FirstImplants in the Esthetic Zone Vol 1.

Immediate implant placement

1. TN Kan JYK, Rungcharassaeng K, Deflorian M, Weinstein T, Wang HL, Testori T. Immediate implant placement and provisionalization of maxillary anterior single implants. Periodontol. 2000;2018(77):197-212
2. ES Tiziano Testori, Tommaso Weinstein, Fabio Scutellà, Hom-Lay Wang, Giovanni Zucchelli. Implant placement in the esthetic area: criteria for positioning single and multiple implants Periodontol 2000 2018 Jun;77(1):176-196.
3. BT Joseph Y K Kan 1, Phillip Roe, Kitichai Rungcharassaeng, Rishi D Patel, Tomonori Waki, Jaime L Lozada, Grenith Zimmerman. Classification of sagittal root position in relation to the anterior maxillary osseous housing for immediate implant placement: a cone beam computed tomography study Int J Oral Maxillofac Implants. 2011 Jul-Aug;26(4):873-6.
4. AK Sabri H, Barootchi S, Heck T, Wang HL Single-rooted extraction socket classification: A systematic review and proposal of a new classification system based on morphologic and patient-related factors. J Esthet Restor Dent. 2023 Jan;35(1):168-182.
5. TV Mao Z, Lee CT, He SM, Zhang S, Bao J, Xie ZG. Buccal bone dimensional changes at immediate implant sites in the maxillary esthetic zone within a 4-12-month follow-up period: A systematic review and meta-analysis. Clin Implant Dent Relat Res. 2021 Dec;23(6):883-903.
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Topic: Immediate Implant Placement
Authors: Kan JYK, Rungcharassaeng K, Deflorian M, Weinstein T, Wang HL, Testori T.
Title: Immediate implant placement and provisionalization of maxillary anterior single implants.
Source: Periodontol. 2000;2018(77):197-212
DOI: 10.1111/prd.12212.
Type: Review
Reviewer: Trisha Nguyen-Luu
Keywords: dental implants, immediate implant, provisionalization, anterior,
Purpose: To review concepts of immediate implant placement and provisionalizaton of maxillary anterior single implants + to provide a full clinical protocol for immediate implant placement and its provisionalization in the esthetic area
Discussion:

- Rationale: Preservation of periosteum, supraperiosteal plexus + blood supply to alveolar bone is maintained
- Advantages of flapless procedures:
    - Simplify procedure, reduce operative time + patient discomfort
    - Usually done with a guided implant surgery template
        - Be aware of a 0.85-1.1 mm global inaccuracy of 3D planning
    - May reduce marginal bone loss + maintain soft tissue health + preserve peri-implant papilla especially in esthetic areas
    - **Raes + Cosyn:** 7% recession in flapless immediate implants w+ 43% recession with immediate implants with flap
- Disadvantage of flapless: Technique sensitive, bon dehiscence + fenestration may occur
- Opportunity to fill the fap between implant + buccal bone
    - Animal: Spontaneous bone formation occurs only after only after 4 months with a max gap btw the implant and the buccal bone of 1- 1.25 mm
    - **Paoloantonio:** 70% BIC after immediate implant placement in the mandible
        - 64.8% BIC after immediate implant placement in the maxilla
    - **Wilson:** avg 50% BIC with a 1.5 mm gap
    - Bone resorption is reduced by 20% in areas where biomaterial is used
- Augmentation of soft tissue at immediate implants
    - Absence of a vestibular bone plate and the presence of a thin periodontal biotype is risk factor for recession of peri-implant tissue with immediate implants
    - Bone augmentation + soft tissue thickening in order to achieve stability over time should be the goal of esthetic surgery
    - Combo of immediate loading of implant + CTG
- Main advantage in terms of esthetics
    - Bone resorption after EXT is not reduced by immediate implant placement per se but is influenced by the apicocoronal + buccopalatal position of the implant
    - Immediate implant placement is a favorable clinical protocol in terms of esthetics only through a combo of different factors
    - Importance of pre-surgical diagnostic phase:
        - Evaluation of morphology of alveolar process

        - Periodontal biotype
        - Guided implant placement
        - manage peri-implant gap
        - Less-invasive soft tissue (flapless approach) technique + thickening
        - Immediate loading to condition the soft tissue during healing with provisional prosthetic restoration + shorten treatment time
- Esthetic evaluation and patient centered outcome
    - 12% of patients are willing to tolerate a higher risk of implant failure for the sake of shortening treatment duration
    - Osteology consensus: survival of immediate implant in esthetic area is high but also very high risk of mucosal recession
    - identifying risk factors is essential:
        - Smoking
        - < 1 mm vestibular bone
        - Thin biotype
        - Vestibular position of implant
    - Case selection is essential:
        - Intact socket wall
        - Min 1 mm thick facial bone wall
        - Thick soft tissue
        - No acute infection at the site
        - Availability of bone apical and palatal to the socket for primary stability
        - Surgical template + provisional fixed restoration
    - International team for Implantology: timing of loading
        - Torque of 20-45 N for immediate loading
        - No systemic health contraindication
        - More benefits than risks

Diagnosis + Treatment planning:

