Quality Resource Guide

Pre-Prosthetic Periodontal Surgery

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Educational Objectives

Following this unit of instruction, the practitioner should be able to:

1. Discuss the considerations for clinical and esthetic crown lengthening.
2. Describe the components and dimensions of the supracrestal tissue attachment (STA) and the importance of the STA in restorative outcomes.
3. Define periodontal phenotype and its role in maintaining periodontal and peri-implant health.
4. Give examples of soft and hard tissue resection utilized for pre-prosthetic site preparation in partially or fully edentulous patients.
5. Discuss prosthetic space requirements for implant restorations in the completely edentulous patient.

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Introduction

Tooth position and fixed and removable dental restorations have been associated with dental plaque retention and periodontal disease progression.[1,2] Further, long-term restorative success requires attentiveness to the restorative-periodontal interface, including:

1) the supracrestal tissue attachment (STA),
2) adequate sound tooth structure,
3) an appropriate periodontal or peri-implant phenotype,
4) the creation of adequate sites for prostheses,
5) ridge preservation procedures after tooth extraction,
6) prosthetic space requirements, and
7) access for oral hygiene measures.[3-6]

This Quality Resource Guide will review the considerations for pre-prosthetic periodontal therapies to enhance oral health and restorative outcomes.

What is Supracrestal Tissue Attachment (STA), and how does it impact restorative success?

Supracrestal tissue attachment (STA) has been defined as the cumulative apical-coronal dimension of the junctional epithelium (JE) and supracrestal connective tissue attachment (SCTA).[2,7] Variable measurements are recorded for components of the STA and the periodontal sulcus, with SCTA having the most consistency among individuals.[8-10] STA measurements vary based on tooth type, tooth surface, periodontal phenotype, attachment loss, and restorative margin position.[8-14] Clinically, the measurement of STA can be confirmed with transgingival probing or parallel radiographs, but this is insufficient to differentiate between the individual components.[15,16] In vivo studies have demonstrated that crown margins positioned within the JE or SCTA attachment apparatus have been associated with gingival recession, crestal bone loss, and connective tissue remodeling between 0 to 8 weeks.[17] It should also be noted that even in the presence of low, but consistent levels of supragingival plaque, sites with restorative margins placed in a manner that impinges upon the SCTA demonstrate increased gingival bleeding and other signs of gingival inflammation, increased probing depth and attachment loss.[3,18] While it is unclear if the underlying cause of this progressive attachment loss is related to enhanced bacterial plaque retention, trauma, or a combination of these factors, encroachment of restorative margins within the STA has been identified as a contributing factor to progressive periodontitis and attachment loss.[18] Given these findings, determination of the location of the final restorative finish line and referral for clinical crown lengthening should encroachment of the STA appear eminent are critical to ensure adequate restorative margin seal and caries removal as well as promotion of the periodontal health and stability of the restored tooth.

Crown Lengthening Procedures (Functional and Esthetic): When, Why, and Hows

Crown lengthening procedures may be undertaken for a variety of reasons, including:

1) lack of adequate supragingival tooth structure or ferrule,
2) exposure of sound tooth structure beyond subgingival caries or fracture,
3) a need to avoid placement of the restorative finish line within the STA, and
4) establishing a normal relationship between the cemento-enamel junction (CEJ) and the osseous crest in instances of altered passive eruption resulting in short clinical crowns.

Many clinical situations may present a combination of these scenarios in real-world applications and require clinicians' judgment to determine the best course of action to retain and restore teeth.

Functional or esthetic crown lengthening must involve the removal of both hard and soft tissue around the teeth to avoid soft tissue rebound and the potential need for repetition of the procedures. To allow adequate reduction, sufficient space for the STA, the ferrule length, and existing sound tooth structure are necessary. The ferrule is defined as "a 360-degree collar of the crown surrounding the parallel walls of the dentin extending coronally to the shoulder of the preparation."[19] It is generally accepted that the ferrule should be 1-2 mm apically to the most apical extent of a restorative core or buildup. Allowing for adequate ferrule through restorative marginal placement or clinical crown lengthening results in more predictable prosthetic outcomes.[20,21] Methods used to enhance the clinical crown length, including clinical crown lengthening and orthodontic tooth extrusion, require altering the relative position of the tooth within the soft and hard tissue housing.

