PROSTHODONTIC CONSIDERATIONS IN THE MANAGEMENT OF IMPLANT-SUPPORTED RESTORATIONS IN THE AESTHETIC ZONE – A NARRATIVE REVIEW

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ABSTRACT

Dental implants represent a predictable treatment option for replacing missing teeth. However, implant-supported restorations in the aesthetic zone remain clinically demanding because success depends on the integration of biological, functional, and patient-centred parameters. This narrative review systematises current evidence and clinical trends regarding the main prosthodontic considerations involved in aesthetic-zone implant rehabilitation. Particular attention is given to restoration-driven implant placement, timing of insertion, three-dimensional positioning, management of single and multiple edentulous spaces, abutment and retention selection, occlusal factors, provisional soft-tissue conditioning, and aesthetic assessment. The available evidence supports an interdisciplinary, prosthodontically driven approach in which the definitive restoration guides surgical and restorative decision-making. Predictable outcomes depend not only on implant survival, but on peri-implant tissue stability, emergence profile control, functional loading, maintainability, and patient-reported satisfaction.

Key words: aesthetic zone; implant-supported restorations; prosthodontic planning.

INTRODUCTION

Dental implants are currently regarded as a reliable and predictable modality for the replacement of missing teeth. Over the past two decades, their use has expanded substantially in dental practice, particularly for single-tooth replacement in the aesthetic zone. This widespread adoption is supported by favourable long-term outcomes, with reported 10-year survival estimates of approximately 96.4%. Consequently, implant prosthodontics has become increasingly established as a routine treatment option, with epidemiological data from the USA showing a marked rise in the prevalence of dental implants in older adults, from 0.7% in 1999 up to a projected 23% in 2026 [1,2].

The aesthetic zone constitutes a highly sensitive area in implant-supported prosthodontics, where the visual integration of the restoration within the patient's smile is critical to therapeutic success, besides osseointegration and functional rehabilitation. Although it is commonly defined as the region extending from canine to canine, its limits may also include the first or second premolars depending on smile width and the degree of tooth display. Implant-supported restorations in this region are therefore directly exposed during smiling, speech, and facial expression, making even minor discrepancies in crown morphology, colour integration and gingival contour clinically relevant. This is particularly critical in single-tooth replacements in the anterior maxilla, where the implant-supported crown is compared directly with adjacent natural teeth [3–8].

Moreover, patients usually present with high aesthetic demands that need to be properly addressed by the prosthodontist through efficient communication during treatment planning, for a consensus to be reached between the expectations and therapeutic possibilities. Within the shifting paradigms of patient-centred care and wish-

fulfilling dentistry, the implementation of dental patient reported outcome measures (dPROMs) thus became another instrument in improving the predictability of treatments and patient satisfaction [9,10].

Restorations in the aesthetic zone prove to be a considerable challenge in contemporary dentistry, where the prosthodontists must balance the multiple functional, periodontal, masticatory, aesthetic, and occlusal demands. Therefore, the aim of this narrative review is to systematise the current evidence and contemporary clinical trends concerning the principal prosthodontic determinants of implant-supported restorations in the aesthetic zone, thereby providing an evidence-informed framework for restorative planning and clinical decision-making.

RESTORATION-DRIVEN IMPLANT SELECTION AND PLACEMENT

Prosthodontically-driven implant insertion constitutes a core principle of implant rehabilitation, where the final prosthetic reconstruction should determine the three-dimensional implant position rather than be adapted to an implant placed solely according to residual bone availability [11–14].

Aesthetic success in implant-supported rehabilitation depends on coordinated planning between the prosthodontist and the surgeon, as the surgical and prosthetic phases are biologically and mechanically interdependent [11,15]. Adequate bone volume is required to permit correct three-dimensional implant placement, and when deficient, the site must be developed either before or, in selected cases, simultaneously with implant insertion [15–19]. The implant placement must be precise, since spatial deviations may compromise the emergence profile, soft-tissue stability, prosthetic axis, and final aesthetic integration [11,18]. Equally important are a stable implant-abutment interface [13,18], a minimal implant-abutment microgap, and a restoration designed with a cleansable emergence profile rather than a ridge-lap configuration [3,11,18]. The definitive prosthesis should ultimately reproduce the appearance of the adjacent natural teeth [5,11,15].

According to the Straightforward, Advanced, and Complex classification system of the International Team for Implantology (ITI), implants placed in the aesthetic zone of either the maxilla or the mandible are considered advanced or complex, depending on technique [3,11,20].

When it comes to implant placement planning, there are two interdependent determinants that govern the decision making process: the timing of insertion and the three-dimensional position of the implant [11,16,21].