- Gingival level: same level as or more coronal than the contralateral tooth
    - Orthodontic forced eruption if gingival level is more apical
- Osseous Tissue-gingival tissue relationship: Evaluated by bone sounding
    - Measure 3 mm on facial aspect + 4 mm on the proximal aspect of adjacent teeth
    - > 3 mm on facial + > 4 mm on the proximal is associated with higher risk of recession
    - Tx via periodontal or orthodontic tx.
- Gingival biotype: visibility of periodontal probe through gingival tissue
    - Tx: bilaminar SCTG at time of implant placement + provisionalisation
- Sagittal root position:
    - Class I sagittal root position is the most favorable
    - Class II – III are more technique sensitive
    - Class IV is contraindicated

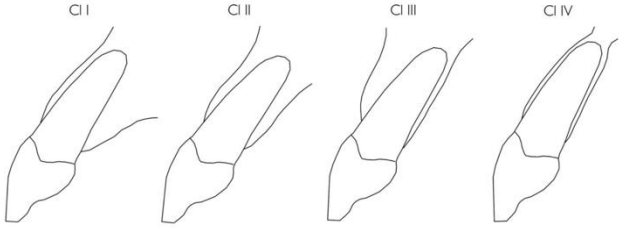

Fig. 3. Sagittal root position classification. Class I (Cl I): the root is positioned against the labial cortical plate. Class II (Cl II): the root is centered in the middle of the alveolar housing without engaging either labial or palatal cortical plates at the apical third of the root. Class III (Cl III): the root is positioned against the palatal cortical plate. Class IV (Cl IV): at least two-thirds of the root is engaging both labial and palatal cortical plates.

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Table 2. Checklist for diagnostic and surgical prerequisites

Diagnosis: parameters to be evaluated	Gingival level in relationship to adjacent teeth
	Osseous tissue–gingival tissue relationship at facial aspect
	Bone sounding of adjacent teeth (peri-apical X-rays)
	Gingival biotype
	Sagittal root position (cone-beam computed tomography if needed)
	Labiopalatal width
	Inter-radicular mesiodistal width
	Diagnostic wax-up (tooth shape)
Surgical procedure prerequisites	Minimally traumatic extraction
	Evaluation of the labial bony plate with a periodontal probe
	Correct three-dimensional implant position
	Primary implant stability
	Evaluation of the gap morphology (implant and vestibular bone plate)

Table 3. Predictive factors for post-extractive immediate implant placement

Variable	Low risk	High risk
Biotype	Thick	Thin
Gingival form	Flat scallop	High scallop
Tooth position/free gingival margin	Coronal	Ideal or apical
Tooth shape	Square	Triangular
Position of the osseous crest: < 3 mm from adjacent teeth and facially	High crest	Low crest

Modified from Kois & Kan (57).

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Surgical Procedure:

1) Atraumatic ext – controlled expansion of bony socket to avoid soft + hard tissue damage
    - Periotome: sulcular incisions with transeptal fiberectomy that extends apically beyond marginal bone into PDL space
2) Verify the integrity of labial plate using periodontal probe
    - Fenestrations at least 5 mm apical to intact facial marginal bone can be predictably grafted
    - Shape/ size of defect determines the predictability of IIPP
    - V shaped: responds favorably to IIPP with GBR
    - U + UU shaped: responds poorly to GBR – sig facial recession after 1 year of function
        - Contraindication for IIPP

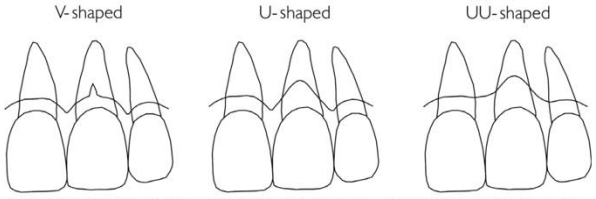

Fig. 6. Facial bone-defect classification. V-shaped defect: isolated only to the mid-facial portion of the facial bony plate. U-shaped defect: extends to mesial and/or distal aspects of the failing tooth. UU-shaped defect: extends to the mesial and distal aspects of the immediately adjacent teeth.

3) Papilla sparing incisions
4) Place implant by engaging palatal wall + bone 4-5 mm beyond apex of EXT socket
    - Class I sagittal root position is optimal for IIPP
    - Class II sagittal root position: compromised / challenging condition for IIPP
        - Implant stability replies on amount of bone beyond the apex b/c limited bone on the palate + labial
    - Class III sagittal root position: compromised / challenging condition for IIPP
        - Implant stability replied on engagement with labial bone which can cause facial fenestration or perforations
    - Class IV sagittal root position has limited bone for engagement + is contraindicated
5) Implant diameter: within confines of tooth socket but not engage the thin coronal portion of labial plate
6) Implant position:
    - Center of M-D width of final restoration + min. 2 mm btw implants + adjacent teeth

- Cervically implant should emerge slightly lingual from the B/L width of final restoration
- Implant should emerge at the incisal edge of the final restoration
- Gap of 1.5 mm btw implant + buccal bone is maintained + integrity of labial bone is ensured
- Neck of implant is placed 3 mm apical to predetermined FGM of final restoration