Crown lengthening procedures involve the resection of both hard and soft tissues of the periodontium. Initial soft tissue resection can be accomplished with various gingivectomy techniques, including using a scalpel blade, electrosurgery, or laser. Care must be taken to assess the width of keratinized tissue before resection to ensure that an adequate band of keratinized tissue remains to maintain adequate oral health and hygiene. It has been established that sites with >2mm of keratinized tissue width experience less gingival inflammation and progressive gingival recession.[22,23] Further, at sites with subgingival restorative margin placement, a wider band of keratinized tissue has been recommended to enhance outcomes.[24,25]

Prior to initiating clinical crown lengthening procedures, the approximate establishment of the finish line position is critical to accurate hard and soft tissue resection. To accomplish this, prior to initiation of the surgical crown lengthening procedures, excavation of caries and faulty restorations and placement of a quality provisional restoration allows for the most accurate intrasurgical assessment and access. Once the provisional restoration is completed, referral for completion of the clinical crown lengthening procedure and other needed soft tissue corrections. During the crown lengthening procedure, intrasurgical measurements should be carefully considered to ensure adequate reduction and space for STA.

Differences in the overall reduction delivered during clinical crown lengthening procedures have been seen at different tooth sites, and gingival margin rebound can be expected at six months post-operatively based upon the position of the gingival tissues in relation to the post-surgical alveolar crest.[26-28] Flap management during crown lengthening may affect healing outcomes. Overall, flaps replaced less than 3 mm from the bone after conventional osseous surgery were stable 93% of the time at six months. Further, a linear relationship between final flap margin position and posttreatment tissue rebound has been shown.[29] In esthetic areas where gingival margin stability is critical, delaying final restoration placement for at least six months after crown lengthening may provide the most predictable outcome, as 12% of treated sites exhibit between 2 to 4 mm gingival recession at six months post-operatively. Conversely, soft tissue rebound may also occur during this initial healing phase. Refinement of the provisional restoration during this healing period can help guide marginal tissue stability.[30]

Clinical crown lengthening procedures are resective in nature, and as such, they result in a reduction of the periodontal attachment apparatus on treated teeth and can also result in loss of attachment on the proximal surfaces of adjacent teeth. Careful presurgical assessment of the anticipated amount of hard tissue resection is necessary to determine the likely final crown-to-root ratio and stability. Further, in multi-rooted teeth, determination of root trunk length and assessment of likely furcation exposure if resection is completed in interfurcal areas should be considered. If the amount of bone removal necessary to allow for adequate sound tooth structure and ferrule would result in significant compromise to the periodontal apparatus support of the treated or adjacent teeth, other treatment plans should be considered. It should also be noted that in teeth that have been treated with clinical crown lengthening, alterations to the final restoration design, such as reducing buccal contour to facilitate oral hygiene, may be required to optimize the final result. Multidisciplinary collaboration in the surgical and restorative phases can allow for stable outcomes.

Periodontal and Peri-implant Phenotype: Definitions and Pre-Prosthetic Alteration

Periodontal phenotype is a mechanism to characterize the overall anatomic characteristics of the masticatory complex, including: 1) gingival phenotype (three-dimensional gingival volume, including gingival thickness and keratinized tissue width) and 2) bone morphotype (thickness of the buccal bone plate).[3,31,32] It should be further noted that in clinical practice, bucco-lingual tooth dimension and tooth position in the arch can impact the thickness of overlying hard and soft tissues over radicular surfaces.[31,32] Periodontal phenotype has also been expanded to include peri-implant tissues (peri-implant phenotype).[33] Types of periodontal/peri-implant phenotype that have been defined are generally considered to include three categories:

- ***The thin scalloped phenotype*** has a more significant association with slender triangular crown shapes, subtle cervical convexity, interproximal contacts close to the incisal edge, a narrow zone of keratinized tissue, thin delicate gingiva, and relatively thin alveolar bone (**Figure 1a**).
- ***The thick flat phenotype*** demonstrates more square-shaped tooth crowns, pronounced vertical convexity, more significant interproximal contacts located more apically, a broad zone of keratinized tissue, thick fibrotic gingiva, and a comparatively thick alveolar bone (**Figure 1b**).
- ***The thick scalloped phenotype*** shows thick fibrotic gingiva, slender teeth, a narrow zone of keratinized tissue, and pronounced gingival scalloping (**Figure 1c**).