The timing of implant placement in the aesthetic zone is commonly classified into four protocols: immediate placement in the extraction socket, early placement after soft-tissue healing, early placement after partial bone healing, and late placement in a healed ridge [16,17,22–24]. Among these protocols, immediate implant placement may provide favourable aesthetic outcomes in carefully selected cases, particularly when combined with adequate socket management and immediate provisionalisation [6,11,21,23]. Nevertheless, it should not be interpreted as a universally predictable procedure, since the literature consistently identifies mid-facial mucosal recession as a principal aesthetic risk when implants are placed immediately after extraction [16,17,25]. The stability of the peri-implant soft tissues depends largely on the preservation or reconstruction of facial tissue volume, which is influenced by the presence of the facial bone wall, grafting of the implant–socket gap, and local vascular support [16]. Bone grafting associated with a provisional restoration has been shown to reduce dimensional changes of the facial-palatal ridge and to support peri-implant soft-tissue volume. Although soft-tissue phenotype and connective tissue augmentation may influence the peri-implant mucosal profile [16,26], their effect on aesthetic outcomes after immediate placement is less consistent than the evidence supporting the importance of hard-tissue support and socket grafting [16,26–29]. Therefore, immediate placement, with or without immediate

provisionalisation/loading, should be regarded as a technique-sensitive protocol requiring favourable anatomy, adequate primary stability, strict case selection, and close surgical–prosthodontic coordination [11,22,23,30].

Classical protocols for anterior maxillary implant therapy emphasise that predictable aesthetic outcomes require ideal mesio-distal, oro-facial, and apico-coronal positioning within defined "comfort" zones [11,16,22,23], with the restorative plan transferred clinically by means of a surgical guide [17]. This concept remains central in contemporary ITI consensus guidance, which recommends three-dimensional, restoration-oriented planning for single-tooth replacement in the anterior maxilla [11], supported by radiographic and digital assessment of the implant site, facial bone wall, prosthetic axis, and abutment options [16].

Apico-coronal positioning determines the vertical restorative space available for the transition from the implant platform to the gingival margin [15]. In general, the implant shoulder is positioned approximately 3–4 mm apical to the planned gingival margin of the definitive restoration [11,31]. This is particularly relevant for maxillary central incisors, where the cervical crown dimension is expected to measure approximately 7–8 mm mesio-distally and 6 mm facio-lingually, whereas a standard implant platform may be approximately 4 mm in diameter [15]. This vertical distance permits a gradual transition from the implant platform to the cervical contour of the future crown. A less apical position may be sufficient for smaller teeth, such as maxillary lateral incisors, because their cervical crown dimensions are reduced [11,15]. Coronal malposition prevents the development of an adequate emergence profile and may result in a short or over-contoured restoration, whereas excessive apical placement may induce circumferential bone loss, compromise the facial bone wall, complicate impression procedures, and increase the risk of residual cement when cement-retained restorations are used [15,17,31].

Mesio-distal positioning is decisive for interproximal bone preservation and papillary support. A minimum distance of approximately 1.25 mm [31] or 1.5–2.0 mm [15,16] should be maintained between the implant and an adjacent natural tooth, since placement too close to the root may result in crestal bone resorption and loss of papillary height [15,17]. When two adjacent implants are inserted, an interimplant distance of approximately 3 mm is generally recommended to preserve bone between implant shoulders [16]. The vertical relationship between the contact point and the bone crest is also clinically relevant, as a distance of 5 mm or less is associated with more predictable papillary fill [15,16,32]. Therefore, adjacent root position, available restorative space, and, where necessary, orthodontic root divergence should be evaluated before implant insertion.

Facio-lingual positioning influences facial tissue stability, restorative contour, retention mode, and hygiene access [11,16,17]. At least 1 mm of bone should ideally remain on both the facial and palatal/lingual aspects of the implant; therefore, a 4 mm diameter implant generally requires approximately 6 mm of ridge width [15,16,33]. In the maxillary anterior region, the implant is usually positioned slightly palatal to the facial contour of the adjacent teeth. In aesthetic-zone protocols, the implant shoulder has also been described within a restorative "comfort zone," approximately 1.5–2.0 mm palatal to the anticipated incisal margin of the definitive crown, while maintaining sufficient buccal bone thickness, ideally at least 2 mm where possible [15–17,31]. Facial malposition may lead to buccal bone resorption, mucosal recession, discoloration, and an elongated restoration, whereas excessive palatal placement can produce bulky, non-hygienic contours and unfavourable biomechanical loading [11,16]. In post-extraction sites, a separate parameter must also be considered: the horizontal gap between the implant surface and the inner aspect of the facial socket wall. A gap of at least 2 mm has been recommended to allow grafting and maintenance of facial ridge contour; when the facial socket wall is thin or

the outer facial contour is inadequately supported, internal gap grafting and/or buccal contour augmentation may be required to preserve ridge volume and support the peri-implant mucosa [15–17,33].

Single tooth implants have a high degree of predictability as the adjacent teeth can provide the morphological substructure that is required to restore natural gingival and papillary architecture [11,31,34]. Replacement of multiple missing teeth in the aesthetic zone is challenging particularly when the three-dimensional architecture of the existing bone and soft tissue is deficient. The bony housing in this instance would require augmentation to provide a configuration that permits placement of implants in optimal positions which in turn would result in pleasing aesthetics.

