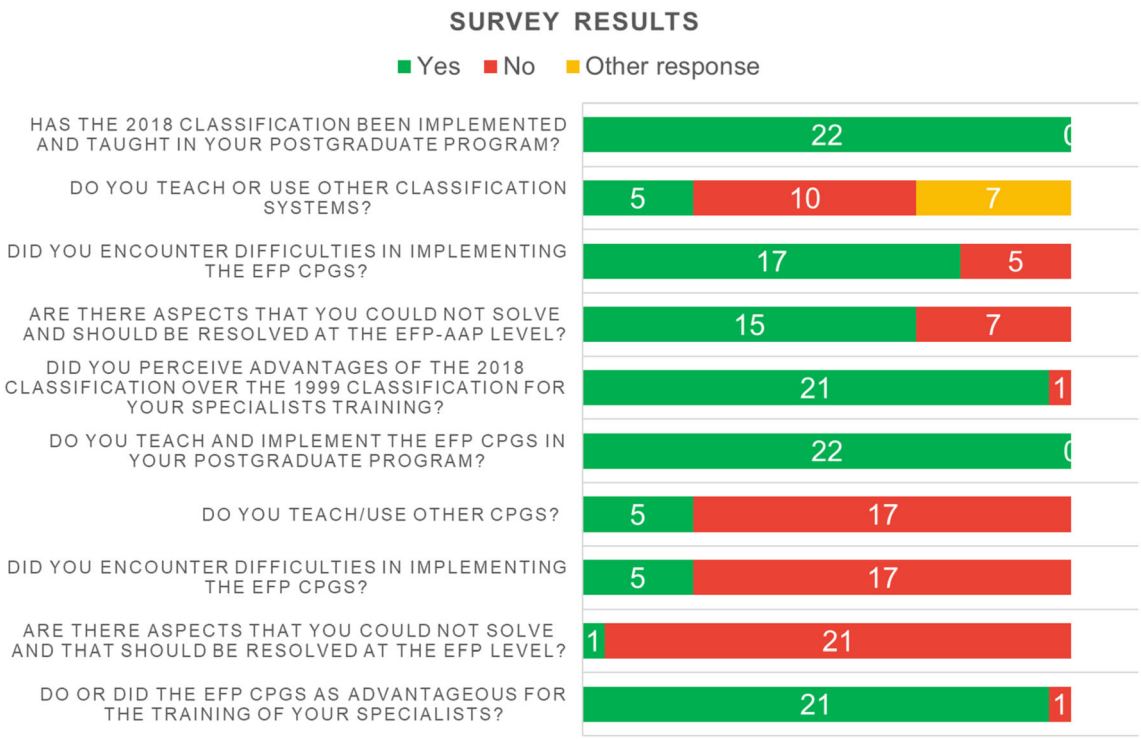

FIGURE 6 Results of the questionnaire on the impact of the publication of the 2018 Classification and the EFP clinical practice guidelines in specialist training programs, as filled in by program directors.

clubs, seminars and clinical case discussions are used, as for the 2018 Classification. Seventeen of 22 program directors reported no EFP CPG implementation issues. Difficulties that were encountered related to (i) the huge variety of treatment options even when the diagnosis for cases is similar; (ii) the clinical meaning of non-surgical re-treatment of residual pockets after cause-related therapy; (iii) the deviation of the EFP guidelines from the local national guidelines; (iv) the scientific backbone for some of the recommendations being sometimes weak; (v) the justification for taking a full radiographical analysis during periodontal maintenance; and (vi) the graduate students who mainly rely on the CPGs for their clinical strategies but become less curious about the rest of the literature. These issues were solved by (i) case presentations where all treatment options are evaluated and debated, (ii) implementing specific literature seminars where the deviations of the EFP guidelines from the local national guidelines are discussed, and (iii) the alignment of clinical staff in regard to treatment planning using the CPGs, expected endpoints and expected records according to the CPGs. The majority of program directors ($n = 21$) indicated that there were no issues that could not be resolved at the program level. One program director proposed a global continuing education resource. Additionally, most program directors ($n = 21$) consider EFP CPGs beneficial for specialist training. They consider CPGs a 'formal' endorsement of their protocols. CPGs constitute a strong foundation for the entire education and a summary of the pertinent literature. They identify interventions supported by scientific evidence and concentrate on achieving excellence in those interventions recommended by the CPGs. CPGs specify the anticipated outcome of each therapy step and contribute to the standardization of the majority of treatments in Europe. Concern exists, however, that CPGs impede individualized treatment planning because students believe they must strictly adhere to them.

3.4 | Do the 2018 Classification and CPGs have an impact on the competencies, teaching and assessment methods in postgraduate education?