7) Immediate provisionalization is screwed / cemented
   - Manually prepare a prefabricated zirconium abutment or metal temporary abutment extra orally + hand tighten onto implant
   - Provisional shell is relined with light polymerized provisional shell to establish gingival emergency of extracted tooth + adjusted to clear all centric + eccentric functional contacts
   - Cement retained provisional restoration is usually more esthetic (esp. if the access opening is at or facial to the incisal edge but higher risk of gingival inflammation + cement debonding
8) Bone graft (Bio-Oss + Puros) is placed into gap btw implant + boney socket + absorbable membrane (Bioguide) over the facial aspect of socket
   - Prevents resorption
9) SCTG for thin gingival biotype
10) Primary closure with 6-0 chromic gut
11) Post-op instructions:
   - No brushing, rinse with 0.12 % CHX + antibiotics + analgesics
   - Liquid diet 2 weeks after sx
   - Soft food diet for the rest of the implant healing phase (4 months) + no activity that can irritate surgical site

Table 4. Checklist for procedures after implant insertion

1. Immediate provisionalization	Relining and connection of provisional crown to a prefacbficated abutment
2. Regenerative procedure and soft-tissue management	Bone regeneration
	Subepithelial connective tissue graft (thin biotypes)
3. Postoperative instruction	Antibiotics, analgesics
	Soft diet (4 months)
4. Definitive restorations	6 months after surgery

- Definitive restoration:
   - Final impression 6 months post – sx
   - Zirconium/ gold allow abutment is fabricated duplicated gingival emergence profile of provisional restoration
   - Follow up 1, 3, 6, 12 months + annually after

Topic: Esthetic zone implant positioning
Authors: Testori T, Weinstein T, Scutellà F, Wang HL, Zucchelli G
Title: Implant placement in the esthetic area: criteria for positioning single and multiple implants
Source: Periodontol 2000 2018 Jun;77(1):176-196.
DOI: 10.1111/prd.12211
Type: review
Reviewer: Erin Schwoegl

Purpose: To discuss criteria for positioning of single and multiple DIs in the esthetic zone

Discussion:
<u>Timing of placement/regenerative procedures/skeletal growth/altered passive eruption</u>
Factors for evaluating growth cessation in younger pts:
- Check the tracing of cep radiographs taken at least 6mo apart.
- No growth changes for 1 year.
- Body growth, in length, annually for 2 years; annual growth should be <0.5 mm per year

Factors for DI placement/regenerative procedures/skeletal growth/APE:

- Less bone resorption when a bone graft is placed with a provisional restoration.
- In early placement, bone augmentation is necessary to support soft tissue.
- Quality-of-life evals show pts preferred immediate placement

Correct 3-D position of the fixture between cuspids

- Objectives:
    - Minimize resorption of bundle bone.
    - Maintain correct distance btwn adj teeth/DIs
    - Allow a correct prosthetic phase.
- **Buser**: comfort zone: DI placed 1.5– 2.0mm palatal to incisal margin of central max incisors and should leave at least 2mm of B bone. Important to note distance btwn DI and outer surface of alv wall. If <4mm, internal (in alveolus) and external (outside B bone) grafting advised
- DI should be 3-4mm apical to FGM of future restoration
- M-D DI position determines supporting bone and blood supply for papilla preservation; 1.5mm from adj teeth and 3mm from adj DIs
    - May be less with platform-switching

Correct 3-D position in the premolar site

- DI should be buccally inclined for 2 clinical advantages: to avoid fenestration due to natural morphology of maxilla and to achieve correct emergence profile of future crown if the DI platform is more buccally positioned; easier to create a proper profile when DI is buccally inclined

Multiple missing teeth w single tooth/pontic or cantilevered options

- When replacing 4 ant teeth, 4 DIs rarely possible due to space.
- According to author, 5mm of inter-DI space recommended in esthetic zone.
    - Therefore, in a rehab of 4 max incisors, possible to insert 4 w minimum 33mm of intercanine space
- If root morphology of adj teeth prevent placement in most favorable position, cantilever restorations strongly recommended.

Influence of abutment morphology and crown contours on soft tissue

- Abutment shape gold standard: divergent profile to establish emergence profile similar to a natural tooth.
    - However, divergent transmucosal profile can have adverse effects, such as ischemia and recession.
    - **Rompen**: concave, gingivally converging transmucosal profile could improve ST stability and prevent recession.
    - **Redemagni**: immediate DIs w concave abutments (Nobel); B soft tissue stability w little recession
    - Author recommends gingivally convergent abutment profile vs divergent as space will fill w new tissue that is thicker and more stable
- DI/abutment contour divided into 2 portions: critical contour, area of abutment and crown immediately apical to GM and subcritical contour, located apical to critical contour and corresponds to intramucosal portion of abutment
- Critical contour should resemble the physiologic contour of a natural tooth; this is mainly influenced by the DI position
- Traditional guidelines for DI placement have been conceived for restorative abutments made with a wide horizontal preparation.
- The long axis of the DI should correspond to the incisal edge of the future resto or to adj teeth, assuming 1.5- 2.0mm of buccal bone can be maintained
- The sub-critical contour should be concave, allowing soft tissue growth, creating a barrier for bone protection

Table 1. Literature corresponding to the correct three-dimensional positioning of an implant

