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Aesthetics and Patient-Reported Outcomes in Periodontology and Implant Dentistry: Consensus Report

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Keywords: aesthetic scores | connective tissue grafts | gingival recession | patient-reported | patient-reported outcome measures | peri-implant soft-tissue dehiscence | soft-tissue substitutes

ABSTRACT

Background: Aesthetics and patient-reported experiences (PREs) and outcomes (PROs) influence treatment choices, but have been largely overlooked in periodontology and implant dentistry. This consensus conference evaluated these factors by focusing on gingival recession defects (GRDs), immediate or early/delayed implant placement and peri-implant buccal soft-tissue dehiscences.

Methods: The workshop discussions were informed by five specifically commissioned systematic reviews covering PREs, PROs and clinician-reported outcomes (CROs), including effectiveness, aesthetics and other concerns.

Results: Following treatments such as coronally advanced flaps (CAFs) with a connective tissue graft (CTG) for root coverage (RC), a positive correlation was noted between clinician-reported aesthetic scores and RC measures for GRDs. However, a corresponding correlation for patient-reported aesthetic perceptions was not evident. In dental implant procedures, the addition of a CTG immediately after implant placement significantly mitigated the apical shift in the mid-facial mucosal level. However, clinician- and patient-reported aesthetic scores were not reflective of these changes. Neither set of scores captured the impact of grafting on improving peri-implant soft-tissue volume. In the treatment of peri-implant dehiscences, soft-tissue augmentation (STA), using CTG beneath CAF, resulted in favourable outcomes in clinician- and patient-perceived aesthetics.

Conclusions: Clinician and patient views provide complementary perspectives for evidence-based clinical decision making. They need to be integrated into select interventions. Specific trials are needed encompassing PREs, PROs and CROs and reporting benefits and harms.

Maurizio Tonetti and Mariano Sanz contributed equally to this study.

For affiliations refer to page 18.

1 | Introduction

Over the last two decades, a strong body of evidence has emerged, suggesting that soft-tissue reconstruction at exposed root surfaces can be predictably achieved with different techniques (Cairo et al. 2008; Tonetti et al. 2014), leading to excellent clinical outcomes, with stable long-term results in compliant patients (Tavelli et al. 2019). In addition, a growing tendency in applying soft-tissue reconstructive techniques has been observed at dental implant sites, to improve the aesthetic outcomes of therapy and to reduce the risk of peri-implant dehiscences (Cairo et al. 2019).

This scientific interest has pushed clinical research to develop and validate specific tools for evaluating aesthetic outcomes of therapy, using standardised approaches (Cairo et al. 2009; Furhauser et al. 2005), and to systematically assess patient experience and satisfaction after treatments. The 10th European Workshop on Periodontology, held in 2014, represented an original starting point in this field. In this event, experts emphasised the relevance of patient-reported outcomes (PROs) as 'true endpoints' by clustering patients' perceptions of therapy (Tonetti et al. 2014). Thereafter, professional aesthetic scores, PROs and patient-reported experiences (PREs) have progressively gathered attention and have been included in randomised clinical trials (RCTs) to provide a reliable and standardised assessment of treatment quality (Cairo et al. 2020a; Stefanini et al. 2016; Tonetti et al. 2018). These tools seem to be fundamental in assessing the impact of treatment on patients' health and well-being.

A *patient-reported outcome* is any health status information reported directly by the person (or their carer) experiencing the condition. For instance, it might assess the patient's view of the effect of a health condition, such as their rating of symptoms and functional status (Broomhead et al. 2022). This is different from a *clinician-reported outcome* (CRO), for which the evaluation is generated by a clinician/investigator or other professional. When the assessment is specifically related to the experience of treatment (e.g., overall satisfaction with a procedure), the appropriate term is *patient-reported experience* (Needleman et al. 2023).

In contrast, a *patient-reported outcome measure* (PROM) is a tool that has been developed and validated by a standardised process (Swan et al. 2023). The development process includes testing of the characteristics of the outcome measure to understand how it can be used to evaluate the health condition, especially for research. Like clinical outcomes, these properties pertain to the validity to measure what it claims to detect, how it is affected by the specific person reporting the outcome (for instance, as a function of age, gender socio-economic status and cultural influences, etc.), and how responsive it is to change when used to detect the effect of a condition or an intervention. However, the relevance of the values derived from PROMs is often difficult to interpret. To aid in this interpretation, an important development is to determine the *minimally important difference* (MID) for a PROM. This is the minimally important change (from baseline) in the assessment of a PRO that is regarded as relevant to a patient and could capture either perceived benefits or harms (Tsakos et al. 2010).

Therefore, when adequately validated, a PROM may be considered as the methodological tool of reference to assess the primary outcome (e.g., a given PRO), because the information they provide is likely to be more relevant to patients than most CROs. See also Figure 1.

2 | Objectives

The main objectives of this Focused Workshop on Aesthetics and Patient-Reported Outcomes in Periodontology and Implant Dentistry were (i) to understand the methods of assessment of aesthetic outcomes and PROs, and (ii) to evaluate the effect of different interventions in terms of aesthetic outcomes and PROs.

3 | Methods

The Focused Workshop on Aesthetics and Patient-Reported Outcomes in Periodontology and Implant Dentistry was organised by the European Federation of Periodontology (EFP), in collaboration with the Italian Society of Periodontology and Implantology (SIdP) and the Spanish Society of Periodontology and Osseointegration (SEPA). The in-person meeting took place at the Educatorio del Fuligno (Florence, Italy) from 19 to 21 January 2025. A total of 40 experts examined the current evidence derived from five previously prepared systematic reviews on the topic (Cairo et al. 2025; Lambert et al. 2025; Nart et al. 2025; Ramanauskaite et al. 2025; Stefanini et al. 2025), and debated their results and the clinical implications for therapy in terms of professionally assessed aesthetic results and PROs in periodontal and peri-implant plastic surgery (Photograph 1).

Three clinical scenarios and five groups of interventions were considered. The clinical scenarios were (i) single or multiple gingival recession defects (GRDs) (Cairo et al. 2025; Stefanini et al. 2025), (ii) peri-implant buccal soft-tissue dehiscences (Nart et al. 2025), and (iii) placement of dental implants (immediate or early, delayed and late) (Lambert et al. 2025; Ramanauskaite et al. 2025). The five groups of interventions were (i) surgical procedures for root coverage in single GRDs (Cairo et al. 2025); (ii) surgical procedures for RC in multiple GRDs (Stefanini et al. 2025); (iii) surgical procedures to increase soft-tissue thickness/height adjunctive to immediate implant placement (Lambert et al. 2025); (iv) surgical procedures involving soft-tissue augmentation (STA) during early, delayed and late implant placement (Ramanauskaite et al. 2025); and (v) surgical procedures involving STA to correct peri-implant buccal soft-tissue dehiscences (Nart et al. 2025).

Because of the extensive use of acronyms and abbreviations an Appendix A describing the meaning of the acronyms/abbreviations used in the consensus report is provided herewith.

For organising the discussions and preparing the consensus report, two working groups were designed: one to discuss interventions around teeth, and another for interventions around dental implants.

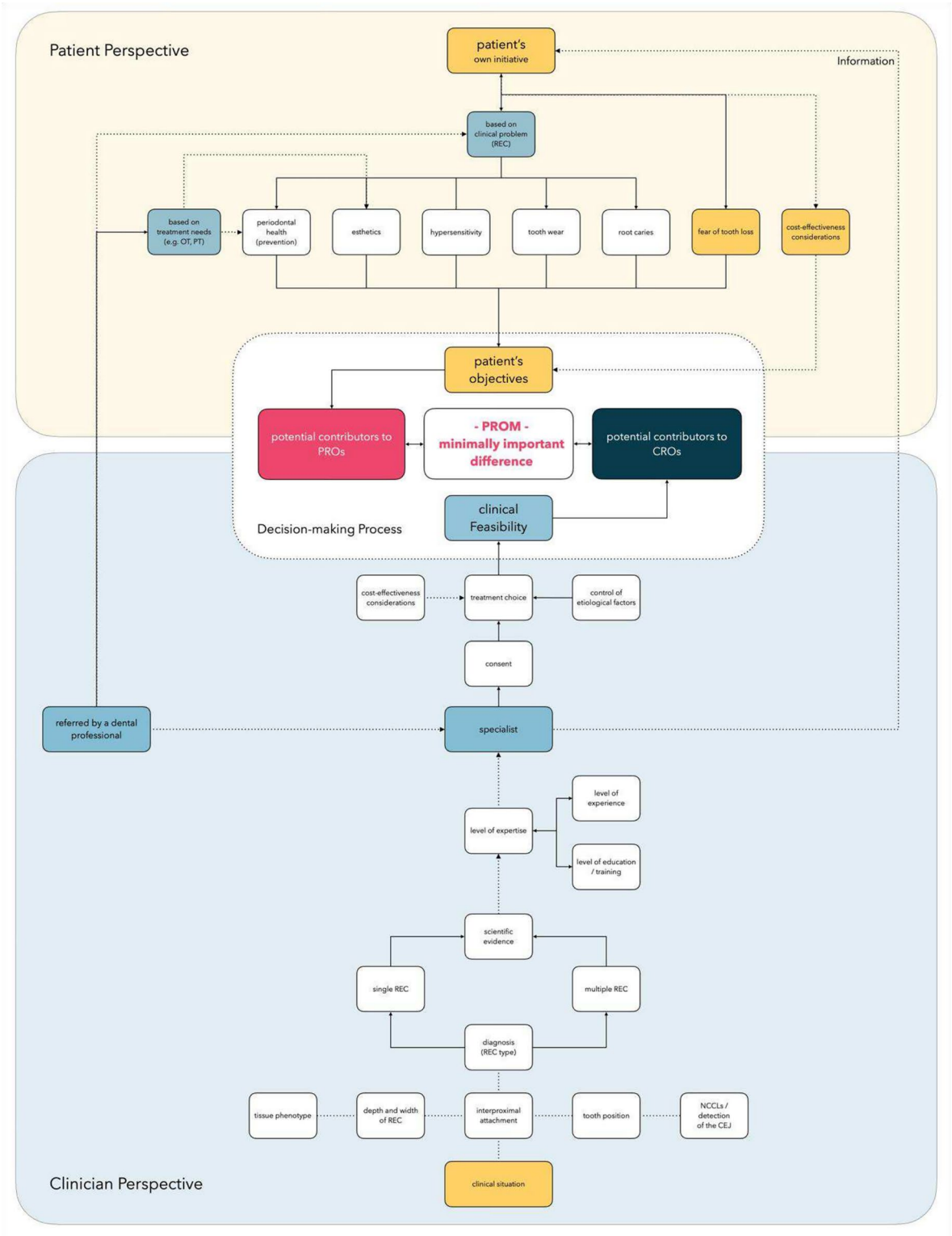

FIGURE 1 | Legend on next page.