3.4.1 | Competencies

In the survey, program directors were also asked their view on how the 2018 Classification and EFP CPGs impacted the program's competencies and learning outcomes. In general, the program directors agreed that the 2018 Classification and EFP CPGs had no effect on formal competencies and learning outcomes due to their broadness. However, they noted that the new classification system and CPGs improved periodontal disease diagnosis, case presentations, interdisciplinary management and scientific evidence understanding. In addition, they have enhanced the training structure, thereby facilitating teaching and learning, and altered the format of case presentations. Overall, the 2018 Classification and EFP CPGs have improved learning and clinical outcomes significantly.

3.4.2 | Teaching methods

In the survey, program directors were also asked for their views on how the 2018 Classification and EFP CPGs impacted the program's

educational methods. According to them, the educational methods did not undergo significant change. They believe that the 2018 Classification and EFP CPGs increased case-based learning and clinical case discussions. The 2018 Classification and EFP CPGs in some training programs led to inter-university clinical case discussions. Staff and students participate in additional seminars, workshops and calibrations.

3.4.3 | Assessment methods

The program directors indicate that the methods for evaluating students have not changed; but, in addition, both their theoretical and practical knowledge of the classification system and EFP CPGs are assessed. The 2018 Classification and EFP CPGs primarily influenced the evaluation of student-presented and -performed clinical cases. In general, case presentations must include the 2018 Classification system and EFP CPGs, and students must be familiar with additional literature. One of the program directors mentioned that when open recommendations are proposed, the EFP CPGs can make it more difficult for the student.

3.5 | Is there a need to change the 2010-defined competencies, teaching and assessment methods in postgraduate education due to the 2018 Classification and CPGs?

3.5.1 | Competencies

A comparative analysis was done to determine whether the implementation of the updated classification system and CPGs (Caton et al., 2018; Papapanou et al., 2018; Tonetti et al., 2018) in postgraduate education require changes to the core skills and competencies that were set in 2010 (Van der Velden & Sanz, 2010). This comparative analysis revealed that the new classification and CPGs do not require an alteration in the competencies and related learning outcomes established in 2010, primarily due to the broadness of the defined competencies. While the 2018 Classification and EFP CPGs introduced refinements and incorporated advancements in medical knowledge, the fundamental educational objectives and core competencies remained consistent. Because the 2010 framework fits with the current classification system and CPGs, it shows that the original educational structure was strong and still has value. This knowledge can help educators and curriculum designers to integrate future disease classification and CPG changes without compromising the educational objectives. Additionally, one needs to emphasize the importance of periodically reviewing and updating educational frameworks to reflect advancements in medical knowledge while maintaining continuity in core competencies.

3.5.2 | Teaching methods

Teaching and learning methods are broadly outlined in the 2009 Workshop EFP consensus report (Van der Velden & Sanz, 2010). In this regard, postgraduate education for the new classification and CPGs can include the following instructional methods:

Small-group interactive sessions. Small-group interactive sessions can permit in-depth discussions on and active participation with the classification system and clinical practice guidelines. These sessions may consist of case-based discussions as well as problem-solving and role-playing exercises. Trainees should be capable of analysing complex clinical scenarios, applying guidelines to patient cases, and engaging in critical thinking and decision-making.

Case presentations and grand rounds. Case presentations and grand rounds allow trainees to present patient cases, discuss diagnostic and treatment challenges and receive feedback from experienced faculty. This format should facilitate applying clinical practice guidelines to real-world cases, fostering peer discussion and critical evaluation of evidence and guidelines.

Hands-on workshops and simulations. Participants can practice CPG-compliant procedures in workshops and simulations. These sessions may include simulated patient scenarios, mock operations, dental models, VR or all of the above. Trainees can apply guidelines and classification, receive feedback and improve clinical skills in a controlled environment.

Journal clubs and literature reviews. Classification- and CPG-focused journal clubs and literature reviews can allow trainees to conduct a critical analysis of the most recent research articles, evaluate the evidence supporting the guidelines and discuss the implications for clinical practice. Journal clubs provide an opportunity to remain current with new evidence and engage in discussions based on this evidence.

Mentorship and preceptorships. Assigning trainees to experienced mentors or preceptors familiar with the 2018 classification and CPGs can provide personalized guidance and mentoring. Under instructor supervision, trainees can observe and actively participate in clinical practice, applying guidelines and classifications to patient care. Mentoring promotes clinical decision-making using guidelines and classification and professional development.