Individuals/sites with thin periodontal phenotypes have a greater tendency to develop more gingival recession than individuals/sites with thick phenotypes.[24,34] Phenotype modification of keratinized tissue width and gingival thickness influence the likelihood of recurrent gingival recession.[35] When gingival thickness was greater than approximately 1.5mm, gingival margin stability could be obtained.[35] Additionally, the thin peri-implant phenotype has been associated with a greater incidence of peri-implant diseases, including peri-implant mucositis and peri-implantitis.[33,36,37] Given the critical impact of periodontal and peri-implant phenotype on oral health, it is imperative that pre-restorative evaluation of periodontal phenotype and interventions to alter periodontal/peri-implant phenotype be a part of treatment plans to achieve optimal oral health outcomes.

Figure 1

Figure 1a: Thin, scalloped periodontal phenotype

Figure 1b: Thick, flat periodontal phenotype

Figure 1c: Thick, scalloped periodontal phenotype

Restorative Site Preparation at Edentulous Sites for Conventional Removable Prostheses

Ideal restoration of edentulous, partially edentulous, and tooth replacement sites may require pre-prosthetic periodontal surgery. These procedures may include: alveoloplasty, tuberosity reduction and exostoses/tori removal, removal of redundant soft tissues, frenectomy,

vestibuloplasty, and alveolar ridge preservation. Careful consideration should be used prior to hard and soft tissue resection to preserve natural alveolar bone contours and volume. When tooth extraction is necessary prior to restorative reconstruction, alveolar bone and prosthetic space requirements should be carefully evaluated to preserve as much bone volume as possible. The possibility of increasing vertical dimension should be assessed if additional prosthetic space is required for restoration. Further, bone grafting should be considered a potential treatment for inadequate ridge width, bony undercuts, and alveoloplasty. Alveoloplasty may be performed in conjunction with tooth extractions or prior to prosthetic reconstruction. It has been noted that simple extractions and extraction site compression resulted in the least amount of alveolar bone resorption.[38] Other surgical procedures that may be necessary to allow the fit of removal prostheses include: tori and exostoses removal, excision of redundant or excess soft tissues, or frenectomy.[39]

Dental Implant Supported Prosthetic Requirements and Considerations in Partially or Completely Edentulous Patients

Dental implant therapy requires adequate bone volume to support the dental implant fixtures and allow for osseointegration. Three-dimensional assessment of proposed dental implant sites is critical to ensure adequate support is available for dental implant restorations. The clinical goal in implant therapy involving tooth extraction is to provide treatment that preserves the natural tissue contours of the alveolar ridge, as alterations may hinder optimal implant placement. The chief significance of ridge preservation is to limit alveolar ridge contraction over the healing period. Compared to unassisted socket healing, alveolar ridge preservation procedures significantly decrease the need for further ridge augmentation during implant placement.[40-42] When combined with bone grafts, resorbable[43,44] and nonresorbable[45,46] membranes have shown positive results in ridge preservation. Recent systematic reviews[47,48] have yet to demonstrate clear superiority regarding a specific technique or choice of biomaterials. Especially at sites with a thin bone morphotype, a thin periodontal phenotype and in esthetically critical sites, ridge preservation to mitigate post-extraction bone remodeling must be considered.

Prosthetic space should also be assessed prior to implant placement. Lack of adequate prosthetic space can lead to an increased rate of prosthetic failure due to weak prosthetic substructure. Additionally, lack of prosthetic space may lead to poor physiological contours of the prostheses, reduced interocclusal restorative space, lack of access for oral hygiene procedures, and poor esthetics.[49] The prosthetic space is defined as the vertical distance from the soft tissue of the edentulous ridge to the occlusal surface of the opposing dentition (in an ideal occlusal relationship) across the arch.[50] This space must accommodate the bulk of the restorative materials and abutments/attachments and allow for a prosthetic design that facilitates esthetics, phonetics, and proper hygiene measures. Different types of restorations require varying space requirements, which must be considered during the treatment planning phase (**Table 1**).[51-55] Accurately mounted casts are critical when measuring the available prosthetic space. This space can be measured through several methods:

- A periodontal probe or millimeter ruler may be used on mounted casts.
- Radiographic measurements may be taken after capturing a patient's and prosthesis's CBCT image using a dual-scan protocol and imaging software. Measurements are taken from the intaglio surface of the denture to the occlusal surface utilizing fiduciary markers to align the prosthesis.
- Measurements may be made directly on the denture prosthesis using a gauge to measure the distance from the intaglio surface of the denture to the occlusal surface of the teeth.