3.1 | Working Group 1—Gingival Recession Defects Around Teeth

Working Group 1 was chaired by Maurizio Tonetti and David Herrera (Table 1) and focused on the treatment of GRDs. The review on single GRDs was led by Cairo et al. (2025), while the review covering multiple GRDs was prepared by Stefanini et al. (2025).

3.2 | Working Group 2—Immediate, Early, Delayed and Late Dental Implants and Peri-Implant Buccal Soft-Tissue Dehiscences

Working Group 2 was chaired by Mariano Sanz and Iain Chapple (Table 2) and focused on approaches for STA around dental implants, in immediate, early, delayed, and late placement. An additional topic was the treatment of peri-implant

FIGURE 1 | Diagram of the decision-making process leading to patient-reported outcomes and clinician-reported outcomes. The diagram illustrates the interplay between patient and clinician perspectives on managing gingival recessions defects. Symptoms and perceptions are central to the considerations that patients take into account when making treatment decisions. Clinical presentation and scientific evidence are the main factors that inform a professional assessment of addressing the patient's problem. The two perspectives inform each other during the evaluation and are integrated throughout the decision-making process. While the different perspectives are separated for illustrative purposes, they are closely integrated in real life. The diagram specifically describes the decision-making process that leads to the identification and consideration of patient-reported outcomes (PROs) and clinician-reported outcomes (CROs). Patient-reported outcome measures (PROMs) pertain to the 'minimally important difference' (e.g., improved oral hygiene performance, root coverage, reduction of dentine hypersensitivity, no progression of tooth wear, and tooth retention) that justify an intervention. PROs are influenced by the considerations of the dental professional team and/or the patient regarding clinical problems or treatment needs, such as periodontal health, aesthetics, dentin hypersensitivity, tooth wear and root caries. Fear of tooth loss and health economics also play a role in patient considerations. These factors and the information provided by the specialist influence the patient's objectives and, eventually, decisions. The clinical situation is characterised by the diagnosis and professional assessment, which considers tissue phenotype, the depth and width of the recession, interproximal attachment, tooth position and non-carious cervical lesions, including the detection of the cemento-enamel junction, in cases of single or multiple gingival recession defects. The available scientific evidence determines the diagnosis and potential solutions, and the decision-making process is influenced by the clinician's level of expertise, including their education, training and experience. The specialist informs the patient about treatment options, cost effectiveness and the ability to manage aetiological factors. With the patient's consent, the clinical feasibility can contribute to CROs. CROs, clinician-reported outcomes; NCCLs, non-carious cervical lesions; OT, orthodontic treatment; PROMs, patient-reported outcome measures; PROs, patient-reported outcomes; PT, prosthodontic treatment; REC, gingival recession. Colour code: blue boxes, clinically/clinician-related factors; yellow boxes, patient-related factors.

PHOTOGRAPH 1 | Photograph of Workshop participants.

buccal soft-tissue dehiscences. The review on STA in immediate dental implants was led by Ramanauskaite et al. (2025); the one on STA in early, delayed or late dental implants was compiled by Lambert et al. (2025); and the review on the treatment of peri-implant buccal soft-tissue dehiscences was written by Nart et al. (2025).

4 | Surgical Treatment of Single and Multiple Gingival Recession Defects

Group discussions were guided by available scientific evidence integrated with expert opinion. Two systematic reviews were commissioned to introduce a new perspective focusing on aesthetics and patient viewpoints, broadening previously gathered knowledge to encompass these vital aspects (Cairo et al. 2025; Stefanini et al. 2025). Additionally, the group reviewed high-quality systematic reviews and individual trials that had been published previously. Ultimately, the group acknowledged that, to answer some relevant questions, it was necessary to provide a viewpoint based on expert opinion that could improve understanding, support the application of this evidence in clinical practice and direct future research. Specific questions and answers were formulated to emphasise the appropriate syntax to separate scientific evidence and expert opinion.

4.1 | Background and Introduction

4.1.1 | What Are Gingival Recession Defects?

GRDs refer to apical shifts of the gingival margin that may be initiated and sustained by various diseases or conditions. GRDs are linked to clinical attachment loss and may occur on any surface (buccal, lingual or interproximal). The group categorised cases of GRDs based on a matrix proposed in 2018 (Cortellini and Bissada 2018), which has been accepted by the International

TABLE 1 | List of participants, with their role, in Working Group 1.

Role	Full name	Country
Scientific Chair	Maurizio Tonetti	China
EWC Chair	David Herrera	Spain
Reviewer	Gustavo Avila-Ortiz	Spain
Reviewer	Francesco Cairo	Italy
Reviewer	Martina Stefanini	Italy
Reviewer	Anton Sculean	Switzerland
Participant	Sofia Aroca	France
Participant	Pierpaolo Cortellini	Italy
Participant	Massimo de Sanctis	Italy
Participant	Henrik Dommisch	Germany
Participant	Elena Figuero	Spain
Participant	Filippo Graziani	Italy
Participant	Søren Jepsen	Germany
Participant	Ian Needleman	UK
Participant	Andrea Pilloni	Italy
Participant	Giovanni Zucchelli	Italy
EFP representative	Moritz Kebschull	UK
EFP representative	Nicola West	UK
SIdP representative	Raffaele Cavalcanti	Italy
Curasept representative	Paola Della Bruna	UK
Curasept representative	Giulia Giovannardi	Italy
Klockner representative	Matteo Albertini	Spain
Klockner representative	Elena Martí	Spain

Abbreviations: EFP, European Federation of Periodontology; EWC, European Workshop Committee; SEPA, Spanish Society of Periodontotology; SIdP, Italian Society of Periodontotology.

Classification of Periodontal Diseases and Conditions (Jepsen et al. 2018). In the present Workshop, recession defects related to periodontitis were not discussed.

4.1.2 | What Is the Periodontal Phenotype?

The periodontal phenotype refers to the observable properties and dimensions of the periodontal tissues that arise from the interaction between the genotype and the environment throughout an individual's lifetime. Hence, phenotypical dimensions may change over time depending on environmental factors and clinical interventions, and may be site-specific (the phenotype can be modified, but not the genotype). The periodontal phenotype is essentially constituted by the gingival phenotype (which includes the gingival thickness [GT] and the keratinized tissue width [KTW]) and the bone morphotype (thickness of the alveolar bone plate).

4.1.3 | What Is the Significance of an Exposed Root Surface?

An exposed root surface is the consequence of the apical migration of the gingival margin that can lead to symptoms and worsen the periodontal prognosis in extreme situations. GRDs may be linked to dentine hypersensitivity, non-carious cervical lesions (NCCLs), root caries, restorations on the exposed roots and the development of secondary caries beneath such restorations.

4.1.4 | How Prevalent Are Gingival Recession Defects?

GRDs occur frequently in adults, their prevalence tends to increase with age and they are observed in populations with varying standards of oral hygiene. Surveys revealed that 88% of individuals aged 65 and older and 50% of those aged 18–64 have at least one site showing gingival recession (Gorman 1967; Tonetti et al. 2014). More recent studies have focused on assessing the prevalence of recession-type (RT) 1 GRDs to avoid the inclusion of periodontitis cases. In South American adolescents, the observed prevalence of RT1 GRDs was 4.3% (Strauss et al. 2023). In Chilean adults, it was 0.3% (Strauss et al. 2023). In a representative U.S. adult population, the patient-level prevalence of RT1 GRDs was 12.4%, while it was 5.8% when only the aesthetic zone was considered. Most RT1 GRDs were 1–2 mm deep (Romandini et al. 2020). In a Northern Italian population, the RT1 prevalence was 40.9% and 6.3% at the patient and tooth level, respectively (Romano et al. 2022).

4.1.5 | What Are the Risk Factors for Gingival Recession Defects?

Improper Toothbrushing. Some studies have reported a positive association between toothbrushing and recession, others a negative one and some no association at all. Overall, the data do not allow the extraction of overarching conclusions; however, experts agree that modifying any traumatic tooth brushing habit, if present, is essential for conservative management and for achieving stable outcomes following surgical intervention.

Thin Phenotype. A thin phenotype increases the risk of GRDs, and associated lesions are more prone to progression.

Submarginal Restorative Margins. Submarginal restorative/prosthetic cervical margins may be associated with the development of GRDs, particularly in the presence of a thin periodontal phenotype.

Orthodontic Treatment. (i) Several studies have reported on GRDs following orthodontic treatment (mainly on the effect of mandibular incisor proclination). The reported prevalence spans from 5% to 12% at the end of treatment. Authors report an increase in the prevalence of up to 47% in long-term observations (5 years) (Aziz and Flores-Mir 2011; Morris et al. 2017; Renkema et al. 2013, 2015). One study reported a correlation

TABLE 2 | List of participants, with their role, in Working Group 2.