Extended edentulous spaces in the aesthetic zone are more difficult to manage than single-tooth sites because post-extraction healing of adjacent teeth produces apical and facio-lingual ridge resorption, resulting in a flattened edentulous segment. As in single-tooth replacement, implant placement must be based on the three-dimensional configuration of the hard and soft tissues, with the objective of allowing implants to be positioned in a prosthetically and biologically favourable location [15–17,21,23].

When adjacent implants are placed, papilla preservation becomes less predictable. At a tooth–implant interface, papillary support is largely determined by the height of the interproximal bone crest of the adjacent natural tooth [6,11,31]. Between two implants, however, the interimplant bone crest may remodel apically, producing loss of interimplant soft tissue and black triangles. For this reason, a minimum distance of 3 mm between adjacent implants at the implant–abutment level is recommended, since closer placement may cause overlapping bone remodeling, vertical crestal bone loss, and soft-tissue compromise [15–17,32].

These limitations have important prosthetic consequences. A one-implant-per-tooth approach may be unfavourable in the anterior aesthetic zone when several adjacent teeth are missing, because interimplant papillae are difficult to maintain predictably. In such cases, placing fewer implants farther apart and restoring the segment with a fixed dental prosthesis may allow the use of ovate pontics to sculpt the intervening soft tissue and create a more convincing illusion of papillae. Where severe horizontal or vertical tissue deficiencies persist, hard- and soft-tissue reconstruction, or artificial gingiva, may be required to compensate for deficient tissue volume and restore acceptable tooth proportions, axis alignment, and lip support [15–17,27].

The biological state of the area is also of great importance. Teeth are often extracted as a result of an irreversible infectious process, leaving behind a contaminated area. Previously, any ongoing infective process represented a contraindication for implant placement, because of the possibility that the infection could interfere with the healing process and prevent osseointegration. However, later investigations showed that an accurate socket debridement before implant placement could allow successful osseointegration, comparable to otherwise healthy sites [16,35,36].

ABUTMENT SELECTION AND RETENTION TYPE

Abutment selection in the aesthetic zone must be coordinated with implant position and the cervical contour of the definitive crown. Although divergent transmucosal profiles have traditionally been used to reproduce a natural emergence profile, excessive divergence may negatively affect the peri-implant tissues through pressure, ischemia, and recession. Concave or gingivally convergent transmucosal profiles have therefore been proposed to improve soft-tissue stability and limit recession [6,13,16,37].

The abutment design also determines the critical contour required for the final restoration. When an implant is positioned according to conventional cingulum-oriented guidelines and restored with a narrow shoulderless abutment, light chamfer, or feather-edge preparation, the crown may require an excessively convex cervical contour to reach the expected natural outline.

Such contours may deviate from physiological tooth anatomy and have been associated with adverse soft-tissue behaviour, although clear evidence regarding their effect on tissue stability remains limited. In cemented crowns, increased cervical convexity may also create undercuts that make cement removal more difficult, increasing the risk of residual cement within the peri-implant sulcus. For this reason, when a shoulderless abutment, light chamfer, or feather-edge preparation is selected instead of a wide-shoulder abutment, conventional cingulum- or palatal-oriented implant placement may be inappropriate. In the aesthetic zone, the bucco-lingual implant position should be modified so that the centre of the implant corresponds to the incisal edge of the future restoration or adjacent teeth, provided that 1.5–2.0 mm of buccal bone can be maintained [7,13,16,37].

Abutment selection in the anterior region also requires reconciliation of biological and mechanical predictability with peri-implant optical integration. Internal-connection implants restored with customized metal abutments, such as titanium or cast metal, appear to be associated with fewer technical complications. From an aesthetic perspective, however, metal abutments, particularly titanium, may compromise the colour of the peri-implant mucosa, an effect of greater relevance in patients with thin soft tissues or high smile lines [38]. Ceramic abutments, and especially zirconia, generally provide a more favourable soft-tissue colour match than titanium or gold abutments, although they may still produce slight discoloration and have been associated with a low but present risk of abutment failure, particularly in internal-connection designs. Gold- or pink-hued metal abutments may modestly improve colour performance, while submucosally modified zirconia abutments have shown encouraging results. Current data do not indicate significant differences between abutment materials or retention types regarding recession, papillary fill, or biological outcomes [38,39].

For frontal implants, screw retention is generally preferred when the implant is correctly positioned and the screw-access channel emerges palatally, because it improves retrievability and avoids residual cement. Cement retention remains indicated when screw-access emergence would compromise aesthetics or occlusion, but it requires careful margin design and cement control [40,41]. One study underscores that the facial emergence angle is significantly greater for implants in a screw-retained position, however this may be partially alleviated by deeper implant placement [42].