In cases where prosthetic space is limited, and the patient requires additional restorative space to accommodate the thickness of the planned prosthesis, the practitioner must determine whether additional prosthetic space can be achieved through alveoloplasty or if altering the planned prosthesis is preferable to the patient (**Figure 2**). A rational, step-by-step approach should be taken to determine the optimal prosthesis, including an assessment of the existing space and an objective review of the risks and benefits of alveoloplasty and other prosthetic options.

Alveoloplasty - Prosthetic space can be directly increased through bone removal from the alveolar crest. In this manner, alveoloplasty may be used alone or in combination with other modalities to gain sufficient prosthetic space.[56] When determining the feasibility of alveoloplasty, the clinician must consider the potential remaining bone after adequate prosthetic space is achieved.

Table 1 - Prosthetic Space Requirements for Common Prostheses Used in Oral Rehabilitation of Edentulous Arches

Type of Prosthesis	Minimum Vertical Space
Non-splinted overdenture	10 mm - 12mm[51]
Bar overdenture	11 mm[52], 13 mm - 14 mm[51]
Implant fixed crown and bridge	7 mm - 8 mm[53] (cement-retained prosthesis) 7.5 mm[54] (screw-retained prosthesis)
Fixed screw-retained hybrid	≥ 15 mm[55]
Fixed screw zirconia prosthesis	10 mm - 12 mm[56]

Figure 2

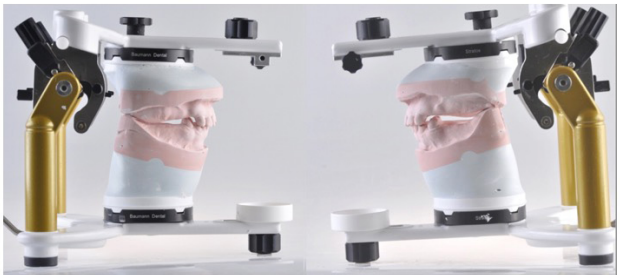

Figure 2a: Mounted stone casts demonstrating inadequate prosthetic space for implant restorations at #30, 19

Figure 2b: Clinical photographs of inadequate prosthetic space for implant restorations at #30, 19

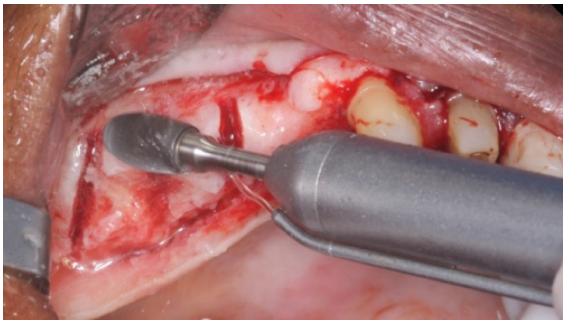

Figure 2c: Intrasurgical photograph of maxillary tuberosity reduction to achieve adequate prosthetic space.

Figure 2d: Post-operative clinical photographs demonstrating increased prosthetic space to allow for implant restoration at #30, 19

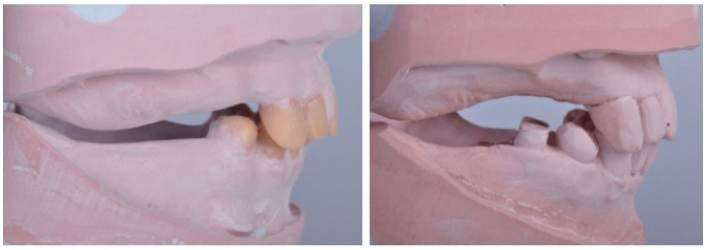

Figure 2e: Mounted stone casts demonstrating the pre- and post-surgical prosthetic space at implant site #30

Other treatment options should be considered if bone removal required to achieve necessary prosthetic space would compromise implant placement, underlying anatomical structures, or ideal interocclusal relationships. In severe space-limits cases, alveoloplasty may be employed with other bone grafting procedures, such as sinus augmentation or lateral ridge augmentation, to improve residual bone volume or position for ideal implant placement. Alveoloplasty affords the practitioner control of bone removal to ensure adequate prosthetic space gain without affecting phonetics, esthetics, or vertical dimension after prosthesis placement and provides increased ridge width.[55] Drawbacks of alveoloplasty include the potential over-reduction of the alveolus, minimal residual keratinized tissue, or loss of cortical plate post-operatively. Furthermore, alveoloplasty may result in a challenging clinical situation for the practitioner if bone loss due to peri-implantitis occurs and implants must be replaced. Retrievability and the long-term outcome must be considered in cases where alveoloplasty is employed.