Role	Full name	Country
Scientific Chair	Mariano Sanz	Spain
EWC Chair	Iain Chapple	UK
Reviewer	Mario Aimetti	Italy
Reviewer	France Lambert	Belgium
Reviewer	Jose Nart	Spain
Reviewer	Ausra Ramanauskaite	Germany
Reviewer	Ignacio Sanz-Sánchez	Spain
Reviewer	Daniel Thoma	Switzerland
Participant	Juan Blanco	Spain
Participant	Jan Cosyn	Belgium
Participant	Jan Derks	Sweden
Participant	Eduardo Montero	Spain
Participant	Nadja Naenni	Switzerland
Participant	Mario Roccuzzo	Italy
Participant	Ignacio Sanz-Martín	Switzerland
Participant	Frank Schwarz	Germany
Participant	Leonardo Trombelli	Italy
Participant	Otto Zuhr	Switzerland
EFP representative	Monique Danser	The Netherlands
SIdP representative	Rodolfo Gianserra	Italy
SEPA representative	Cristina Valles	Spain
SEPA representative	Antonio Bujaldon	Spain
Curasept representative	Silvia Masiero	Italy
Klockner representative	Pedro Lázaro	Spain
Klockner representative	Juan Manuel Lorenzo García	Spain

Abbreviations: EFP, European Federation of Periodontology; EWC, European Workshop Committee; SEPA, Spanish Society of Periodontotology; SIdP, Italian Society of Periodontotology.

between lower incisor proclination and thin phenotype with GRDs (Rasperini et al. 2015). (ii) The direction of the tooth movement and the bucco-lingual thickness of the gingiva and alveolar bone may play important roles in the occurrence of soft-tissue alterations during orthodontic treatment.

Traumatic Occlusion. There is limited evidence from observational studies that traumatic occlusal forces do not contribute to the onset and progression of GRDs.

4.1.6 | What Are the Long-Term Consequences of Gingival Recession Defects and Associated Root Exposure?

Progression of the Defect. Untreated GRDs in individuals with good oral hygiene are likely to progress over time. In a systematic review that analysed the long-term fate of 1647 untreated buccal GRDs, a 78.1% progression rate, a 79.3% increase in the number of GRDs and significantly higher odds of recession at follow-up were reported (Chambrone and Tatakis 2016). Although limited, available scientific evidence suggests that existing or progressing gingival recession does not necessarily result in tooth loss.

Exposed Root Surface. Root surfaces exposed to the oral cavity represent a potential clinical problem, as they are associated with

- dentine hypersensitivity (Rees and Addy 2002; West et al. 2024),
- increased risk for the development of NCCL (Pini-Prato et al. 2010), and
- root caries (Bignozzi et al. 2014).

Plaque Control. The presence of GRDs may impair adequate plaque control (Smukler and Machtei 1987).

Aesthetic Concerns. Exposed facial root surfaces may present an aesthetic problem that could interfere with the patient's well-being (Nieri et al. 2013).

4.1.7 | What Are the Medical/Professional Indications for Intervention and the Potential Benefits?

Medical/professional indications for intervention in an individual patient presenting at least one GRD include one or more of the following: impaired aesthetics; dentine hypersensitivity; difficulty in self-performed oral hygiene; and progressive loss of root substance due to non-carious lesions/caries, particularly at sites that are at greater risk of progression (e.g., thin gingival phenotype).

Potential benefits include enhanced aesthetics, reduction or elimination of dentine hypersensitivity, improved plaque control, reduced risk of recurrence or progression of the recession defect and prevention of further loss of root substance.

Indications.

- Aesthetics: RC, phenotype modification (root discoloration, visible cervical margin of restorations).
- Root-surface-related conditions: dentine hypersensitivity, NCCL (tooth wear), root caries. Note that these indications often involve interdisciplinary surgical and restorative therapy.
- Gingival-tissue-related conditions: pain while brushing, particularly in the lower jaw in the absence of sufficient keratinised tissue, difficulties in home care (insufficient keratinized tissue, frenum interference, shallow vestibulum, mal-alignment of the gingival margin).
- Periodontal health: progression of the GRD, persistent gingival inflammation, incipient furcation involvement.
- Interdisciplinary: phenotype modification prior to orthodontic treatment that requires specific tooth movements (e.g., adults with thin phenotype or recessions and need for a buccal movement) and tooth reconstruction.

4.1.8 | What Are the Concerns Reported by People With Gingival Recession Defects?

Most people experiencing GRDs do not report perceiving a problem. However, those who do have concerns report fear of tooth loss, aesthetic concerns, dentine hypersensitivity and difficulties and discomfort during oral hygiene procedures. Only limited data are available.

The concerns of 120 adult patients regarding their GRDs were reported in a survey (Nieri et al. 2013). Out of the 783 diagnosed GRDs, only 218 (28%) were recognised by the patients. Among these perceived defects, 160 (73%) were asymptomatic and unrelated to aesthetic concerns or dentine hypersensitivity. In contrast, 36 (17%) were associated with dentine hypersensitivity, 13 (6%) with aesthetic concerns and 9 (4%) with both aesthetic concerns and hypersensitivity. Consequently, 725 (160 + 565) (92%) of the 783 recessions were either asymptomatic or unnoticed by the patients.

An RCT, primarily aimed at evaluating the outcomes of surgical therapy for GRDs (Tonetti et al. 2018), assessed the concerns of enrolled subjects regarding these deformities. Participants reported concerns about aesthetics, dentine hypersensitivity, brushing difficulties at the affected sites, root abrasion and fear of developing caries or, eventually, tooth loss.

No specific information about socio-economic, cultural or geographic factors, or other determinants of patient concerns with recessions or their changes over time, could be identified.

4.1.9 | What Are the Objectives of Root Coverage Therapy?

The objectives of RC therapy procedures include (i) improved aesthetics, (ii) reduction or elimination of dentinal hypersensitivity, (iii) facilitation of plaque control, (iv) decreased risk of recurrence and progression of existing GRDs, (v) prevention of further loss of root substance and (vi) modification of gingival phenotype, if necessary.

4.1.10 | What Clinician- and Patient-Reported Outcome Measures Have Been Used to Assess the Benefits of Surgical Interventions, Adverse Events and Risks?

CROMs, which are used to assess benefits, are summarised in the commissioned systematic reviews (Cairo et al. 2025; Stefanini et al. 2025) and include aesthetic scores, percentage of root coverage (%RC), percentage of complete root coverage (%CRC), reduction in gingival recession depth, changes in KTW and changes in GT. A few recent studies have utilised digital tools.

PROs that have been identified in the commissioned systematic reviews (Cairo et al. 2025; Stefanini et al. 2025) include aesthetic perception and satisfaction assessed with a visual analogue scale (VAS), Likert scale, qualitative cosmetic evaluation (QCE) and oral-health-related quality of life (OHRQoL) measures assessed by the Oral Health Impact Profile (OHIP)-14. Changes in dentine hypersensitivity were evaluated through questionnaires or VAS.

Adverse events were assessed using a wound healing index (WHI) and questionnaires on post-operative morbidity and complications.

4.1.11 | Are Aesthetic Outcomes Correlated With Clinical Measures of Root Coverage?

Meta-regression analyses revealed a statistically significant positive association between clinician-reported aesthetic scores assessed using the Root Coverage Aesthetic Score (RES) and mean root coverage (MRC), after the surgical treatment of both single and multiple GRDs. Conversely, the association between patient-reported aesthetic perception measured with VAS and

MRC was not statistically significant (Cairo et al. 2025; Stefanini et al. 2025).

4.2 | Therapeutic Interventions for Gingival Recession Defects

4.2.1 | Is There a Standard of Care (Reference Treatment) for Treating Gingival Recession Defects Based on Scientific Evidence? Is It Different by Indications or Locations?

A thorough assessment of the performance of surgical modalities for treating GRDs should encompass a comprehensive set of relevant outcomes, including PROs, PREs and CROs. Priority should be given to achieving CRC with clinical attachment gain, despite the unpredictability of this outcome.

In relation to the treatment of RT1 and RT2 single GRDs, the findings from clinical trials on RC outcomes (such as MRC and %CRC) suggest that employing a coronally advanced flap (CAF) with an autogenous connective tissue graft (CTG) (i.e., CAF + CTG) can be considered the standard of care (Cairo et al. 2025; Chambrone et al. 2022b).

Similarly, using multiple-teeth coronally advanced flap (MCAF) or a tunnel flap (TF) with an autogenous connective tissue graft (MCAF + CTG or TF + CTG) may be considered the most effective therapy for treating RT1 and RT2 multiple GRDs (Stefanini et al. 2025).

Various surgical techniques can be employed to achieve favourable clinician-reported aesthetic scores and patient-reported aesthetic perception following the treatment of single and multiple RT1 and RT2 GRDs. Quantitative analyses of pooled data indicated a positive correlation between MRC and RES (i.e., the greater the MRC, the greater the RES) (Cairo et al. 2025; Stefanini et al. 2025).

Current scientific evidence does not support any specific surgical treatment modality for RC based on specific intraoral locations. However, in clinical practice, after diagnosing single or multiple RT1 and RT2 GRDs, the clinical presentation (e.g., phenotypical features, NCCLs, etc.) affects the choice of surgical approach.

4.2.2 | According to Expert Opinion, What Is the Clinical Rationale for Different Surgical Flap Designs?

Many surgical techniques have been proposed for treating GRDs. Their rationale is difficult to grasp, as experts agree that a few well-documented and effective procedures can address most clinical needs. A clear biological and clinical rationale should drive surgical innovations.