OCCLUSAL FACTORS

The occlusal scheme of implant-supported restorations must be planned to reduce excessive mechanical stress, as overload has been associated with crestal bone loss, peri-implant disease progression, and prosthetic complications [43,44]. In single-implant restorations, occlusal contacts should be designed to minimize loading of the implant and, when possible, transfer guidance and force distribution to the natural dentition [45,46]. Accordingly, anterior and lateral guidance should preferably be provided by natural teeth, while working and non-working contacts on the implant crown should be avoided [43,45,47]. In maximum intercuspation, a protective scheme may involve no contact during light closure and only light contact during firm closure. Static contacts should be located on mechanically supported areas of the restoration: on the cingulum for anterior implant crowns [43,45]. For anterior implants, long centric freedom is recommended, with Shimstock pulling through against an opposing anterior tooth and passing more freely against an opposing implant restoration. If an implant crown contributes to anterior guidance, posterior dynamic interferences should be absent [43–45]. These occlusal principles should be accompanied by patient education, since implant therapy does not modify parafunctional activity, such as clenching or bruxism, nor does it eliminate the risk of plaque-induced peri-implant mucositis or peri-implantitis [43,45,46].

Assessment of restorative space is a core step in implant treatment planning and should be performed in relation to the vertical dimension of occlusion. The available

restorative space cannot be properly evaluated until the vertical dimension has been established using conventional prosthodontic parameters, including aesthetics, interocclusal rest space, phonetics, and facial or lip support. The clinician must first determine the definitive position of the prosthetic tooth or teeth and then work backward to identify the vertical, mesiodistal, and buccolingual volume required for the implant components and restoration. For single-tooth spaces, the vertical dimension can usually be measured intraorally with a periodontal probe from the soft tissue of the edentulous ridge to the opposing dentition [44,48].

In the anterior region, overbite and sagittal jaw relationships directly influence how restorative space is measured. For mandibular anterior implants, the potential space is assessed from the edentulous ridge to the cingulum or lingual aspect of the maxillary anterior teeth. For maxillary anterior implants, the relevant measurement is taken in the projected cingulum region of the future crown, where implant components are expected to be positioned, from the soft tissue or bone to the mandibular incisal edge. This dimension may be shorter than the apparent prosthetic tooth length in cases of horizontal ridge resorption, because the cervical portion of the planned crown may be positioned buccal and coronal to the residual ridge rather than directly over it. Particular caution is required in Class III jaw relationships or in patients with marked maxillary anterior overjet, since the site from which restorative space is measured may differ depending on whether the missing teeth are maxillary or mandibular [48].

PROVISIONAL RESTORATIONS

Provisional restorations represent an important prosthodontic instrument in aesthetic-zone implant therapy, as they contribute both to the prediction of the final aesthetic outcome and to the control of the definitive prosthetic design [49–51]. Their principal value lies in soft-tissue management during healing, particularly in the development of an ideal emergence profile. Acting as a clinical prototype, the provisional crown allows evaluation and modification of the gingival contour, gingival margin level, zenith position, labial profile, and papillary support before fabrication of the definitive restoration. Soft-tissue conditioning is achieved by controlled pressure from the provisional contour, which guides tissue remodeling and helps optimize the peri-implant mucosal profile [50]. After insertion, only moderate mucosal blanching is expected, and this should resolve within approximately 15 minutes [50]. When feasible, screw-retained provisional restorations are preferred because they facilitate removability and repeated contour modification during soft-tissue management [49–51].

AESTHETIC CONSIDERATIONS IN TREATMENT PLANNING

Aesthetic assessment of implant-supported restorations in the aesthetic zone must be performed both before treatment, as part of prosthodontic planning, and after treatment, as part of outcome evaluation. Preoperatively, esthetic risk assessment protocols usually analyse the patient's smile line, lip length, lip mobility, tooth display, gingival exposure, existing ridge morphology, adjacent tooth form, gingival architecture, and aesthetic expectations, along with behavioural risk factors. Smile-line assessment is particularly important because it determines the visibility of the future restoration and peri-implant tissues. In an average smile, approximately 75–100% of the maxillary incisors and interproximal gingiva may be displayed, whereas a high smile line exposes additional gingival tissue and therefore increases the aesthetic risk of the case. In such patients, discrepancies in gingival margin level, papillary fill, tissue volume, crown contour, or mucosal colour are more likely to be visible and must be anticipated during planning, surgery, provisionalisation, and definitive restoration [15,16].

Clinician-based aesthetic evaluation should include both white and pink parameters. The implant crown must reproduce the form, dimension, colour, surface texture, characterization, and optical properties of the adjacent dentition, while the

peri-implant tissues should provide a harmonious gingival frame in terms of margin level, contour, papillary fill, colour, texture, and volume [3,5–7]. Digital photographic analysis, smile-design software, and prosthetic simulations may assist this stage by visualizing tooth proportions, gingival display, crown position, and anticipated restorative contours; however, these tools remain adjuncts to clinical diagnosis and biological feasibility. Standardized indices such as the Pink Esthetic Score (PES) and White Esthetic Score (WES) provide a structured method for evaluating anterior implant restorations by separately assessing peri-implant soft-tissue parameters and visible crown-related parameters [34,52,53]. The PES assesses peri-implant soft-tissue parameters, including papillae, mucosal level, contour, colour, texture, and alveolar process deficiency, whereas the WES evaluates the prosthetic crown in terms of form, volume, colour, texture, and translucency/characterization [52,53].