Literature	Mesiodistal	Literature	Apicocoronal	Literature	Buccopalatal
Grunder et al. (2005) (31)	1.5 mm to adjacent tooth			Buser et al. (2004) (9)	1 mm palatal to the point of emergence of the adjacent teeth
Vela et al. (2012) (72)	1 mm to adjacent tooth with platform switching	Saadoun et al. (1999) (59), Grunder et al. (2005) (31), Capelli & Testori (2012) (12)	3 mm below the apical margin of the crown		
Grunder et al. (2005) (31)	3 mm to adjacent implant	Buser et al. (2004) (9)	1 mm apical to the cementoenamel junction of the adjacent tooth	Scutella et al. (2015) (63)	Long axis of the implant should correspond to the incisal edge of the future restoration or to the adjacent teeth

Table 2. Ideal diameter of implants in relation to the implantation site and the anatomic features of the tooth being replaced

Maxillary	Mesiodistal dimension of the crown (mm)	Mesiodistal dimension of roots at the cementoenamel junction (mm)	Implant diameter (mm)
Central incisor	8.6	5.5	4–5
Lateral incisor	6.5	4.3	3–3.25
Canine	7.6	4.6 ± 1	4/5
First premolar	7.1	4.2 ± 1	4/5

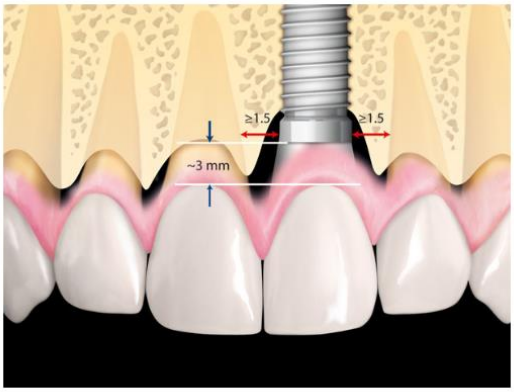

Fig. 3. Correct maxillary anterior implant position, mesiodistally and apicocoronally (courtesy of Capelli & Testori [12]).

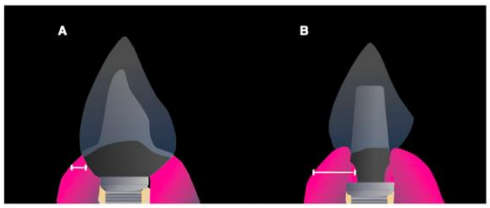

Fig. 10. A convergent abutment profile (B) is the ideal morphology to allow soft tissue to proliferate compared to a divergent design (A).

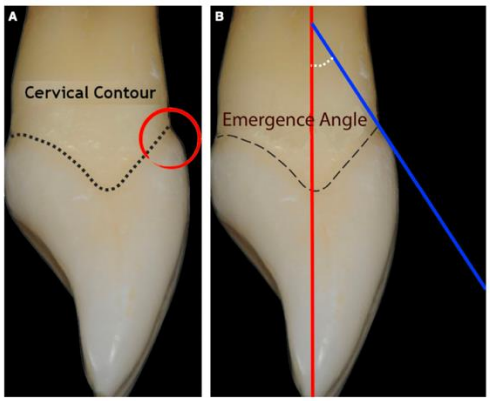

Fig. 11. A natural maxillary incisor. (A) The lateral view shows a convexity corresponding to the cervical contour. (B) The emergence angle is formed by the junction of a line through the long axis of the tooth (red line) and a tangent drawn to the coronal aspect of the tooth as it emerges from the sulcus (blue line).

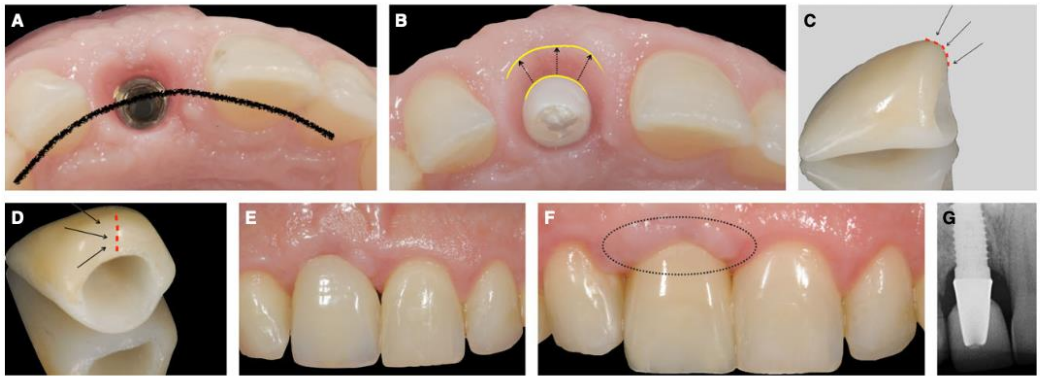

Fig. 12. (A) The center of the implant corresponds to the cingulum of the adjacent teeth. (B) Occlusal view of the final zirconium abutment. The distance A-B will be filled by the cervical contour of the final crown (marked by inner and outer semicircles shown in yellow). (C, D) The definitive lithium disilicate crowns with a cervical contour (marked by red dashed lines and black arrows) out of the physiologic parameters determined by the implant position associated with a vertical finish line geometry. (E) Provisional restoration in place. (F) One-year follow-up of the definitive crown showing signs of tissue reaction (marked by black dashed-line oval). (G) Periapical radiograph of the definitive crown.