Increasing vertical dimension - *The Glossary of Prosthodontic Terms* defines the vertical dimension as the distance between two selected anatomic points.[57] When the mandibular teeth are occluding with the maxillary teeth, the vertical dimension is defined as the vertical dimension of occlusion (VDO). In cases of occlusal wear or long-standing loss of posterior support, increasing the VDO prior to implant placement may be advantageous. Increasing VDO through altering the prosthesis in the maxilla has been reported to be more challenging versus the mandible, which may make this a more suitable option in cases of complete edentulism requiring restoration.[58] Increasing a patient's VDO beyond diagnostically optimal, particularly in the maxilla, can lead to significant esthetic compromises, speech alterations, neuromuscular symptoms, and patient discomfort. An incremental approach to gradually increasing VDO in these cases is advised.[59,60]

Reducing soft-tissue thickness - In cases of excessive sink depth (distance from the implant platform to the gingival margin), subsequent thinning of soft-tissue volume while maintaining an adequate zone of keratinized tissue should be considered, especially in cases with severely limited prosthetic space and significant thickness of overlying soft tissues. One notable rationale for soft-tissue reduction is the availability of attachments of sufficient height. That is, if the sink depth is high, an increased height of prosthetic attachments or abutments may be required. If such abutment heights are unavailable, the thinning of soft tissue in cases with excessive soft-tissue volume could allow for shorter implant attachments, which, in turn, will increase available prosthetic space. Use of this technique alone may be appropriate only where a minimal gain of prosthetic space is needed and depends upon the thickness of the existing soft tissue.

Conclusion

Pre-prosthetic periodontal surgery is an integral part of restorative success. Dental healthcare providers must understand the considerations necessary for the overall success of restorative outcomes utilizing a multidisciplinary approach. Biologic and clinical considerations can positively impact the outcomes of oral reconstruction. All members of the dental treatment team should understand the considerations to achieve optimal results.