Nevertheless, clinician assessed aesthetics alone are insufficient, since the patient's perception of implant-restorative success is inherently subjective. Moreover, numerous studies from various dental disciplines have revealed that patient satisfaction may not fully correspond to professional aesthetic scores [9,34,54], and the patient's own perception of appearance, comfort, smile harmony, and social acceptability must therefore be incorporated into assessment [34]. In this context, dental patient reported outcomes (dPROs) and their corresponding quantification – dental patient reported outcome measures (dPROMs) represent necessary complements to clinical indices because they succeed in recording and quantifying patient-reported aesthetic perception and satisfaction rather than relying exclusively on clinician-defined criteria [55,56]. Systematic reviews indicate generally favourable patient-reported aesthetic outcomes for implant-supported fixed dental prostheses, while also highlighting heterogeneity in outcome measurement and the need for more standardized patient-reported assessment [56]. The increasing implementation of dPROs reflects the current paradigm shift towards patient centred care within an evidence based framework [57,58].

CONCLUSION

Implant-supported rehabilitation in the aesthetic zone requires a prosthodontically driven sequence in which implant timing and three-dimensional positioning, abutment and retention selection, occlusal control, provisional soft-tissue conditioning, and final aesthetic assessment are planned as interdependent factors. Although implant survival is highly predictable, aesthetic success depends on the stable integration of the restoration with the peri-implant tissues, adjacent dentition, functional scheme, and patient expectations. Consequently, predictable outcomes rely not on isolated surgical or restorative decisions, but on coordinated, evidence-informed planning that balances biological stability, prosthetic feasibility, maintainability, and patient-reported satisfaction.

REFERENCES

1. Misje, K.; Bjørnland, T.; Saxegaard, E.; Jensen, J.L. Treatment Outcome of Dental Implants in the Esthetic Zone: A 12- to 15-Year Retrospective Study. *Int J Prosthodont* **2013**, *26*, 365–369, doi:10.11607/ijp.3097.
2. Elani, H.W.; Starr, J.R.; Da Silva, J.D.; Gallucci, G.O. Trends in Dental Implant Use in the U.S., 1999–2016, and Projections to 2026. *J Dent Res* **2018**, *97*, 1424–1430, doi:10.1177/0022034518792567.
3. Alanazi, S. Aesthetic Problems Related to Dental Implants in the Aesthetic Zone: A Systematic Review. *The Saudi Dental Journal* **2024**, *36*, 1179–1183, doi:10.1016/j.sdentj.2024.06.010.