Single Gingival Recession Defects. According to expert opinion, single RT1 and RT2 GRDs can be treated with (i) a free gingival graft, which may be followed by coronal advancement; (ii) a CAF; (iii) a laterally positioned flap (LPF); or (iv) a laterally closed tunnel. The clinical rationale for selecting a particular approach (e.g., mono or bilaminar modality) should be based on the location of the gingival recession (upper/lower jaw; anterior vs. posterior) and the following anatomical conditions:

- Phenotypical characteristics: tissue quality (keratinized/non-keratinized; attached/non-attached) and quantity (apico-coronal, thickness) surrounding the recession defect;
- Root position (prominence, rotation) and root-wear-associated irregularities (steps, abrasion); and
- Dimensions of the root exposure (depth and width).

A CAF-based approach might be favoured in the upper arch because it offers superior tissue integration (colour, texture and blending) and can be used without an autogenous graft when permitted by the phenotype and root position. LPF serves as an alternative (Chambrone and Avila-Ortiz 2021).

CAF and TF may be preferred for the lower jaw, but are typically performed in combination with an autogenous graft or substitute (i.e., bilaminar approach) to support the primary flap. LPF is an alternative when the soft-tissue phenotype of the adjacent areas is favourable. Two-stage procedures, including free gingival grafting followed by coronal advancement, may also be suitable for deep GRDs in the fifth sextant because aesthetics is rarely a priority in this region.

Multiple Adjacent Gingival Recession Defects. Experts believe that various recession-type defects can be effectively managed using MCAF or TF. Because of the associated aesthetic outcomes, MCAF may be the preferred flap design for the upper arch. Incorporating CTG or substitutes with MCAF or TF may be a site-specific decision based on phenotype characteristics, root position and root concavities.

The choice between MCAF and TF in the lower jaw is based on clinical preference. However, an important aspect is the consideration of adding a CTG in a site-specific manner when MCAF is used; however, CTG as an adjunct to support a TF must be applied to the entire surgical area. Although there are various methods to perform a TF, some experts highlight the specific advantages of TF designs that facilitate coronal advancement.

4.2.3 | What Do We Know About the Stability of the Outcomes of Root Coverage of Single and Multiple Recession Defects?

Current evidence indicates that apical migration of the gingival margin after surgical treatment of single and multiple GRDs may occur over time. Several factors affect gingival margin stability. The adjunctive use of a CTG with a flap is linked to improved stability (Cairo et al. 2023; Carbone et al. 2024; Tavelli et al. 2019), while traumatic toothbrushing after tissue maturation has been associated with defect recurrence (Leknes et al. 2005; Tavelli et al. 2019). The clinical status at 6 months post surgery, particularly regarding keratinized tissue height/width and GT, is

a strong predictor of long-term stability (Barootchi et al. 2022; Carbone et al. 2024; Tavelli et al. 2019).

4.2.4 | Is Marginal Tissue Thickness a Critical Treatment Effect Modifier? What Is the Current Standard of Care to Manage It?

Marginal tissue thickness is a strong predictor of RC and aesthetic outcomes following surgical treatment with CAFs (Baldi et al. 1999). In sites with a baseline marginal gingival tissue thickness of at least 0.8 mm, CRC can be predictably achieved using a CAF. However, in sites with <0.8 mm of marginal gingival tissue thickness at baseline, employing a CTG along with a CAF is strongly advised to enhance the likelihood of achieving CRC (Cairo et al. 2020b, 2016; Garces-McIntyre et al. 2017).

4.2.5 | What Is the Clinical Benefit for the Adjunctive Use of a Connective Tissue Graft in Surgical Root Coverage? What Are the Potential Adverse Events of This Choice?

Based on evidence and expert opinion, the following therapeutic purposes support the use of CTG in conjunction with a flap:

- Enhancing the stability of the gingival margin in the early stages of healing with CTG increases the probability of achieving CRC or a greater %MRC, which can also contribute to optimising aesthetic outcomes.
- It modifies the gingival phenotype.
- It increases the long-term stability of the outcomes.
- It prevents vestibular depth relapse (i.e., shallowing) in the mandibular arch.

Conversely, harvesting a CTG and using it in conjunction with a flap may be associated with the following adverse events and disadvantages:

- Donor site morbidity (e.g., pain, discomfort, etc.)
- Additional intra- and post-operative complications (e.g., haemorrhage)
- Unfavourable soft-tissue integration and appearance
- Risk of hyperplastic reaction over time
- Longer surgical intervention compared to flap alone
- Increased cost.

Based on expert opinion, CTG may be applied following site-specific anatomical (marginal soft-tissue characteristics) and patient considerations.

4.2.6 | What Additional Factors Are Relevant in the Choice of a Surgical Approach to Treat Gingival Recession Defects?

Based on expert opinion, the following factors should be considered in the clinical decision-making process when selecting a surgical approach for treating GRDs:

- Control of aetiological/precipitating factors (e.g., traumatic toothbrushing);
- Location: upper versus lower arch/anterior versus posterior region;
- Single versus multiple GRDs;
- Recession type;
- Gingival phenotype features of the recipient and adjacent sites (e.g., gingival thickness, KTW, papilla morphology);
- Tooth position;
- Dimensions of the GRD (i.e., depth and width);
- Presence and extent of non-carious and carious cervical lesions;
- Vestibular depth;
- Level of surgical expertise;
- Ability to implement an adequate post-surgical wound care programme.

4.2.7 | What Is the Evidence to Support the Use of a Connective Tissue Graft Substitute?

RCTs that compare specific substitutes to CTG, considering a comprehensive range of outcomes, provide evidence to support their use. A non-inferiority design may be the most suitable approach to determining the potential benefits.

According to the findings from two RCTs, xenogeneic collagen matrices (CMX) combined with a CAF may serve as an alternative to the combination of CAF and a CTG in the treatment of RT1 multiple GRDs. Using CMX + CAF shortens recovery time, decreases patient morbidity and improves the overall patient experience (Meza-Mauricio et al. 2021; Tonetti et al. 2018). However, CAF + CTG was found to result in better RC outcomes when compared to CAF + CMX (Meza-Mauricio et al. 2021; Tonetti et al. 2018). Overall, the CAF + CTG group showed superior RES scores, whereas the CMX group showed improved marginal tissue texture and marginal contour (Pelekos et al. 2019).

4.2.8 | What Is the Evidence for the Use of Biologics as Substitutes or Adjuncts to Connective Tissue Grafts?

Biological agents, whether used alone or in combination with other components of the recognised tissue engineering triad (growth factors, scaffolds and cells), may enhance wound healing, improve stability, prevent wound contraction and address conventional CTG substitutes' limitations. In a systematic review with a network meta-analysis (Chambrone et al. 2022a), autologous blood products, enamel matrix derivatives and recombinant human-platelet-derived growth factor (rh-PDGF), used as adjuncts to CAF, were evaluated with regard to RC parameters. The results indicated that CTG was the most effective adjunct, and the benefits of the tested biologicals added to CAF did not achieve statistical significance. Focusing on aesthetic outcomes, in a review of 50 selected RCTs on the treatment of

single GRDs (Cairo et al. 2025), the concurrent use of biological agents was assessed in 11 publications: enamel matrix derivatives in 7, autologous blood products in 4, hyaluronic acid in 1 and rhPDGF isoform BB in 1. Analyses showed that the use of biologicals did not affect 'clinician-reported aesthetic scores' (tool: RES) or 'patient-reported aesthetic perception and satisfaction values' (tool: VAS).

4.2.9 | What Expertise (Educational Background) is Required to Safely and Effectively Deliver This Care?

The surgical management of GRDs exceeds the scope of training and competencies provided to European dentists (Herrera et al. 2024; Sanz and Meyle 2010). Therefore, additional specific training is necessary and is included in EFP-accredited specialist training programmes. Given the complexity of these procedures, acquiring proficiency requires dedication to a personal learning journey (Goldstein et al. 2024). Thus, these procedures should be performed 'by dentists with additional specific training or by specialists in referral centres', as recommended in the EFP Clinical Practice Guideline for the Treatment of Periodontitis in Stages I–III (Sanz et al. 2020).

4.3 | Future Perspectives

4.3.1 | What Outcome Parameters Should Clinical Research Consider in Capturing the Effect of Surgical Interventions for the Treatment of Gingival Recession Defects?

Regardless of the clinical study's nature and scope, investigators should implement a comprehensive assessment that includes relevant CROs, PREs and PROs. These parameters should be evaluated and documented at various stages of the continuum of care, such as baseline (prior to intervention) and follow-up visits.

Investigators should consider the following essential CROs of interest in future research: CRC, %MRC, clinical attachment level (CAL) gain, KTW changes, GT changes and aesthetic assessment using reliable and validated tools (e.g., RES). In specific trials, additional outcomes may include blood flow variations in the wound area at different time points and detection of biomarkers related to wound healing. Emerging digital tools show potential. Regarding PROs, these include perceived functional improvement, perceived aesthetic improvement, changes in dentine hypersensitivity, and overall OHRQoL and experience.

There is a need to develop, test and validate optimised tools for measuring the benefits of surgical interventions (e.g., professional and aesthetic) for RC, in collaboration with the clinician and the patient. A significant limitation in our ability to draw conclusions from the evidence during the Workshop was related to the type and validity of the PROs employed in the studies as described in the Introduction section. In brief, it is unlikely that most of these outcomes and tools are valid or sufficiently sensitive to detect differences. A key step will be to develop validated tools (PROMs) specifically for evaluating the outcomes of surgical correction of GRDs. The steps involved are described in Section 4.3.2. The development of specific PROMs has been accomplished in many surgical fields and would provide an essential model for future research in dentistry. This process will require a diverse research team, including individuals with lived experience and those with expertise and experience in co-production in research, soft-tissue surgery, health psychology and biostatistics. It is essential to consider that transcultural, socio-economic and chronological factors may largely influence patients' assessments of perceived benefits after therapy.