Research projects and scholarly activities. Encouraging trainees to participate in research projects and scholarly activities related to the disease classifications and CPGs can promote a deeper comprehension and application of the guidelines and the classification system. Trainees can conduct systematic reviews, observational studies and clinical trials to contribute to the guidelines and classification system's evidence base. Research projects allow trainees to evaluate the guidelines and classification critically, identify knowledge gaps and contribute to the field's advancement.

Continuing education and conferences. Attending CPG and classification system continuing education courses, conferences and professional meetings can expose trainees to expert presentations, updates and discussions on the latest developments. Trainees can network with subject experts, share information and learn how the guidelines are applied at these events.

3.5.3 | Assessment methods

Evaluation of the understanding and application of the 2018 Classification and CPGs is essential in postgraduate education to ensure that

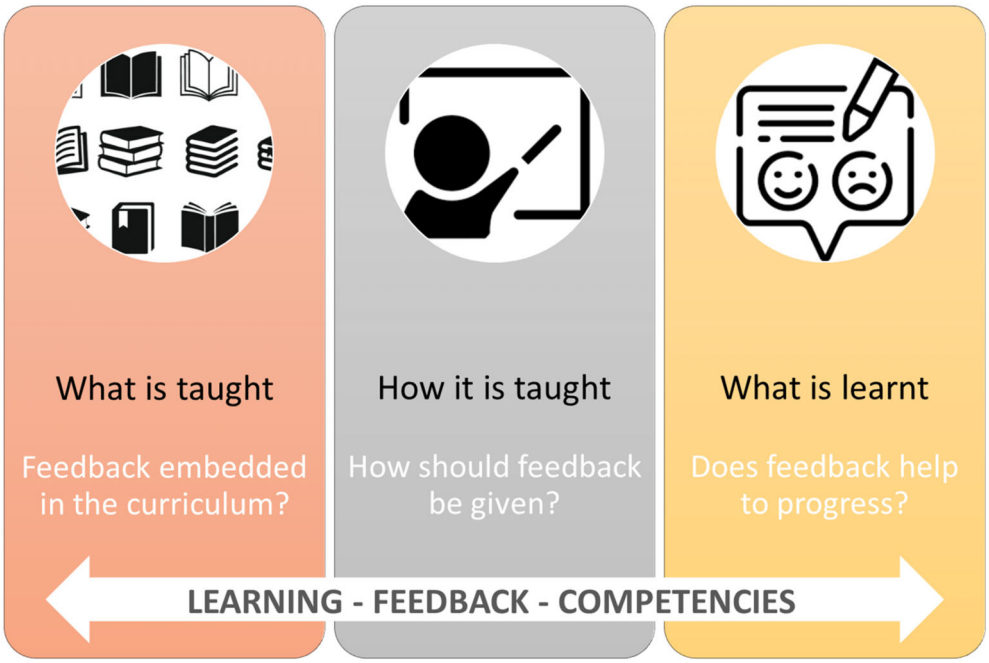

FIGURE 7 The educator–trainee relationship in terms of learning, feedback and competencies (Telio et al., 2015).

trainees effectively incorporate the guidelines into clinical practice. The EFP consensus report from the 2009 Workshop describes learning outcome assessment methods in general (Van der Velden & Sanz, 2010). Some methods for evaluating clinical practice guidelines in postgraduate education may include the following:

Written assessments. Multiple-choice questions, short-answer questions and case-based scenarios can assess trainees' knowledge and comprehension of the classification system and CPGs. These assessments may cover key concepts, diagnostic criteria, treatment recommendations and the rationale for the classification and guidelines. Written exams objectively assess trainees' knowledge.

Oral examinations. One-on-one or group oral exams allow faculty to assess students' comprehension of classification and CPGs. Trainees may present and discuss patient cases, make clinical decisions based on guidelines and classification and explain their reasoning. Students' ability to apply guidelines and classification in clinical settings and communicate their understanding is assessed in oral exams.

Objective structured clinical examinations (OSCEs). OSCEs assess trainees' clinical skills and decision-making ability in relation to clinical practice guidelines and classification. OSCE stations can simulate real-life patient encounters or use real patients to test trainees' ability to obtain a patient history, perform a clinical examination, diagnose conditions and develop guidelines-based treatment plans. OSCEs evaluate medical students' clinical skills in a standardized manner.

Case presentations and discussions. Trainees can be evaluated on the basis of case presentations and discussions in which they present case classification and clinical practice guidelines. Faculty members are able to evaluate trainees' abilities to analyse and interpret clinical data, make accurate diagnoses using the classification system and develop evidence-based treatment plans that adhere to the guidelines. Case presentations and discussions afford trainees the opportunity to demonstrate their comprehension and application of the guidelines in a clinical setting.