4. LeSage, B.P.; Bahat, O. Interdisciplinary Approaches to Restoring Single-Tooth Implants in the Esthetic Zone. *J Esthet Restor Dent* **2025**, *37*, 1219–1232, doi:10.1111/jerd.13417.
5. Levin, B.P.; Rubinstein, S.; Rose, L.F. Advanced Esthetic Management of Dental Implants: Surgical and Restorative Considerations to Improve Outcomes. *J Esthet Restor Dent* **2015**, *27*, 224–230, doi:10.1111/jerd.12161.
6. Levine, R.A.; Ganeles, J.; Gonzaga, L.; Kan, J.K.; Randel, H.; Evans, C.D.; Chen, S.T. 10 Keys for Successful Esthetic-Zone Single Immediate Implants. *Compend Contin Educ Dent* **2017**, *38*, 248–260.
7. Forna, N.; Agop-Forna, D. Esthetic Aspects in Implant-Prosthetic Rehabilitation. *Med Pharm Rep* **2019**, *92*, S6–S13, doi:10.15386/mpr-1515.
8. Cristea, I.; Agop-Forna, D.; Martu, M.-A.; Dascălu, C.; Topoliceanu, C.; Török, R.; Török, B.; Bardis, D.; Bardi, P.M.; Forna, N. Oral and Periodontal Risk Factors of Prosthetic Success for 3-Unit Natural Tooth-Supported Bridges versus Implant-Supported Fixed Dental Prostheses. *Diagnostics* **2023**, *13*, 852, doi:10.3390/diagnostics13050852.
9. Arunyanak, S.P.; Pollini, A.; Ntounis, A.; Morton, D. Clinician Assessments and Patient Perspectives of Single-Tooth Implant Restorations in the Esthetic Zone of the Maxilla: A Systematic Review. *The Journal of Prosthetic Dentistry* **2017**, *118*, 10–17, doi:10.1016/j.prosdent.2016.10.036.
10. Sierwald, I.; John, M.T.; Schierz, O.; Jost-Brinkmann, P.-G.; Reissmann, D.R. Association of Overjet and Overbite with Esthetic Impairments of Oral Health-Related Quality of Life. *J Orofac Orthop* **2015**, *76*, 405–420, doi:10.1007/s00056-015-0300-x.
11. Buser, D.; Belser, U.; Wismeijer, D. *Implant Therapy in the Esthetic Zone: Single-Tooth Replacements*; Quintessenz Verlag: s.l, 2010; ISBN 978-3-938947-10-4.
12. Belser, U.C.; Bernard, J.P.; Buser, D. Implant-Supported Restorations in the Anterior Region: Prosthetic Considerations. *Pract Periodontics Aesthet Dent* **1996**, *8*, 875–883; quiz 884.
13. Gamborena, I.; Sasaki, Y.; Blatz, M.B. Transmucosal Abutments in the Esthetic Zone: Surgical and Prosthetic Considerations. *J Esthet Restor Dent* **2023**, *35*, 148–157, doi:10.1111/jerd.13006.
14. Garber, D.A.; Belser, U.C. Restoration-Driven Implant Placement with Restoration-Generated Site Development. *Compend Contin Educ Dent* **1995**, *16*, 796, 798–802, 804.
15. Jivraj, S.; Chee, W. Treatment Planning of Implants in the Aesthetic Zone. *Br Dent J* **2006**, *201*, 77–89, doi:10.1038/sj.bdj.4813820.
16. Testori, T.; Weinstein, T.; Scutellà, F.; Wang, H.; Zucchelli, G. Implant Placement in the Esthetic Area: Criteria for Positioning Single and Multiple Implants. *Periodontology 2000* **2018**, *77*, 176–196, doi:10.1111/prd.12211.
17. Chen, S.T.; Buser, D.; Sculean, A.; Belser, U.C. Complications and Treatment Errors in Implant Positioning in the Aesthetic Zone: Diagnosis and Possible Solutions. *Periodontology 2000* **2023**, *92*, 220–234, doi:10.1111/prd.12474.
18. Higginbottom, F.; Belser, U.; Jones, J.D.; Keith, S.E. Prosthetic Management of Implants in the Esthetic Zone. *Int J Oral Maxillofac Implants* **2004**, *19 Suppl*, 62–72.
19. Cordaro, L. *Ridge Augmentation Procedures in Implant Patients: A Staged Approach*; ITI Treatment Guide Series; 1st ed.; Quintessenz Verlag: Berlin, 2019; ISBN 978-3-86867-217-6.
20. Wismeijer, D.; Buser, D.; Belser, U. *Loading Protocols in Implant Dentistry: Edentulous Patients*; Quintessenz Verlag: s.l, 2010; ISBN 978-1-85097-347-8.
21. Wismeijer, D.; Buser, D.; Belser, U. *Loading Protocols in Implant Dentistry: Partially Dentate Patients*; Quintessenz Verlag: s.l, 2010; ISBN 978-1-85097-345-4.
22. Morton, D.; Gallucci, G.; Lin, W.; Pjetursson, B.; Polido, W.; Roehling, S.; Sailer, I.; Aghaloo, T.; Albera, H.; Bohner, L.; et al. Group 2 ITI Consensus Report: Prosthodontics and Implant Dentistry. *Clinical Oral Implants Res* **2018**, *29*, 215–223, doi:10.1111/clr.13298.
23. Morton, D.; Wismeijer, D.; Chen, S.; Hamilton, A.; Wittneben, J.; Casentini, P.; Gonzaga, L.; Lazarin, R.; Martin, W.; Molinero-Mourelle, P.; et al. Group 5 ITI Consensus Report: Implant

Placement and Loading Protocols. *Clinical Oral Implants Res* **2023**, *34*, 349–356, doi:10.1111/clr.14137.