Furthermore, the skill and experience of the surgical team conducting the research are vital for interpreting the findings of studies. Evaluating this aspect in the studies included in the systematic reviews has proven challenging, as such details are generally unreported (Leow et al. 2016). We recommend that authors and journal editors support and adopt the Consolidated Standards of Reporting Trials (CONSORT) checklist tailored for operative studies, as this promotes complete reporting of essential details (CONSORT non-pharmacological extension) (Boutron et al. 2017).

4.3.2 | How Can Professional and Patient Perspectives Be Aligned and How Can Cost–Benefit Ratios of Treatment Be Captured?

A true endpoint is a clinically meaningful one that reflects 'how a patient feels, functions, or survives' (Baker 2018). It is recognised that most outcomes routinely used in periodontology are surrogate outcomes whose relevance to the patient is limited (Loos and Needleman 2020). As described in the introductory section, PROMs are widely used to evaluate the impact of conditions on people's health and, more recently, within periodontal research (particularly measures of OHRQoL). Developed *with* patients rather than *for* them, PROMs can hold much greater relevance to patients and can, therefore, be more informative in helping them to make decisions about their care than surrogate clinical outcomes. However, no PROM has been developed to assess the treatment of gingival recession. Existing PROMs (such as OHIP-14) have not been evaluated for their utility in assessing recession treatment. Instead, a PROM designed explicitly for this condition should be created using robust methods (Swan et al. 2023).

Developing a PROM should involve relevant stakeholders from the outset, particularly those with lived experience, preferably through co-production. In the absence of an existing tool, the process begins with defining the condition to be assessed (e.g., what type of gingival recession, in what kinds of people and which conditions to exclude) (Swan et al. 2023). Potentially relevant items for evaluation in the tool are drawn from existing literature but, importantly, new items may be added if stakeholders deem it necessary. Generally, at this stage, the number of items will be 2–5 times the desired final count. After determining the types of scales appropriate for each item, a draft instrument is reviewed by stakeholder groups, incorporating both consensus-style approaches (e.g., Delphi) and in-depth interviews that inform the draft tool. The tool is then piloted in a small group of the target population, gathering systematic user feedback on

elements such as relevance and comprehensibility, comprehensiveness and feasibility of use. Items are subsequently reduced based on user feedback and psychometric properties (such as accuracy [validity], reproducibility [reliability] and responsiveness). Finally, it is trialled in a larger sample to assess the tool's psychometric properties, with further evaluation considered following testing in more diverse settings and populations.

CROs are essential for assessing the feasibility and efficacy of various surgical procedures: for instance, changes in tissue phenotype features, dimensions of recession and CAL gain. Understanding which procedures are superior and more predictable in different clinical scenarios allows the PROMs to evaluate their effectiveness in delivering real patient benefits to aid decision making. Additionally, healthcare costs will also impact these choices.

4.3.3 | What Are the Key Unsolved Issues in the Surgical Management of Gingival Recession Defects?

1. Understanding the critical factors limiting the outcomes of periodontal plastic surgery. In particular, these include the following:
   - Dimension of the avascular surface of the root. There is an inverse correlation between the amount of RC and the extension of the root surface (Bertoldi et al. 2024). The long-term stability of the outcomes is also inversely correlated with the extent of the exposed root surface.
   - Extreme root proximity and reduced width of the papilla.
   - Severe root rotation/malposition.
   - Gingival recession extending to the apical area. This situation usually requires an interdisciplinary approach, including orthodontic and/or endodontic treatment.
2. Reducing the need for CTG in clinical practice
   - Critical evaluation of the necessary CTG thickness and size with reference to the baseline recessions.
   - Potential of bio-engineering constructs as substitutes to CTG to enhance outcomes and promote long-term stability.
   - Combined restorative and periodontal treatment when treating GRDs (RT1 associated with NCCLs, and RT2 and RT3) to achieve higher patient satisfaction.

4.3.4 | What Is the Potential Role of Adjuncts and Connective Tissue Graft Substitutes, and What Is the Framework for Testing Their Efficacy?

Biological agents, CTG substitutes and their combinations have been proposed as adjunctive therapies for surgical-flap-based treatment of GRDs. CTG substitutes and platelet-rich fibrin are commonly employed in contemporary practice to overcome the drawbacks of graft harvesting. Other biological agents (e.g., enamel matrix derivative, hyaluronic acid, etc.) may be applied during surgery or in the post-operative period to enhance early healing. However, their indications have not yet been defined. In the future, new materials or biological agents designed to improve flap stability and long-term marginal stability should be developed and tested. Studies on all these biomaterials should include selecting an appropriate control group, specific inclusion criteria for GRDs and a judicious choice of CROs and PROs, with particular emphasis on cost–benefit analyses.

4.3.5 | How Applicable Is Surgical Correction of Gingival Recession Defects in Ageing Populations and Subjects With Comorbidities?

GRDs are highly prevalent in ageing populations, with an increasing occurrence as individuals age. When managing GRDs in older adults, the level of dependency becomes a crucial factor in the decision-making process. For patients who are independent (defined as 'fit, robust individuals who exercise regularly and belong to the healthiest group for their age'), decisions should adhere to the same criteria as applied to other adults. Special considerations are warranted for patients with pre-dependency (defined as 'individuals with chronic systemic conditions that may affect oral health'), as well as for those with varying degrees of dependency (each presenting different chronic conditions and differing levels of access to dental services or maintaining oral health) (Pretty et al. 2014). Non-invasive or preventive approaches should be prioritised before exploring invasive treatments (Tonetti et al. 2017). Similar considerations should also apply to patients with multiple comorbidities.

5 | Adjunctive Procedures to Immediate Dental Implant Placement Aiming to Increase Soft-Tissue Thickness/Height

5.1 | Are There Aesthetic Benefits From Soft-Tissue Augmentation During the Immediate Placement of Dental Implants in the Aesthetic Zone?

5.1.1 | When Evaluated by Clinicians

Based on a meta-analysis of four RCTs with 1 year of follow-up, the addition of a CTG to IIP significantly reduced the apical shift in the mid-facial mucosal level (weighted mean difference [WMD] = 0.38; 95% confidence interval [CI]: 0.15–0.61) (Lambert et al. 2025). Additionally, based on three RCTs with a 1-year follow-up, the addition of a CTG to IIP decreased the likelihood of unfavourable aesthetic outcomes (marginal mucosal recessions > 1 mm, pink aesthetic scor [PES] values ≤ 5). However, these differences were not confirmed when examining the mean values of the currently available professional aesthetic scores/indices ($n = 2$, WMD = −0.27; 95% CI: −0.95 to 0.41).

5.1.2 | When Evaluated by Patients (PROs)

Based on two RCTs with a 1-year follow-up, the addition of STA to IIP did not seem to impact the general aesthetic satisfaction assessed by patients, using VAS scores (range 8.9–9.6, out of 10).

These results must be interpreted with caution, as they relate to ideal selection criteria (e.g., intact buccal bone plate, no/minor baseline recessions, etc.). VAS scores may not adequately capture the aesthetic impact of STA. There is a need to develop more appropriate assessment tools to effectively identify those factors that are critical to patient-perceived aesthetic outcomes.

5.2 | Which of the Available Indices Used to Evaluate the Aesthetic Outcomes of STA Are Preferred?

The indices employed to professionally evaluate soft-tissue aesthetic outcomes, related to STA combined with IIP and used in the reference systematic review (Lambert et al. 2025), were PES, PES/white aesthetic score (WESBelser et al. 2009) and ICAI (Meijer et al. 2005). However, none of them has been developed to specifically assess the aesthetic outcomes of STA. Additionally, most of the authors did not report the individual components of these indices, which precludes accurate evaluation of the effect of STA on the aesthetic outcomes. These indices were primarily designed to evaluate the overall aesthetic outcomes of implant treatment. There is a clear need for sensitive assessment tools to accurately assess aesthetic outcomes both prior to and following STA.

5.3 | What Are the Effects of STA on PREs or PROs?

Patients reported high satisfaction levels, scoring between 8.4 and 9.4 out of 10 (two RCTs), regardless of the use of STA procedures combined with IIP. Additionally, one study highlighted a significant improvement in patients' OHRQoL, assessed by OHIP-14, whether or not STA was performed alongside IIP. It should be emphasised that the composite value of OHIP-14 may not specifically capture the patient experience related to the STA procedure itself. There is a clear need for more sensitive assessment tools to accurately assess PREs and PROs related to STA procedures.

5.4 | What Are the Effects of STA on Patient Morbidity and on the Occurrence of Post-Surgical Complications?

Additional STA for single tooth replacement by IIP did not affect the post-surgical complications or implant failure rate. Two RCTs indicated that adding CTG to IIP did not increase pain or discomfort during the early post-operative period, with the pain level remaining below 4 (out of 10), 2–3 days following STA. One study reported significantly less pain associated with STA when using a soft-tissue substitute compared to adding CTG to IIP.

5.5 | What Is the Preferred STA Technique, Material, Source, and Composition?

Data from the systematic review (Lambert et al. 2025) did not support the conclusion that any specific STA technique, material, source or composition for STA combined with IIP is superior to another based on aesthetic outcomes assessed by composite indices.

According to the included studies, the preferred STA technique is a minimally invasive approach (i.e., pouch/envelope) combined with CTG. There is no clear preference for the source of CTG (lateral palate vs. tuberosity). Compared to soft-tissue substitutes, CTG led to a lower incidence of mid-facial mucosal recessions (≥ 1 mm) and ridge deficiencies. Soft-tissue substitutes were associated with less self-reported post-surgical pain.

5.6 | What Is the Effect of STA During Immediate Implant Placement on

5.6.1 | Soft-Tissue Thickness?