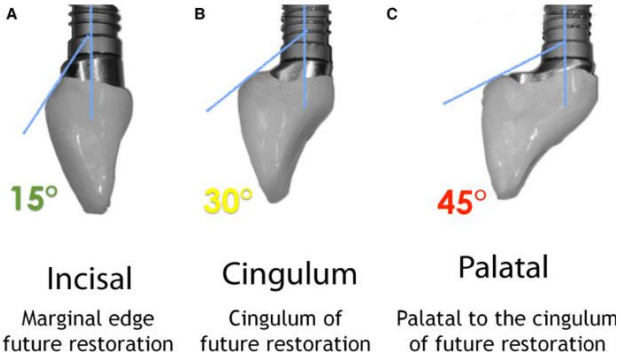

Fig. 13. The long axis of the implant aiming (A) at the incisal edge of the future restoration, (B) at the cingulum of the future restoration and (C) palatal at the cingulum of the future restoration.

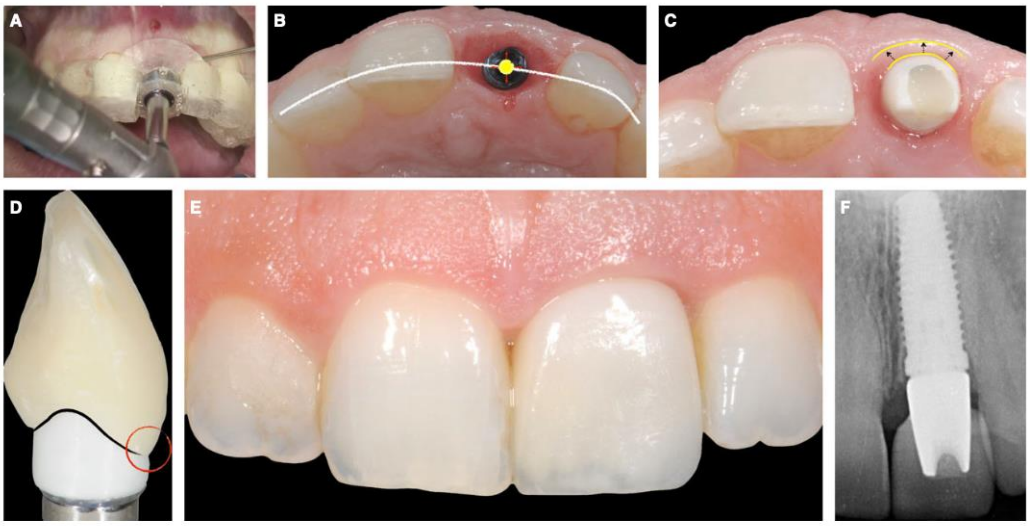

Fig. 14. (A) The position of the implant is driven by a computerized surgical stent. (B) Occlusal view of the implant in place at the time of the final impression. The center of the implant (yellow circle) corresponds to the incisal edge of the adjacent teeth. (C) Occlusal view of the final zirconium abutment in place. Phisiologic profile determines a good tissue response as marked by the two yellow lines. The screw access hole has been filled with Teflon and composite. (D) The ideal placement of the implant will generate a correct cervical contour and emergence angle (marked by the red circle). (E) Final lithium disilicate crown cemented. (F) The final radiograph.

Topic: Root position
Author: Kan JY, Roe P, Rungcharassaeng K, Patel RD, Waki T, Lozada JL, Zimmerman G.
Title: Classification of sagittal root position in relation to the anterior maxillary osseous housing for immediate implant placement: a cone beam computed tomography study.
Source: Int J Oral Maxillofac Implants. 2011 Jul-Aug;26(4):873-6.
DOI:
Type: Retrospective review
Reviewer: Brook Thibodeaux
Keywords: anterior maxilla, cone beam computed tomography, esthetics, immediate implant placement, immediate provisionalization, osseous housing, sagittal root position, single-tooth replacement, treatment planning

Purpose: to classify sagittal root positions with regard to maxillary anterior osseous housing, using cone beam computed tomography (CBCT), and report frequency of each classification.

Methods:

- Retrospective study,100 pt's CBCTs reviewed for the relationship of the sagittal root position of the maxillary anterior teeth to its osseous housing
- Classification of sagittal root position:

Fig 1 Class I sagittal root position.

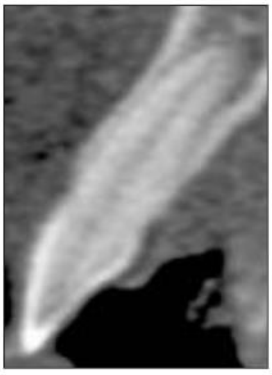

Fig 2 Class II sagittal root position.

Fig 3 Class III sagittal root position.

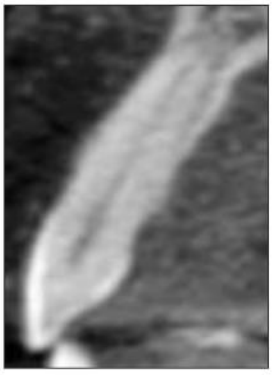

Fig 4 Class IV sagittal root position.