24. Thoma, D.S.; Mancini, L.; Jung, R.E. Timing of Dental Implant Placement: The Past, the Present, the Future. *J Periodontal Res* **2026**, *61*, 101–106, doi:10.1111/jre.70088.
25. Chu, S.J.; Tarnow, D.P. Managing Esthetic Challenges with Anterior Implants. Part 1: Midfacial Recession Defects from Etiology to Resolution. *Compend Contin Educ Dent* **2013**, *34 Spec No 7*, 26–31.
26. Khzam, N.; Arora, H.; Kim, P.; Fisher, A.; Mattheos, N.; Ivanovski, S. Systematic Review of Soft Tissue Alterations and Esthetic Outcomes Following Immediate Implant Placement and Restoration of Single Implants in the Anterior Maxilla. *Journal of Periodontology* **2015**, *86*, 1321–1330, doi:10.1902/jop.2015.150287.
27. Tarnow, D.; Chu, S.; Salama, M.; Stappert, C.; Salama, H.; Garber, D.; Sarnachiaro, G.; Sarnachiaro, E.; Gotta, S.; Saito, H. Flapless Postextraction Socket Implant Placement in the Esthetic Zone: Part 1. The Effect of Bone Grafting and/or Provisional Restoration on Facial-Palatal Ridge Dimensional Change—A Retrospective Cohort Study. *Int J Periodontics Restorative Dent* **2014**, *34*, 323–331, doi:10.11607/prd.1821.
28. Chu, S.; Salama, M.; Garber, D.; Salama, H.; Sarnachiaro, G.; Sarnachiaro, E.; Gotta, S.; Reynolds, M.; Saito, H.; Tarnow, D. Flapless Postextraction Socket Implant Placement, Part 2: The Effects of Bone Grafting and Provisional Restoration on Peri-Implant Soft Tissue Height and Thickness— A Retrospective Study. *Int J Periodontics Restorative Dent* **2015**, *35*, 803–809, doi:10.11607/prd.2178.
29. Chu, S.; Saito, H.; Salama, M.; Garber, D.; Salama, H.; Sarnachiaro, G.; Reynolds, M.; Tarnow, D. Flapless Postextraction Socket Implant Placement, Part 3: The Effects of Bone Grafting and Provisional Restoration on Soft Tissue Color Change—A Retrospective Pilot Study. *Int J Periodontics Restorative Dent* **2018**, *38*, 509–516, doi:10.11607/prd.3571.
30. Wittneben, J.; Molinero-Mourelle, P.; Hamilton, A.; Alnasser, M.; Obermaier, B.; Morton, D.; Gallucci, G.O.; Wismeijer, D. Clinical Performance of Immediately Placed and Immediately Loaded Single Implants in the Esthetic Zone: A Systematic Review and Meta-analysis. *Clinical Oral Implants Res* **2023**, *34*, 266–303, doi:10.1111/clr.14172.
31. Leblebicioglu, B.; Rawal, S.; Mariotti, A. A Review of the Functional and Esthetic Requirements for Dental Implants. *The Journal of the American Dental Association* **2007**, *138*, 321–329, doi:10.14219/jada.archive.2007.0164.
32. Roccuzzo, M.; Roccuzzo, A.; Ramanuskaite, A. Papilla Height in Relation to the Distance between Bone Crest and Interproximal Contact Point at Single-tooth Implants: A Systematic Review. *Clinical Oral Implants Res* **2018**, *29*, 50–61, doi:10.1111/clr.13116.
33. Su, C.; Fu, J.; Wang, H. The Role of Implant Position on Long-Term Success. *Clin Adv Periodontics* **2014**, *4*, 187–193, doi:10.1902/cap.2013.120100.
34. Altay, M.A.; Sindel, A.; Tezerişener, H.A.; Yıldırımyan, N.; Özarslan, M.M. Esthetic Evaluation of Implant-Supported Single Crowns: A Comparison of Objective and Patient-Reported Outcomes. *Int J Implant Dent* **2019**, *5*, 2, doi:10.1186/s40729-018-0153-3.
35. Truninger, T.C.; Philipp, A.O.H.; Siegenthaler, D.W.; Roos, M.; Hämmerle, C.H.F.; Jung, R.E. A Prospective, Controlled Clinical Trial Evaluating the Clinical and Radiological Outcome after 3 Years of Immediately Placed Implants in Sockets Exhibiting Periapical Pathology: Outcome after 3 Years of Immediately Placed Implants in Sockets Exhibiting Periapical Pathology. *Clinical Oral Implants Research* **2011**, *22*, 20–27, doi:10.1111/j.1600-0501.2010.01973.x.
36. Fugazzotto, P. A Retrospective Analysis of Immediately Placed Implants in 418 Sites Exhibiting Periapical Pathology: Results and Clinical Considerations. *Int J Oral Maxillofac Implants* **2012**, *27*, 194–202.
37. Cocchetto, R.; Canullo, L. The “Hybrid Abutment”: A New Design for Implant Cemented Restorations in the Esthetic Zones. *Int J Esthet Dent* **2015**, *10*, 186–208.