References

1. Ercoli C and Caton JG. Dental prostheses and tooth-related factors. J Periodontol 2018; 89(Suppl 1): S223-S236.
2. Jepsen S, Caton JG, Albandar JM, et al. Periodontal manifestations of systemic diseases and developmental and acquired conditions: Consensus report workgroup 3 of the 2017 World Workshop on the Classification of Periodontal and Peri-implant Diseases and Conditions. J Periodontal 2018; 89(Suppl 1): S237-S256.
3. Kaldahl WB, Becter CM, Wentz FM. Periodontal surgical preparation for specific problems in restorative dentistry. J Prosth Dent 1984; 51: 36-41.
4. Costello BJ, Betts NJ, Barber HD, Fonseca RJ. Preprosthetic surgery for the edentulous patient. Dent Clin N Am 1996; 40: 19-38.
5. Krishnan DG. Controversies in dentoalveolar and preprosthetic surgery. Oral Maxillofac Surg N Am 2017; 29: 383-390.
6. Hampton TJ and Dominici JT. Contemporary crown-lengthening therapy: A review. J Am Dent Assoc 2010; 141: 647-655.
7. American Academy of Periodontology. Glossary of periodontal terms. https://members.perio.org/libraries/glossary/entry?GlossaryKey=f06f6a8c-bb24-404d-9f69-d70e667b31af Accessed September 27, 2022
8. Gargiulo AW, Wentz FM, Orban B. Dimensions and relations of the dentogingival junction in humans. J Periodontol 1961; 32: 261-267.
9. Vacek JS, Gher ME, Assad DA, Richardson AC, Giambarresi LI. The dimensions of the human dentogingival junction. Int J Periodontics Restorative Dent 1994; 14: 154-165.
10. Rasouli Ghahroudi AA, Khorsand A, Yaghobee S, Haghighati F. Is biologic width of anterior and posterior teeth similar. Acta Med Iran 2014; 52: 697-702.
11. Alpiste-Illueca F. Dimensions of the dentogingival unit in maxillary anterior teeth: a new exploration technique (parallel profile radiograph). Int J Periodontics Restorative Dent 2004; 24: 386-396.
12. Barboza EP, MonteAlto RF, Ferreira VF, Carvalho WR. Supracrestal gingival tissue measurement in healthy human periodontium. Int J Periodontics Restorative Dent 2008; 28: 55-61.
13. Garguilo A, Krajweski J, Garguilo M. Defining biologic width in crown lengthening. CDS Rev 1995; 88: 20-23.
14. Schmidt JC, Sahrmann P, Weiger R, Schmidlin PR, Walter C. Biologic width dimensions – A systematic review. J Clin Periodontol 2013; 40: 495-504.
15. Greenberg J, Laster L, Listgarten MA. Transgingival probing as a potential estimator of alveolar bone level. J Periodontol 1976; 47: 514-517.
16. Galgali SR, Gontiya G. Evaluation of an innovative radiographic technique—parallel profile radiography—to determine the dimensions of dentogingival unit. Indian J Dent Res 2011; 22: 237-241.
17. Tarnow D, Stahl SS, Magner A, Zamzok J. Human gingival attachment responses to subgingival crown placement. Marginal remodeling. J Clin Periodontol 1986; 13: 563-569.
18. Gunay H, Seeger A, Tschernitschek H, Geurtsen W. Placement of the preparation line and periodontal health – a prospective 2 year clinical study. Int J Periodontics Restorative Dent 2000; 20: 171-181.
19. Sorensen JA, Engelman MJ. Ferrule design and fracture resistance of endodontically treated teeth. J Prosthet Dent 1990; 63(5): 529-536.
20. Wagenberg BD, Eskow RN, Langer B. Exposing adequate tooth structure for restorative dentistry. Int J Periodontics Restorative Dent 1989; 9(5): 322-331.
21. Hempton TJ, Dominici JT. Contemporary crown-lengthening therapy: A review. J Am Dent Assoc 2010; 141: 647-655.
22. Lang NP, Löe H. The relationship between the width of keratinized gingiva and gingival health. J Periodontol. 1972;43(10):623-627.
23. Chambrone L, Tatakis DN. Periodontal soft tissue root coverage procedures: a systematic review from the AAP regeneration workshop. J Periodontol 2015; 86(Suppl 2): S8-S51.
24. Kim DM, Neiva R. Periodontal soft tissue non-root coverage procedures: a systematic review from the AAP regeneration workshop. J Periodontol 2015; 86(Suppl 2): S56-S72.
25. Maynard JG, Wilson RD. Physiological dimensions of the periodontium significant to the restorative dentist. J Periodontol 1979; 50(4): 170-174.
26. Deas DE, Moritz AJ, McDonnell HT, Powell CA, Mealey BL. Osseous surgery for crown lengthening: A 6-month clinical study. J Periodontal 2004; 75(9): 1288-1294.
27. Abou Arraj RV, Majzoub ZAK, Holmes CM, Geisinger ML, Geurs NC. Healing time for final restorative therapy after surgical crown lengthening procedures: A review of related evidence. Clin Adv Periodont 2015; 5(2): 131-139.

References (continued)