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    - Class I: The root is positioned against the labial cortical plate. ideal you have palatal and apical buccal bone
    - Class II: The root is centered in the middle of the alveolar housing without engaging either the labial or the palatal cortical plates at the apical third of the root
    - Class III: The root is positioned against the palatal cortical plate
    - Class IV: At least two thirds of the root is engaging both the labial and palatal cortical plates
- Statistical analysis

Results:

- 600 samples total
    - Cl I: 82%; 487/600
    - CL II: 6.5%; 39/600
    - CL III: 0.7%; 4/600
    - Class IV: 11.7%, 70/600
- Centrals: CL I= 86.5%, CL II= 5%, CL III= 0.5%, CL IV= 8%
- Laterals: CL I= 76.5%, CL II= 8.5%, CL III= 1.5%, CL IV= 14%
- Canines: CL I= 81%, CL II= 6%, CL III= 0%, CL IV= 13%

Table 1 Frequency Distribution of Sagittal Root Position Classification

	Percentage (no.)			
SRP	**Central incisor**	**Lateral incisor**	**Canine**	**Overall**
Class I	86.5 (173)	76 (152)	81 (162)	81.1 (487)
Class II	5 (10)	8.5 (17)	6 (12)	6.5 (39)
Class III	0.5 (1)	1.5 (3)	0 (0)	0.7 (4)
Class IV	8 (16)	14 (28)	13 (26)	11.7 (70)
Total	100 (200)	100 (200)	100 (200)	100 (600)

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Conclusion: Understanding the clinical relevance of sagittal root position helps clinical decision making for treatment planning immediate implant placement and provisionalization in the anterior maxilla.

Topic: single root socket classification
Authors: Sabri H, Barootchi S, Heck T, Wang HL
Title: Single-rooted extraction socket classification: A systematic review and proposal of a new classification system based on morphologic and patient-related factors.
Source: J Esthet Restor Dent. 2023 Jan;35(1):168-182.
DOI: 10.1111/jerd.12967
Reviewer: Amber Kreko
Type: systematic review
Keywords: classification, dental socket, extraction socket, immediate implants

Purpose: To provide a critical appraisal of current existing extraction socket classifications within the framework of a systematic review and propose a new single-rooted extraction sockets (ES) classification that takes into consideration all important factors based on the latest evidence and consensus in implant dentistry.

Material and methods:

- Systematic review up to January 2022 with focused question "What are the currently available ES classification systems for single rooted sockets, the factors concerning ES that are considered and the suggested treatment approaches?" Prospective, retrospective, cohort, case-control, and review studies were all included.

Results:

- 13 articles were included in the qualitative analysis.
- Included factors in existing classification systems:
    - Hard tissue parameters – remaining buccal bone dimensions, defect walls, apical topography, future peri-implant hard tissue
    - Soft tissue parameters – soft tissue phenotype (previously named biotype), buccal dosft tissue level/loss, soft tissue quality, blood supply
    - Etiology pathology and systemic factors

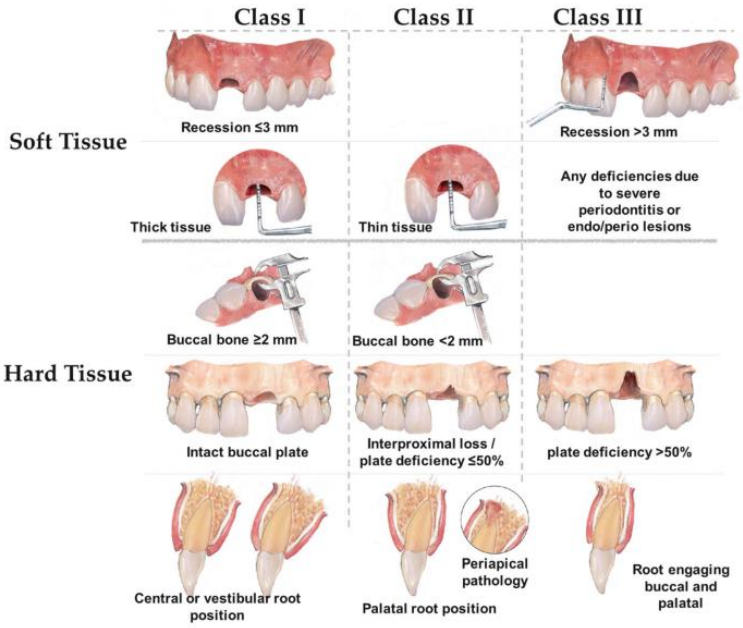
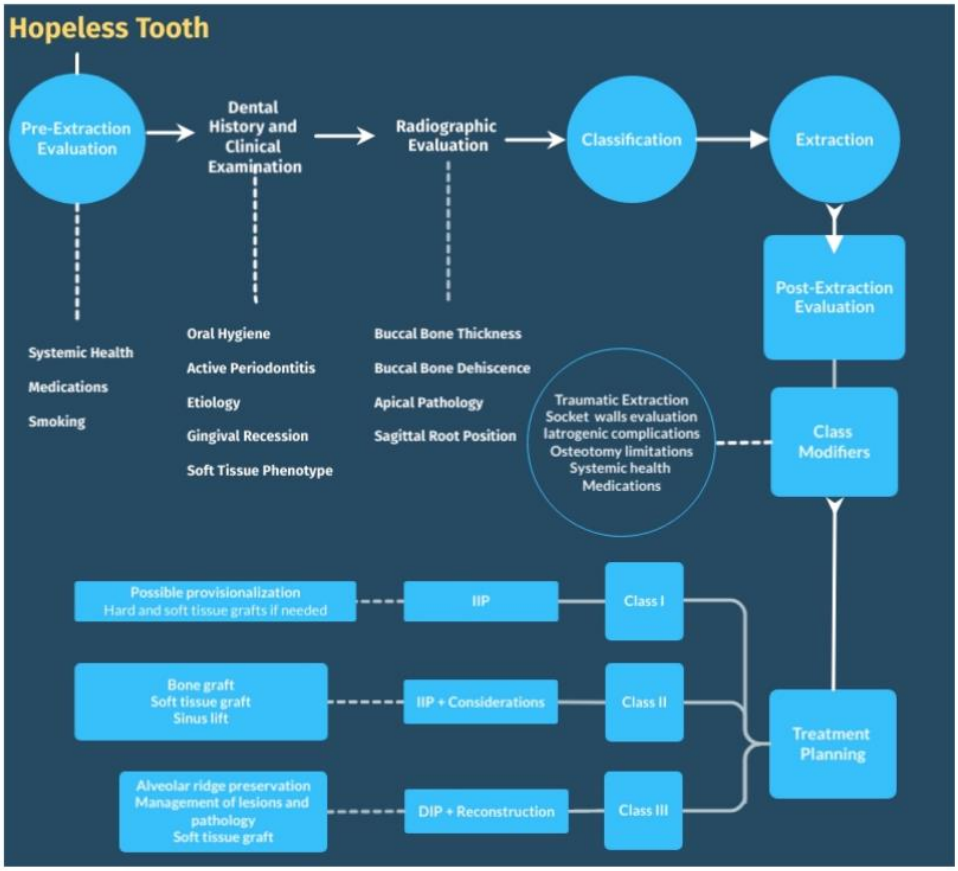