38. Bidra, A.S.; Rungruanganunt, P. Clinical Outcomes of Implant Abutments in the Anterior Region: A Systematic Review. *J Esthet Restor Dent* **2013**, *25*, 159–176, doi:10.1111/jerd.12031.
39. Totou, D.; Naka, O.; Mehta, S.B.; Banerji, S. Esthetic, Mechanical, and Biological Outcomes of Various Implant Abutments for Single-Tooth Replacement in the Anterior Region: A Systematic Review of the Literature. *Int J Implant Dent* **2021**, *7*, 85, doi:10.1186/s40729-021-00370-7.
40. Hamed, M.T.; Abdullah Mously, H.; Khalid Alamoudi, S.; Hossam Hashem, A.B.; Hussein Naguib, G. A Systematic Review of Screw versus Cement-Retained Fixed Implant Supported Reconstructions. *Clin Cosmet Investig Dent* **2020**, *12*, 9–16, doi:10.2147/CCIDE.S231070.
41. Wittneben, J.-G.; Millen, C.; Brägger, U. Clinical Performance of Screw- Versus Cement-Retained Fixed Implant-Supported Reconstructions—A Systematic Review. *Int J Oral Maxillofac Implants* **2014**, *29*, 84–98, doi:10.11607/jomi.2014suppl.g2.1.
42. Choy, K.; Sattler, D.; Daubert, D.; Wang, I.-C. The Effect of Cement versus Screw-Retained Implant Positioning in the Esthetic Zone on Emergence Angle: A Proof of Principle. *Int J Periodontics Restorative Dent* **2023**, doi:10.11607/prd.6903.
43. Stilwell, C. Occlusal Considerations in Maintaining Health of Implants and Their Restorations. *Br Dent J* **2024**, *236*, 773–779, doi:10.1038/s41415-024-7407-7.
44. Kim, Y.; Oh, T.; Misch, C.E.; Wang, H. Occlusal Considerations in Implant Therapy: Clinical Guidelines with Biomechanical Rationale. *Clinical Oral Implants Res* **2005**, *16*, 26–35, doi:10.1111/j.1600-0501.2004.01067.x.
45. Verma, M.; Nanda, A.; Sood, A. Principles of Occlusion in Implant Dentistry. *J Int Clin Dent Res Organ* **2015**, *7*, 27, doi:10.4103/2231-0754.172924.
46. Al-Ani, Z.; Maghaireh, H. Occlusion on a Single Implant-Supported Crown: Any Differences? *Prim Dent J* **2022**, *11*, 32–38, doi:10.1177/20501684221100944.
47. Sheridan, R.A.; Decker, A.M.; Plonka, A.B.; Wang, H.-L. The Role of Occlusion in Implant Therapy: A Comprehensive Updated Review. *Implant Dentistry* **2016**, *25*, 829–838, doi:10.1097/ID.0000000000000488.
48. Carpentieri, J.; Greenstein, G.; Cavallaro, J. Hierarchy of Restorative Space Required for Different Types of Dental Implant Prostheses. *The Journal of the American Dental Association* **2019**, *150*, 695–706, doi:10.1016/j.adaj.2019.04.015.
49. Alshiddi, I.F.; Dent, D.C. Accurate Registration of Peri-Implant Soft Tissues to Create an Optimal Emergence Profile. *Contemp Clin Dent* **2015**, *6*, S122-125, doi:10.4103/0976-237X.152967.
50. Sun, T.C.; Chang, T.-K. Soft Tissue Management around Dental Implant in Esthetic Zone - the Current Concepts and Novel Techniques. *J Dent Sci* **2024**, *19*, 1348–1358, doi:10.1016/j.jds.2024.03.003.
51. Son, M.-K.; Jang, H.-S. Gingival Recontouring by Provisional Implant Restoration for Optimal Emergence Profile: Report of Two Cases. *J Periodontal Implant Sci* **2011**, *41*, 302–308, doi:10.5051/jpis.2011.41.6.302.
52. Dash, S.; Srivastava, G.; Padhiary, S.K.; Samal, M.; Çakmak, G.; Roccuzzo, A.; Molinero-Mourelle, P. Validation of the Pink Esthetic Score/White Esthetic Score at Single Tooth-supported Prostheses in the Esthetic Zone: A Randomized Clinical Trial. *J Esthet Restor Dent* **2024**, *36*, 976–984, doi:10.1111/jerd.13243.
53. Belser, U.C.; Grütter, L.; Vailati, F.; Bornstein, M.M.; Weber, H.-P.; Buser, D. Outcome Evaluation of Early Placed Maxillary Anterior Single-Tooth Implants Using Objective Esthetic Criteria: A Cross-Sectional, Retrospective Study in 45 Patients with a 2- to 4-Year Follow-up Using Pink and White Esthetic Scores. *J Periodontol* **2009**, *80*, 140–151, doi:10.1902/jop.2009.080435.
54. Sadilina, S.; Müller, N.P.A.; Strauss, F.J.; Jung, R.E.; Thoma, D.S.; Bienz, S.P. Patient-Reported and Clinician-Reported Esthetic Outcomes at Implant Sites Are Not Associated: A

Systematic Review With Individual Participant Data Meta-Analysis. *Clinical Oral Implants Res* **2025**, *36*, 1382–1411, doi:10.1111/clr.70019.

55. Tonetti, M.; Sanz, M.; Cairo, F.; Nart, J.; Chapple, I.; Aimetti, M.; Aroca, S.; Avila-Ortiz, G.; Blanco, J.; Bujaldón, A.; et al. Aesthetics and Patient-Reported Outcomes in Periodontology and Implant Dentistry: Consensus Report. *J Clinic Periodontology* **2025**, *52*, 1222–1244, doi:10.1111/jcpe.14182.
56. Wittneben, J.; Wismeijer, D.; Brägger, U.; Joda, T.; Abou-Ayash, S. Patient-reported Outcome Measures Focusing on Aesthetics of Implant- and Tooth-supported Fixed Dental Prostheses: A Systematic Review and Meta-analysis. *Clinical Oral Implants Res* **2018**, *29*, 224–240, doi:10.1111/clr.13295.
57. Reissmann, D.R. Dental Patient-Reported Outcome Measures Are Essential for Evidence-Based Prosthetic Dentistry. *Journal of Evidence Based Dental Practice* **2019**, *19*, 1–6, doi:10.1016/j.jebdp.2019.01.003.
58. Reissmann, D.R. Methodological Considerations When Measuring Oral Health–Related Quality of Life. *J of Oral Rehabilitation* **2021**, *48*, 233–245, doi:10.1111/joor.12983.