28. Majzoub ZAK, Romanos A, Cordioli G. Crown lengthening procedures: A literature review. Sem Orthod 2014; 20(3): 188-207.
29. Penner JK, Deas DE, Mills MP, et al. Post-surgical flap placement following osseous surgery: A short-term clinical evaluation. J Periodontol. 2020;91:501–507.
30. Brägger U, Lauchenauer D, Lang NP. Surgical lengthening of the clinical crown. J Clin Periodontol. 1992;19:58–63.
31. Cortellini P and Bissada NF. Mucogingival conditions in the natural dentition: Narrative review, case definitions, and diagnostic considerations. J Periodontol 2018; 89(Suppl 1): S204-S213.
32. Kao RT, Curtis DA, Kim DM, et al., American Academy of Periodontology best evidence consensus statement on modifying periodontal phenotype in preparation for orthodontic and restorative treatment. J Periodontol 2020; 91(3): 289-298.
33. Avial-Ortiz G, Gonzalez-Martin O, Couso-Queiruga E, Wang HL. The peri-implant phenotype. J Periodontol 2020; 91: 283-288.
34. Scheyer ET, Sanz M, Dibart S, et al. Periodontal soft tissue non-root coverage procedures: a consensus report from the AAP regeneration workshop. J Periodontal 2015; 86(Suppl 2): S73-S76.
35. Barootchi S, Tavelli L, Di Gianfilippo R, Shedden K, Oh TJ, Rasperini G, Neiva R, Giannobile WV, Wang HL. Soft tissue phenotype modification predicts gingival margin long-term (10-year) stability: Longitudinal analysis of six randomized clinical trials. J Clin Periodontol 2022; 49(7): 672-683.
36. Lin CY, Kuo PY, Chiu MY, Chen ZZ, Wang HL. Soft tissue phenotype modification impacts on peri-implant stability: a comparative cohort study. Clin Oral Investig 2022 Sep 1:1–12.
37. Lin G, Chan H, Wang H. The significance of keratinized mucosa on implant health: a systematic review. J Periodontol 2013; 84: 1755–1767.
38. Michael CG, Barsoum WM. Comparing ridge resorption with various surgical techniques in immediate dentures. J Prosthet Dent 1976; 35: 142.
39. Costello BJ, Betts NJ, Barber HD, Fonseca RJ. Preprosthetic surgery for the edentulous patient. Complete Dentures 1996; 40(1): 19-37.
40. Atieh MA, Alsabeeha NHM, Payne AGT, Ali S, Faggion CM Jr, Esposito M. Interventions for replacing missing teeth: alveolar ridge preservation techniques for dental implant site development. Cochrane Database of Systematic Reviews 2021, Issue 4. Art. No.: CD010176.
41. Schropp L, Wenzel A, Kostopoulos L, Karring T. Bone healing and soft tissue contour changes following single-tooth extraction: a clinical and radiographic 12-month prospective study. Int J Periodontics Restorative Dent. 2003; 23: 313–323.
42. Van der Weijden F, Dell'Acqua F, Slot DE. Alveolar bone dimensional changes of post-extraction sockets in humans: a systematic review. J Clin Periodontol. 2009; 36: 1048–1058.
43. Barone A, Ricci M, Tonelli P, Santini S, Covani U. Tissue changes of extraction sockets in humans: a comparison of spontaneous healing vs. ridge preservation with secondary soft tissue healing. Clin Oral Implants Res. 2013; 24: 1231–1237.
44. Serrano Mendez C, Lang NP, Caneva M, Ramirez Lemus G, Mora Solano G, Botticelli D. Comparison of allografts and xenografts used for alveolar ridge preservation. A clinical and histomorphometric RCT in humans. Clini Implant Dent Related Res. 2017; 19: 608–615.
45. Hoffmann O, Bartee BK, Beaumont C, Kasaj A, Deli G, Zafiropoulos GG. Alveolar bone preservation in extraction sockets using non-resorbable dPTFE membranes: a retrospective non-randomized study. J Periodontol. 2008; 79: 1355–1369.
46. Barber HD, Lignelli J, Smith BM, Bartee BK. Using a dense PTFE membrane without primary closure to achieve bone and tissue regeneration. J Oral Maxillofac Surg. 2007; 65: 748–752.
47. MacBeth N, Trullenque-Eriksson A, Donos N, Mardas N. Hard and soft tissue changes following alveolar ridge preservation: a systematic review. Clin Oral Implants Res. 2017; 28: 982–1004.
48. Willenbacher M, Al-Nawas B, Berres M, Kämmerer PW, Schiegnitz E. The effects of alveolar ridge preservation: a meta-analysis. Clin Implant Dent Relat Res. 2016; 18: 1248–1268.
49. Chaimattayompol N, Arbree NS. Assessing the space limitation inside a complete denture for implant attachments. J Prosthet Dent. 2003; 89(1): 82-85.
50. Avrampou M, Mericske-Stern R, Blatz MB, Katsoulis J. Virtual implant planning in the edentulous maxilla: criteria for decision making of prosthesis design. Clin Oral Implants Res. 2013; 24(Suppl A100): 152-159.
51. Sadowsky SJ. Treatment considerations for maxillary implant overdentures: a systematic review. J Prosthet Dent. 2007; 97(6): 340-348.
52. Carpentieri J, Drago C. Treatment of edentulous and partially edentulous maxillae: clinical guidelines. J Implant Reconstr Dent. 2011; 3(1): 7-17.
53. Kendrick S, Wong D. Vertical and horizontal dimensions of implant dentistry: numbers every dentist should know. Inside Dentistry. 2009; 5(7): 32-38.
54. Biomet 3i Restorative Manual. Palm Beach Gardens, FL: Biomet 3i. http://www.zimmerbiomet.co.il/filesystem/INSTRM_REV+E_Restorative+Manual_Final_SECURED.pdf. Accessed September 30, 2022.
55. Ahuja S, Cagna DR. Classification and management of restorative space in edentulous implant overdenture patients. J Prosthet Dent. 2011; 105(5): 332-337.
56. Lee CK, Agar JR. Surgical and prosthetic planning for a two-implant-retained mandibular overdenture: a clinical report. J Prosthet Dent. 2006; 95(2): 102-105.
57. The glossary of prosthodontic terms: ninth edition. J Prosthet Dent. 2017;117(5S):e1-e105.
58. Massad JJ, Connelly ME, Rudd KD, Cagna DR. Occlusal device for diagnostic evaluation of maxillomandibular relationships in edentulous patients: a clinical technique. J Prosthet Dent. 2004; 91(6): 586-590.
59. Hansen CA. Diagnostically restoring a reduced occlusal vertical dimension without permanently altering the existing dentures. J Prosthet Dent. 1985; 54(5): 671-673.
60. Jeganathan S, Payne JA. Common faults in complete dentures: a review. Quintessence Int. 1993; 24(7): 483-487.