Portfolio assessment. Trainees may keep a portfolio that demonstrates their application of the classification system and CPGs in a variety of clinical scenarios. The portfolio may contain case reports, treatment plans, patient outcomes and reflections on how the guidelines or classification impacted their decision-making. Faculty members can periodically review trainees' portfolios to assess their integration of clinical practice guidelines and provide feedback for improvement.

Direct observation and feedback. Faculty can observe trainees during clinical encounters and provide immediate feedback on classification and CPG adherence. Formative evaluation allows trainees to receive continuous feedback on clinical decision-making, treatment planning and patient management. Feedback and observation aid self-reflection and improvement.

Self-assessment and reflection. To assess their understanding and application of the classification system and clinical practice guidelines, trainees can self-evaluate and reflect. They can assess their knowledge, skills and compliance with guidelines and identify areas for improvement. Structured questionnaires, self-evaluation checklists and reflective writing exercises aid self-assessment and reflection.

4 | DISCUSSION

The 2018 Classification and EFP CPGs have affected clinical practice and periodontology specialty education programs. Even though the new classification and associated CPGs have been widely implemented at least in EFP-accredited postgraduate training programs, they do not seem to require changes to the competencies or teaching and assessment methods described for postgraduate education in 2010. This is in relation to the all-encompassing nature of the formal competencies as well as teaching and assessment methods. However, the

survey shows that program directors believe students must learn and apply the new classification and CPGs. Despite the fact that they see this as a necessity, the methods of teaching and evaluation have not changed. Moreover, the survey indicates that the program directors use various educational and evaluation methods. In relation to teaching methods, this is essential to accommodate different learning styles, provide a comprehensive learning experience and ensure the effective incorporation of CPGs and the classification system into postgraduate education. Furthermore, incorporating technology-enhanced learning, such as online modules, interactive apps and virtual simulations, can also improve the guidelines' accessibility and engagement. Finally, the common thread throughout the listed teaching methods is feedback. Student learning relies heavily on feedback, regardless of training level. Feedback bridges the gap between students' current learning state and their future needs (Figure 7). Good feedback has many facets, of which the main ones for postgraduate clinical training are the following, according to us: (i) feedback directly linked to the learning objectives, (ii) feedback during learning, (iii) specific and objectively descriptive feedback, and (iv) feedback that provokes a dialogue about the approach taken.

Multiple assessment methods are needed to evaluate trainees' classification system and CPG knowledge, skills and application. The survey shows that program directors use different assessment methods. These evaluation methods must give trainees constructive feedback to help them develop professionally. The amount of feedback given is inversely proportional to the level of proficiency already achieved: at the skills-based assessment (shows how and does), the importance of feedback is higher than at the knowledge-based assessments (knows and know hows). Moreover, a supportive and non-threatening evaluation environment encourages trainees to actively engage with the classification system and guidelines and to strive for continuous improvement.

This review has several drawbacks. The literature searches revealed no scientific research on the 2018 Classification and CPGs' effects on postgraduate education. The survey was sent only to course directors of EFP-accredited postgraduate periodontology training programs, which may bias the results of the 2018 Classification and CPG implementation in non-EFP programs. It is also unclear how well the 2018 Classification and CPGs are integrated into other postgraduate training programs.

5 | CONCLUSIONS

In this paper, we have evaluated the impact of the publication of the 2018 Classification and EFP CPGs, and the following can be concluded:

- For periodontal specialist training competencies, the knowledge and application of the 2018 Classification and CPGs are regarded as to-be-acquired competencies during periodontal postgraduate education. However, the 2010-defined competencies are compatible with the current classification system and CPGs, which demonstrates that the 2010-defined educational structure was robust and still has value.
- For periodontal specialist training teaching methods, the implementation of the 2018 Classification and CPGs has not yet resulted in a change in the used methods. However, they can be an opportunity to introduce new teaching approaches. It is essential to accommodate different learning styles, provide a comprehensive learning experience with feedback as key player and ensure the effective integration of CPGs and the classification system into postgraduate education.
- For periodontal specialist training assessment methods, although the 2018 Classification and CPGs have not altered the assessment methods currently used in postgraduate education in periodontology, they present an opportunity to introduce new assessment methods. To comprehensively assess trainees' knowledge, skills and application of the classification system and clinical practice guidelines as well as to guide trainees' professional development, a variety of assessment methods that provide constructive feedback are required.

AUTHOR CONTRIBUTIONS

All authors made substantial contributions to the conception and design of the work; the acquisition, analysis and interpretation of data; the drafting of the work and revising it critically; and the final approval of the manuscript to be published.

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DATA AVAILABILITY STATEMENT

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Additional supporting information can be found online in the Supporting Information section at the end of this article.

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