The use of CTG resulted in a soft-tissue thickness gain ranging from 0.4 to 0.8 mm, compared to IIP without STA. Limited evidence (one RCT, 1-year follow-up) showed similar soft-tissue thickness gains for CTG and acellular dermal matrix (ADM) (approximately 0.8 mm).

5.6.2 | The Amount of Keratinized Mucosa (KM)?

None of the three RCTs reporting on dimensional changes in KM reported KM gain when STA procedures were performed. This may relate to the type of surgical intervention, fully submerging the CTG.

5.6.3 | The Interproximal Papilla?

Interproximal papillae were evaluated, using the papilla index by Jemt (1997) in three RCTs, and by changes in the papilla height quantified by photographic images in three RCTs, or by superimposition of digital data in two RCTs. Papilla-level changes within 1 mm and improved papilla index scores were reported, irrespective of whether an STA procedure was performed. As the morphology of the implant-supported restoration can compensate for papilla defects, the use of the papilla index is considered inappropriate and biased for evaluating the effect of STA on papilla level changes.

5.6.4 | Soft-Tissue Parameters?

The included studies assessed ridge contour changes in a heterogeneous manner, whether volumetric (five RCTs) or linear (three RCTs), preventing a direct comparison. However, all studies demonstrated a certain degree of ridge contour loss, and the additional STA did not influence the outcomes. A comparative study of ADM and CTG found similar volume loss.

5.6.5 | Peri-Implant Health?

None of the studies documented the occurrence of peri-implant diseases according to any proposed definition. However, based on 10 clinical studies, the systematic review (Lambert et al. 2025)

did not observe any effect of STA on marginal bone levels, with mean marginal bone loss < 0.5 mm at the end of the 1–5-year follow-up period. The mean probing depth (PD) ranged from 2 to 3.2 mm (five studies), and inflammation scores reported mean values below 15% for bleeding scores (five studies).

5.7 | Is There an Indication for Including STA During IIP?

Considering the findings of the commissioned systematic review (Lambert et al. 2025) and the available evidence, STA, in addition to IIP, may be indicated when the risk of soft-tissue recession following the procedure is increased, such as in the following clinical scenarios:

5.7.1 | Presence of a Thin Buccal Soft-Tissue Phenotype (Bittner et al. 2019; Cosyn et al. 2024; C. T. Lee et al. 2020)

The thin gingival phenotype is typically assessed by inserting a periodontal probe buccally into the sulcus. The phenotype is classified as thin if the probe is visible through the gingival tissue (De Rouck et al. 2009).

5.7.2 | Presence of Buccal Bone Dehiscence (Chen et al. 2005; Cosyn et al. 2024)

A site presenting with a large dehiscence of the buccal bone plate is considered unfavourable for IIP. However, when minor dehiscences (< 2 mm) or fenestrations (< 3 mm) are present, adjunctive procedures, such as CTG, can help mitigate the risk of mid-facial recession (Kan et al. 2007).

5.7.3 | Presence of a Thin Buccal Bone Plate (Bone Morphotype) (Yang et al. 2019)

Patients with a thin bone morphotype and a buccal bone plate < 0.5 mm experience greater ridge remodelling and gingival recession. In these cases, combining IIP with CTG may be beneficial.

5.7.4 | Presence of Localised Gingival Recession (Cosyn and Blanco 2023; Hamilton et al. 2023)

A tooth site displaying a pronounced mid-facial GRD (> 2 mm; before extraction) is considered unfavourable for IIP. However, in cases with less pronounced recessions (< 2 mm; before extraction), the addition of CTG can help reduce the risk of further mid-facial recession.

5.7.5 | Buccal Position of the Tooth in Relation to the Alveolar Process (Cosyn and Blanco 2023; Hamilton et al. 2023)

If the root and facial bone plate protrude beyond the bony envelope, particularly when combined with a reduced facial-lingual dimension of the interproximal bone and alveolar housing, the regenerative potential of the socket is less favourable, and greater mid-facial recession is likely with IIP. Depending on the severity, immediate implants may need to be avoided, or STA may need to be done at the time of IIP.

In patients with high aesthetic demands (e.g., high smile line, high aesthetic expectations), STA in combination with IIP may be considered in addition to the aforementioned clinical scenarios.

5.8 | Limitations in the Evaluation of the Results of STA During IIP

The systematic review (Lambert et al. 2025) highlighted several limitations in the evaluation of the aesthetic outcomes and PREs/PROs of STA at immediate implant sites:

1. There is a lack of studies regarding the potential impact of site characteristics and IIP-related procedures on STA outcomes.
2. The number of studies specifically designed to evaluate professional- and patient-assessed aesthetic outcomes, or PREs/PROs, is limited.
3. The assessment tools/methods used to evaluate aesthetic outcomes, both by professionals and patients, were not designed to capture the specific effects of STA.
4. Incomplete reporting of baseline conditions limits the ability to draw definite conclusions about the impact of STA on aesthetics.
5. The number of studies specifically designed to evaluate the impact of immediate provisionalisation on the preservation of the soft-tissue architecture and on the aesthetic outcomes of IIP is limited.

Future studies evaluating STA at IIP sites should be powered on relevant effect sizes for professional and patient-assessed aesthetic outcomes. Sensitive, objective and validated assessment tools to fully capture the aesthetic effect of STA should be developed for use in these investigations. These tools may include AI-driven assessments and refined patient-reported questionnaires with proper validation for different clinical scenarios and populations.

6 | Soft-Tissue Volume Augmentation (STVA) During Dental Implant Therapy

6.1 | Are There Benefits From Soft-Tissue Volume Augmentation for Implants Placed Subsequently to Tooth Extraction (Early, Delayed, Late) On

6.1.1 | Professionally Determined Aesthetics?

Based on the commissioned systematic review (Ramanauskaite et al. 2025), professionally assessed aesthetics, in studies following STVA for implants placed subsequently to tooth extraction, have employed the PES index, which evaluates seven domains, namely

the mesial and distal papillae, mucosal margins, soft-tissue contour, alveolar process, soft-tissue colour and texture. Based on five RCTs with a follow-up of 6–12 months, the standardised mean difference (SMD) from the PES values between CTG and no grafting was 0.47 (95% CI: −0.15 to 1.09), although differences were not statistically significant ($p = 0.14$). It should be highlighted that some of the negative control groups included within the RCTs (no grafting) were assigned high PES scores (as high as 10.6), indicating that patient selection may not have been ideally suited to address the effect of this intervention on aesthetic outcomes.

When comparing the STVA grafting material, six controlled clinical studies (five RCTs and one controlled clinical trial [CCT]) evaluated the effect of xenogeneic soft-tissue substitutes versus autogenous CTG grafting. Professionally assessed aesthetic outcomes evaluated by the PES index resulted in statistically significantly higher scores for CTG. However, these differences were clinically negligible (0.32; 95% CI: 0.07–0.57; $p = 0.01$).

The scientific evidence for the effect of STVA on professionally assessed aesthetics was based on the use of the PES index. The PES index assesses the overall aesthetic outcome of implant treatment, principally based on evaluations made following placement of the implant-supported restoration. However, some of the domains included within this index are potentially unrelated to the aesthetic outcomes pertaining to STVA. There is a clear need to develop sensitive assessment tools to specifically assess aesthetic outcomes before and after STVA.

6.1.2 | PROs and PREs?

Based on the commissioned systematic review (Ramanauskaite et al. 2025), patient assessment of aesthetics following STVA for implants placed subsequently to tooth extraction was based on the use of VAS scores 1 year post intervention. Based on two RCTs, the WMD between CTG and no grafting was 2.01 (95% CI: −20.28 to 24.31), although the differences were not statistically significant ($p = 0.86$). It is notable that the scores in the negative control groups were consistently high (VAS ≥ 92), indicating that patient selection may not have been ideal in terms of treatment needs to address the effect of this surgical intervention on patient-perceived aesthetics. One small split-mouth RCT ($n = 10$) compared CTG grafting versus no grafting (Wiesner et al. 2010) and reported that six patients preferred grafted sites while four patients showed no preference.

6.1.3 | On Patient Morbidity and on the Occurrence of Post-Surgical or Aesthetic Complications?

When comparing different STVA grafting materials, two RCTs evaluated the effect of xenogeneic soft-tissue substitutes versus autogenous CTG grafting at 1 year. Patient-reported satisfaction with aesthetics, assessed through VAS Scores, did not differ between groups (WMD = 5.23; 95% CI: −6.76 to 17.22; $p = 0.39$) (Ramanauskaite et al. 2025).

Morbidity following implant placement with or without STVA with a soft-tissue substitute was measured using VAS scores in one RCT, which reported similar outcomes (9.0, standard deviation [SD] = 1.2 vs. 8.6, SD = 1.0; respectively). The comparison between xenogeneic soft-tissue substitutes and autogenous grafting on post-operative morbidity was assessed in two RCTs and one CCT using VAS scores and reported significantly lower pain scores associated with the xenogeneic soft-tissue substitutes (WMD = –2.83, CI: −4.68 to −0.98, $p = 0.003$).

Patient experience has been assessed through the OHIP-14 questionnaire. Based on one study, the comparison between STVA using soft-tissue substitutes and no grafting at the time of implant placement resulted in similar outcomes (16.6, SD = 4.7 vs. 17.9, SD = 6.3, respectively; $p = 0.34$). When comparing different STVA grafting materials, three RCTs evaluated patient experience using OHIP-14 at 3 months to 5 years post-operatively, reporting significantly lower scores (i.e., a better experience) for the soft-tissue substitutes (WMD = –0.70, 95% CI: −1.24 to −0.16; $p = 0.01$).

It is important to recognise that the use of a composite tool, such as the OHIP-14, to evaluate OHRQoL may not fully capture patient experience specifically related to these surgical interventions.