POST-TEST

Internet Users: This page is intended to assist you in fast and accurate testing when completing the "Online Exam." We suggest reviewing the questions and then circling your answers on this page prior to completing the online exam.

(1.0 CE Credit Contact Hour) Please circle the correct answer. 70% equals passing grade.

1. **In cadaveric studies, which of the following was determined to have the most consistent dimensions between individuals?**
   a. Periodontal sulcus
   b. Junctional epithelium
   c. Supracrestal connective tissue attachment
   d. All of these components are consistent between individuals

2. ***In vivo* studies have demonstrated that a crown margin positioned within the JE or SCTA attachment apparatus has been associated with gingival recession, crestal bone loss, and connective tissue remodeling between 0 to 8 weeks.**

   Sites with restorative margins placed close to the alveolar bone demonstrate increased gingival bleeding and other signs of gingival inflammation only in cases of suboptimal plaque accumulation.
   a. Both statements are true
   b. The first statement is true, the second statement is false
   c. The first statement is false, the second statement is true
   d. Both statements are false

3. **Given the timeline for marginal stability after clinical crown lengthening, it is suggested that final restorations are completed at _____ months post-surgically in esthetic areas.**
   a. 2 months
   b. 3 months
   c. 4 months
   d. 6 months

4. **For the most predictable outcomes, it is recommended that definitive restorations are placed at least _____ months after crown lengthening to ensure gingival margin stability.**
   a. 2 months
   b. 3 months
   c. 6 months
   d. 12 months

5. **Gingival phenotype is defined as:**
   a. Buccal bone plate thickness
   b. Three-dimensional gingival volume
   c. Keratinized tissue width
   d. Tooth dimension

6. **Which of the following is NOT a periodontal phenotype?**
   a. Thin flat phenotype
   b. Thin scalloped phenotype
   c. Thick flat phenotype
   d. Thick scalloped phenotype

7. **Periodontal phenotype alteration may be performed to enhance gingival margin stability. What is the threshold gingival thickness above which gingival margin stability could be obtained?**
   a. 0.86mm
   b. 1.13mm
   c. 1.46mm
   d. 1.81mm

8. **Assessment of prosthetic space allows for an understanding of optimal restorative options for implant-supported restorations in edentulous arches. Methods to measure available prosthetic space include all of the following EXCEPT:**
   a. A periodontal probe or millimeter ruler used on mounted casts
   b. Intraoral measurements performed without prosthesis in place
   c. Radiographic measurements taken after the capture of a CBCT image of both the patient and prosthesis using a dual-scan protocol and imaging software
   d. Measurements made directly on the denture prosthesis using a gauge to measure the distance from the intaglio surface of the denture to the occlusal surface of the teeth

9. **What is the prosthetic space requirement for a screw-retained implant-supported prosthesis?**
   a. 7.5mm
   b. 10mm
   c. 12mm
   d. 15mm

10. **Which of the following is a (are) method(s) to increase prosthetic space in an edentulous arch for implant-supported full-arch restorations?**
    a. Alveoloplasty
    b. Increasing vertical dimension of occlusion
    c. Reducing soft-tissue thickness
    d. All of the above

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