6.2 | What Is the Preferred Method to Evaluate Aesthetic Outcomes and Patient Experience of STVA Following Implant Placement?

Evidence of the aesthetic impact of these interventions has been based on the use of the PES index by professionals and on VAS scores used by patients. As highlighted above, these diagnostic methods may not have been sufficiently specific to capture the aesthetic effect of grafting on enhancing soft-tissue volumes. There is a need to develop appropriate measurement tools to capture those qualities that are critical for both professional and patient-perceived aesthetic outcomes.

Similarly, patient satisfaction and treatment experience have been assessed using the OHIP-14 questionnaire, which evaluates the impact upon OHRQoL rather than specific patient experience related to the surgical intervention. There is, therefore, also a need to develop specific methods capable of capturing how patients perceive these surgical interventions.

6.3 | What Are the Preferred STVA Techniques, Graft Material, Source, and Composition?

Surgical interventions aimed at STVA differed across studies. There are no comparative studies on different surgical techniques employed at implant sites. Most available publications used a CAF (full or split-thickness) and a submerged graft, simultaneous to implant placement. However, in some studies STVA was performed using a staged approach or during implant uncovering procedures combined with an abutment connection. In one multi-centre study (Hammerle et al. 2023), a specific flap design was applied, namely the palatal island flap (Tinti and Parma-Benfenati 1995), to increase the available space for the grafting material. In one study, a sub-periosteal pouch was

employed (Elkashty et al. 2022). Collectively, there is no evidence for a preferred surgical design for STVA around dental implants.

Autogenous soft-tissue grafts have predominantly been harvested from the palatal mucosa, either from the tuberosity or lateral palatal areas. There is one RCT (Rojo et al. 2020) evaluating the volume achieved when the graft was harvested from the tuberosity or from the lateral palate, which reported no significant differences. However, histological outcomes from this RCT reported a greater percentage of lamina propria in the grafts harvested from the tuberosity area (Sanz-Martin et al. 2019). Furthermore, evidence from one CCT, which also included histological data, suggested that grafts from the tuberosity with more lamina propria provide better long-term stability (Dellavia et al. 2014).

Most studies employing xenogeneic soft-tissue substitutes have used either collagen or dermal matrices. There is no evidence of superior outcomes related to the choice of material. Among the collagen matrices, differences in their physico-chemical properties (e.g., native vs. cross-linked) may result in differences in volume gain and stability, although there are no comparative studies evaluating these differential responses.

6.4 | What Is the Effect of STVA On

6.4.1 | Soft Tissue Thickness and Amount of KM?

A recent systematic review has evaluated the efficacy of STVA (Valles et al. 2022). When comparing autogenous grafts versus no grafting, the WMD in mucosal thickness showed significantly more favourable outcomes for the grafting group (WMD = 0.64 mm, 95% CI: 0.16–1.13; $p = 0.01$). These results are similar to those reported in the three RCTs evaluating aesthetic outcomes (mean difference 1.06) (Ramanauskaite et al. 2025). When comparing autogenous grafting versus soft-tissue substitutes, the increase in soft-tissue thickness was significantly higher following autogenous grafting up to 12 months (WMD = 0.51 mm, 95% CI: 0.28–0.75; $p < 0.001$). These results are consistent with those reported in two RCTs evaluating aesthetic outcomes (mean difference 0.42, $p = 0.00$) (Ramanauskaite et al. 2025). There are no published clinical trials evaluating the increase in soft-tissue thickness achieved with different soft-tissue substitutes. However, data from experimental in vivo investigations on STVA using different materials are available, which show the benefits of both autogenous CTGs and collagen matrices for attaining significant soft-tissue volume increases (Thoma et al. 2010).

In terms of the effect of STVA on KM, no significant increase has been achieved when comparing autogenous grafting versus no grafting (WMD = 0.38 mm) (Valles et al. 2022). Similarly, no significant increase in KM was achieved by autogenous grafts when compared to soft-tissue substitutes (WMD = −0.09 mm) (Valles et al. 2022).

In these RCTs comparing autogenous grafting with soft-tissue substitutes and providing aesthetic outcomes, no significant differences in KM increase were identified.

6.4.2 | Peri-Implant Mucosa Margins?

In a recently published systematic review (Valles et al. 2022), the effect of STVA on mucosal margins was reported. When comparing autogenous grafting versus no grafting, the reported change in the mucosal margin level 1 year after the final restoration was statistically significant in favour of grafting (WMD = 0.5 mm). When comparing autogenous grafting versus soft-tissue substitutes, the reported differences in changes in the level of the mucosal margin were statistically significant (WMD = 0.5 mm) in favour of autogenous grafting.

6.4.3 | The Interproximal Papilla?

The effect of STVA on interproximal papillae has been evaluated only in two studies comparing autogenous grafting versus no grafting and in two studies comparing autogenous grafts with soft-tissue substitutes. These studies reported a minor effect on the interproximal papilla (from 0.1 to 0.5 mm) (Valles et al. 2022).

6.4.4 | Peri-Implant Health?

A systematic review (Valles et al. 2022) reported no significant differences in peri-implant health-related parameters (PD, bleeding on probing [BOP]), when comparing autogenous grafting versus no grafting or autogenous grafts versus soft-tissue substitutes. Four RCTs, which compared aesthetic outcomes from autogenous grafting with those from soft-tissue substitutes, reported no differential effect on peri-implant health-related parameters (PD and BOP values after 6 months and 5 years were similar).

6.5 | Is the Outcome of STVA Influenced By

6.5.1 | The Timing of Implant Placement After Tooth Extraction (Early, Delayed, Late)?

No clinical study evaluating the effect of the timing of implant placement on outcomes of STVA was identified. Data originating from one experimental in vivo study suggested that the effect of timing of implant placement (performed together with STVA) on ridge reduction was significant. Hence, the reduction of both soft- and hard-tissue dimensions was less pronounced following delayed compared with early implant placement (K. S. Lee et al. 2022).

6.5.2 | The Timing of STVA in Relation to Implant Placement (Pre, Simultaneous, Post)?

Data from the commissioned systemic review (Ramanauskaite et al. 2025) identified seven studies in which STVA was performed simultaneously with implant placement, while in four studies, STVA was undertaken using a staged approach. However, there are no comparative studies available; hence, no conclusions can be drawn on the preferred timing for STVA.

6.5.3 | Site Characteristics (Location, Hard and Soft Tissue Dimensions, Etc.)?

In most studies included in the systematic review, STVA was performed at healed ridges. However, no information on baseline site characteristics (hard and soft tissues) was provided. Hence, no conclusions can be drawn regarding site characteristics for STVA.

6.5.4 | The Type of Restoration?

Two studies included in the systematic review performed STVA simultaneously with implant placement, and immediate temporary restorations were provided. Aesthetic outcomes in these studies were favourable. Given the lack of comparative studies (direct vs. delayed prosthetic restoration), no conclusions can be drawn on the relevance of the prosthetic protocol to the final aesthetic outcomes.

6.6 | Is There an Indication for STVA for Implants Placed After Tooth Extraction (Early, Delayed, Late)?

Based on expert opinion, the following scenarios (in aesthetically demanding areas) represent indications for STVA:

- Thin buccal and/or crestal tissue phenotype
- Ridge contour deficiencies
- Soft-tissue deficiencies
- Hard-tissue deficiencies not involving the implant surface.

The currently available data on STVA summarised in the commissioned systematic review (Ramanauskaite et al. 2025) did not allow for the identification of evidence-based indications. The accumulated body of evidence suffers from several limitations that should be considered:

- The number of studies evaluating the aesthetic outcomes of STVA is limited.
- Professionally assessed and patient-assessed aesthetic outcomes did not serve as primary outcomes in those studies included in the systematic review. This resulted in sample sizes that were insufficient to identify relevant differences.
- The measurement tools used to evaluate aesthetic outcomes, PROMs and PREMs are not designed to capture the effect of STVA.
- Incomplete reporting of baseline information hampered clear conclusions on the effect of STVA on aesthetics.

Future studies evaluating STVA at implants placed after tooth extraction should be powered appropriately, based on relevant effect sizes for professionally assessed and patient-assessed aesthetic outcomes. Preferably, sensitive, objective and validated measurement tools that fully capture the aesthetic effect of STVA should be developed. These tools may include computer/artificial intelligence-driven assessments and refined questionnaire/interview-based data collection. It is critical that baseline conditions and treatment indications are documented.

7 | Surgical Treatment of Buccal PERI-Implant Soft Tissue Dehiscence

7.1 | What Is the Effect of Surgical Treatment of Buccal Peri-Implant Soft-Tissue Dehiscences (PSTD) On

7.1.1 | Professionally Determined Aesthetics?

In a meta-analysis of three clinical studies with follow-ups of 1 and 10 years, STA using a CTG beneath a CAF, with or without vertical releasing incisions, achieved clinically positive outcomes in professionally assessed aesthetic scores (7.73 out of 10; 95% CI: 6.63–8.83) (Nart et al. 2025).

7.1.2 | PROs and PREs?

Based on three studies, 1-year follow-up improvements ranged from 52.0 to 74.4 (VAS), demonstrating some degree of consistency in PRE improvements following PSTD treatment. In data derived from two studies with a 5-year follow-up, patients reported positive improvements from baseline (before treatment) in VAS scores (100-mm scale) of 60 (Zucchelli et al. 2018) and 45 (A. Roccuzzo et al. 2024). At a 10-year follow-up, improvements were reported as 49 (A. Roccuzzo et al. 2024), implying that stable aesthetic outcomes are achievable depending on the patient.

7.1.3 | Patient Morbidity and on the Occurrence of Post-Surgical or Aesthetic Complications?

Patients report minimal post-operative pain following STA for isolated PSTDs when undertaken by expert clinicians. Pain was reported in three studies included in the commissioned systematic review (Nart et al. 2025), either by VAS score or by questionnaire using a 5-point Lickert scale. Mean VAS scores were 18.9 at 1 week in one study (Tavelli et al. 2023a) and 26.3 at 2 weeks in a second study (Tavelli et al. 2023b).

Estimated reductions in PSTD depths were 2.22 mm (95% CI: 1.76–2.69) following STA surgery, with an estimated coverage of 92.25% and complete coverage achieved in 71% (95% CI: 59–82) of cases. Contextually, it is important to recognise the differential aesthetic impacts of recession defects around implants and teeth. Where metal remains exposed around implants following surgical augmentation, the aesthetic compromise is more significant for patients than for recession defects around teeth (M. Roccuzzo et al. 2014; Zucchelli et al. 2013). The impact of such aesthetic issues on oral health and quality of life remains unknown.

7.2 | What Is the Effect of Surgical Treatment of PSTD On

7.2.1 | Peri-Implant Mucosa Margins?

STA surgery for treating PSTD resulted in an estimated reduction in recession of 2.22 mm ($n = 4$ studies), clinical attachment gains of 2.45 mm ($n = 3$) and gains in attached mucosa of 1.35 mm ($n = 2$). PD remained stable in all four studies (mean change

0.03 mm). In a 10-year follow-up study (A. Roccuzzo et al. 2024), no residual recession was reported in 8 of 12 cases (66.67%), and a mean dehiscence coverage of 89.6% was reported, indicating that, in most cases, the mucosal margin could be restored to its ideal position.

7.2.2 | Interproximal Papilla?

In specific cases where papilla enhancement is desired, additional therapeutic approaches may be required (see later). One 5-year follow-up study reported improvements in papilla levels as evaluated by PES (Zucchelli et al. 2018).

7.2.3 | On Soft-Tissue Thickness and Amount of KM?

Three studies reported overall improvements in soft-tissue thickness of 1.66 mm following STA of PSTDs, with changes in the height of the KM of 1.64 mm. Potential benefits of such positive outcomes include improved tissue contours (Jung et al. 2022), better access to plaque removal by patients and professionals and greater long-term stability of the position of the mucosal margin.

7.2.4 | On Peri-Implant Health?

All STA procedures were undertaken on cases not showing peri-implantitis, and while no data was available on marginal bone levels, the absence of significant BOP ($\leq$1 point of BOP) and PD $\geq$4 mm post-operatively indicated maintenance of peri-implant health.

7.3 | In the Surgical Treatment of PSTD, What Is the Effect Of

7.3.1 | Site Characteristics (Implant Position and Characteristics, Interproximal Tissue Levels, Anatomical Location, Soft-Tissue Quality)?

The available evidence in the commissioned systematic review (Nart et al. 2025) refers to the treatment of buccal peri-implant soft-tissue deficiencies around single implants. Three of the four studies included in the meta-analysis referred to cases where there was no interproximal attachment loss at adjacent teeth.

Facial soft-tissue dehiscences and deficiencies at single implants within the aesthetic zone have been classified recently (Zucchelli et al. 2019). The importance of implant position and the level of the interproximal tissues as key site characteristics is highlighted. A buccal implant position and buccal implant angulation are key negative determinants of the likelihood of achieving a successful outcome. When interproximal soft-tissue loss is evident (Zucchelli et al. 2019), the coverage of the implant soft-tissue dehiscence is limited by the height of the anatomical papilla. Experts agree that the presence of KM, the absence of scar tissue and the absence of a prominent frenum are desirable when contemplating surgical management of PSTD. The presence of multiple adjacent dehiscence defects will significantly complicate corrective surgery, and clinicians should exercise caution when contemplating surgical intervention. Finally, the presence or absence of buccal bone on an implant does not appear to influence treatment success when undertaking STA surgery (Guerrero et al. 2022).

Potential determinants of not pursuing STA surgery in the management of PSTDs and instead considering explantation include excessive coronal or buccal implant position, a large implant diameter or other prosthetic considerations preventing an aesthetically adequate new restoration.

7.3.2 | The Surgical Technique (CAF, Tunnel)?

All five studies included in the commissioned systematic review (Nart et al. 2025) used CAF plus a graft material, with or without vertical releasing incisions. One study compared CAF with a tunnel approach (Tavelli et al. 2023a) and reported superior PSTD coverage with the CAF (90.23% $\pm$ 19.85%) to the tunnel (59.76% $\pm$ 34.94%). The differential outcomes are likely explained by the difficulties in achieving adequate flap advancement, graft position and stabilisation in tunnelling approaches. Both CAF and tunnelling plus CTG improve PSTD outcomes. However, the choice depends upon site conditions and surgical expertise.

7.3.3 | The Preferred Source and Composition of the Graft Material?

Of the five studies included in the commissioned systematic review (Nart et al. 2025), all employed CTG, except one (Anderson et al. 2014), which compared CAF plus CTG (40% mean coverage at 6 months) versus CAF plus ADM (28% mean coverage). Of the other four studies, one harvested the CTG from the tuberosity, two employed CTGs with a de-epithelialisation technique harvested from the lateral palate and one used either the tuberosity if available or a de-epithelialisation technique if not. CTG thicknesses used ranged from 1.5 to 2.0 mm. Expert opinion suggests that while a minimum graft thickness cannot be specifically defined from the research literature, a 2-mm thickness is normally sufficient to facilitate graft survival and to mask any discolouration. The preferred composition of CTG, regardless of the source, is a graft that has dense connective tissue predominantly comprising lamina propria.

7.3.4 | Restoration Modification/Replacement (and Its Timing)?

Of the five studies within the commissioned systematic review (Nart et al. 2025), two modified the prostheses: one by reducing the emergence profile of the abutment and polishing the surface, followed by placement of a provisional restoration prior to surgery; and the other by removing the abutment and implant crown and replacing them with a cover screw at the time of the surgical intervention. In the latter, implants were uncovered after 3 months, followed by provisionalisation, with final restorations completed after 6 months. There was no prosthesis modification

in the remaining three studies. The objective of modifying the prosthetic component is to compensate for the mispositioning of the implant or the over-contour of the abutment/crown, thereby creating sufficient space for the adaptation of the CTG and flap and increasing the dimensions of the mesial and distal papilla prior to surgery. In clinical practice, such decisions are made based on individual site-specific circumstances.

Mispositioned tissue-level implants with a divergent macro design present a particular challenge when attempting to compensate for the implant position with angled abutments.

7.4 | Is There an Indication for Surgical Treatment of PSTD?

Indications for surgical treatment of PSTDs predominantly relate to sub-optimal patient-reported aesthetics or exposure of metal components to the oral cavity, frequently associated with the individual patient's smile line.

The aesthetic outcomes of PSTD treatment have been evaluated using different indices (VAS, PES/WES, IDES, etc.). It would be desirable to develop standardised outcome measures for future studies evaluating the aesthetic results of PSTD treatment.

Because of certain anatomical (e.g., implant position) and biological challenges, adverse events such as failure to achieve buccal PSTD coverage or worsening of the baseline condition may arise. In such circumstances, clinicians should consider implant removal as the treatment of choice. Importantly, there are circumstances where therapeutic decisions may require a multidisciplinary team approach.

Author Contributions

Francesco Cairo, Iain Chapple, Jose Nart, David Herrera, Mariano Sanz, Maurizio S. Tonetti (listed in alphabetic order) substantially contributed to the conception and design of the project, interpretation of data and drafting and critically reviewing the manuscript. The EFP focused workshop participants (listed as co-authors in alphabetic order) significantly contributed by critically reviewing the consensus report and participating in the workshop discussions. All authors approved the final version of the manuscript.

Scientific and academic societies involved in the consensus process

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Conflicts of Interest

Individual potential conflicts of interest forms were completed by all participants and are available on file at the European Federation of Periodontology.

Data Availability Statement

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

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Appendix A

List of Acronyms/Abbreviations

Acronym/abbreviation	Meaning
ADM	Acellular dermal matrix
BOP	Bleeding on probing
CAF	Coronally advanced flap
CAL	Clinical attachment level
CCT	Controlled clinical trial
CI	Confidence interval
CMX	Xenogeneic collagen matrices
CONSORT	Consolidated Standards of Reporting Trials
CRC	Complete root coverage
CRO	Clinician-reported outcome
CROMs	Clinician-reported outcome measures
CTG	(Autogenous) Connective tissue graft
EFP	European Federation of Periodontology
GT	(Change in) Gingival thickness
GRDs	Gingival recession defects
IIP	Immediate implant placement
KM	Keratinized mucosa
KTW	(Change in) keratinized tissue width
LPF	Laterally positioned flap
MCAF	Multiple coronally advanced flap
MID	Minimally important difference
MRC	Mean root coverage
NCCLs	Non-carious cervical lesions
OHIP	Oral Health Impact Profile
OHRQoL	Oral-health-related quality of life
PD	Probing depth
PES	Pink aesthetic score
PRE	Patient-reported experience
PRO	Patient-reported outcome
PROM	Patient-reported outcome measure
PSTD	Peri-implant soft-tissue dehiscence
QCE	Qualitative cosmetic evaluation
RC	Root coverage
RCT	Randomised clinical trial
RES	Root Coverage Aesthetic Score
rh-PDGF	Recombinant human platelet-derived growth factor
RT	Recession type
SD	Standard deviation
SEPA	Spanish Society of Periodontology and Osseointegration
SIdP	Italian Society of Periodontology and Implantology
SMD	Standardised mean difference
STA	Soft-tissue augmentation
STVA	Soft-tissue volume augmentation
TF	Tunnel flap
VAS	Visual analogue scale
WES	White aesthetic score
WG	Working Group
WHI	Wound healing index
WMD	Weighted mean difference