FIGURE 3 the new single-rooted extraction socket classification system. (note that the presence of even one criterion from each class will put a socket into that group. For instance, more than 50% of buccal bone deficiency, even without presence of gingival recession of >3 mm would still be considered as a class III socket)

-
- Proposal of new classification
    - 1. Look at clinical factors – etiology of extraction, recession and soft tissue phenotype
    - 2. Look at radiographic factors – buccal bone, IP bone loss, apical lesions, root position
    - 3. Class modifiers – can be evaluated before or after extraction
        - Poorly controlled systemic disease, smoking, medications, presence of active perio in same sextant, poor OH, major trauma during procedure, iatrogenic complications, re-evaluation of buccal bone thickness and bone quality, osteotomy related factors.

TABLE 5 Extraction socket class modifiers. The modification proceeds the classification step. This aims to include factors that are not properly examinable prior to the extraction and designed to adjust the initial classification if required. These can be divided into patient-, extraction- and osteotomy-related factors. If the extraction process occurs invasively and cause any damage to the adjacent structure this will transform class I and II to class III. Similar scenario is applicable for iatrogenic complications such as nerve damage or sinus floor perforation. Finally, post extraction evaluation of the socket is required to determine whether it is possible to place implant in the correct position in correspondence to adjacent structure (nerve proximity, etc.) and if not possible, classes I and II will be considered as class III

	Post-extraction class modifiers	
Patient-related factors	Active periodontitis in the same sextant	Class I and II to III
	Poor oral hygiene	Class I and II to III
	Medications affecting healing	Class II to III
	Poorly controlled systemic disease	Class II to III
	Smoking More than 10/day	Class I and II to III
Extraction-related factors	Invasively traumatic extraction (extensive bone removal)	Class I and II to III
	Iatrogenic complications (sinus floor damage, nerve damage, Buccal plate fracture)	Class I and II to III
	Post-extraction evaluation of buccal bone thickness and bone quality	If compromised, Class I and II to III
Osteotomy-related factors	Possible limitations in implant osteotomy (nerve proximity, adjacent roots, etc.)	If IIP not possible, Class I and II to III



Conclusions: This new classification system provides a comprehensive inclusion of various crucial parameter in implant placement (such as prediction of future implant position and osteotomy difficulty, etc.) but also, in contrast to the previously introduced systems, is able to classify the ES prior to extraction and take into account the patient-relatied factors as the class modifiers following the extraction.

Topic: Buccal bone resorption
Authors: Mao Z, Lee CT, He SM, Zhang S, Bao J, Xie ZG
Title: Buccal bone dimensional changes at immediate implant sites in the maxillary esthetic zone within a 4-12-month follow-up period: A systematic review and meta-analysis
Source: Clin Implant Dent Relat Res. 2021 Dec;23(6):883-903
DOI:10.1111/cid.13051
Reviewer: Tam Vu

Type: Systematic review and meta-analysis
Keywords: immediate implants, buccal bone resorption, grafting

Purpose: to evaluate changes in buccal bone dimensions after immediate implant placement in the maxillary esthetic zone during the first year, and also identify factors that may influence buccal bone resorption

Material and methods: Electronic and manual search up to Jan 2021.
Population: pts treated with immediate implants
Intervention: implant in esthetic zone
Comparison: baseline to follow up
Outcome: mean horizontal change in buccal bone

Results:

- 16 studies included, with follow up periods ranging from 4-12 mo, 568 implants
- Mean survival rate: 99.6%
- Mean patient esthetic satisfaction rate: 88% ; esthetic complications were low
- Graft materials used to fill gap between implant and buccal plate included nothing, xenografts, autografts, or synthetics
- 13 groups used FTF, 15 groups used flapless approach
- Restoration protocol: immediate provisional in 12 groups, delayed in 16 groups
- **Immediate implant placement in the esthetic zone does not prevent buccal bone resorption follow tooth extraction**
    - Mean horizontal bone change: 0.71 mm
    - Mean vertical bone change: 0.58 mm
- Subgroup analysis
    - Flap vs flapless
        - Horizontal change: 0.82 vs 0.62 mm, respectively
        - Vertical change: 0.58 vs 0.59 mm, respectively
    - Grafted vs not grafted
        - H: 0.63 vs 1.10 mm, respectively
        - V: 0.57 mm vs 0.67 mm, respectively
    - Immediate provisionalization vs regular
        - H: 0.56 vs 0.81 mm, respectively
        - V: 0.65 vs 0.53 mm, respectively
    - GBR vs grafting gap
        - H: 0.80 vs 0.58 mm
- Buccal bone resorption affected by buccal bone thickness, flap design, bone grafting, horizontal defect dimension, and restoration protocol
    - Only bone grafting significantly affected horizontal bone changes
    - More bone formed in larger gaps, smaller gaps showed more horizontal resorption, but NSD

Conclusion: Immediate implant placement does not prevent buccal bone resorption in the esthetic zone, however, regenerative procedures may limit horizontal buccal bone loss around immediate implants.

Topic: Immediate implant placement
Authors: Tarnow DP, Chu SJ, Salama MA, Stappert CF, Salama H, Garber DA, Sarnachiaro GO, Sarnachiaro E, Gotta SL, Saito H
Title: 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
Source: Int J Periodontics Restorative Dent. 2014 May-Jun;34(3):323-31

DOI: 10.11607/prd.1821
Reviewer: Daeoo Lee
Type: Retrospective cohort
Keywords:

Purpose: To investigate horizontal volumetric changes of the ridge contour after flapless tooth extraction and immediate implant placement with and without a bone graft placed into the gap and/or provisional restoration

Material and methods:

- 49 pts with anterior maxillary extraction sockets -> postextraction socket implant placement.
- 70% maxillary central incisor
- Atraumatic tooth removal w/o flap elevation
- Biased palatal placement of the implant to avoid dehiscence
    - 

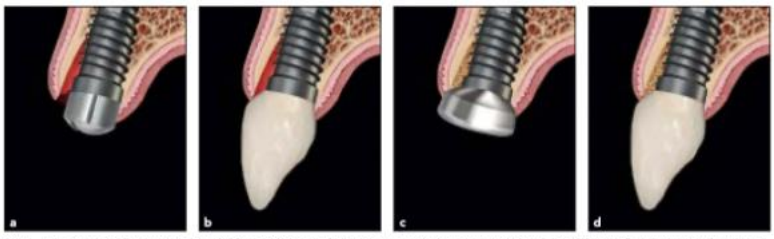
      Fig 4 *A 4-mm-diameter non–platform-switched tapered implant was placed with a palatal bias position within the extraction socket.*
- Tapered non-platform switched internal connection implants 2-4 mm apical to the FGM
- Primary stability (> 35 Ncm)
- 4 test group
    - (1) group no BGPR = no bone graft and no provisional restoration; straight healing abutment; non-contact (to the healing abutment) Maryland bridge
    - (2) group PR = no bone graft, provisional restoration
    - (3) group BG = bone graft, no provisional restoration; stock contoured healing abutment; non-contact (to the healing abutment) Maryland bridge
    - 

      Fig 1 *Four treatment groups. (a) no BGPR = no bone graft and no provisional restoration; (b) PR = no bone graft, provisional restoration; (c) BG = bone graft, no provisional restoration; and (d) BGPR = bone graft, provisional restoration.*
    - (4) group BGPR = bone graft, provisional restoration (Fig 1).
- Screw-retained provisional (autopolymerizing acrylic resin from Super-T, American Consolidated)
- @4 mo post-op: (1) no BGPR and (3) BG Maryland bridge removed and screw-retained polyether-ether-ketone (PEEK) abutment was joined to the implant
    - Started forming soft tissue profile
- @5 mo post-op: (2) PR and (4) BGPR, provisional removed for impression.
- Custom abutment and ceramometal or all ceramic crown delivered 3 mo after final impression.
- At follow-up visits, impressions taken and model poured up; digital caliper used to measure facial-palatal dimensions of the cast.

Results/Discussion:

- 49 pts enrolled in retrospective study (22 to 75 yo)
- 30 (central incisor), 9 (lateral incisor), 3 (canine), 4 (first premolar)
- 5 (no BGPR), 17 (PR), 10 (BG), 17 (BGPR)
- All implantation condition produce a similar reduction in ridge thickness at all distances from the junction/FGM; increasing thickness as one moved apical from FGM
- The analysis indicated that the implant was associated with reduced thickness, but that the extent of this reduction varied depending on both condition (treatment rendered) and distance.
- Dimensional reduction of approximately 1 mm (averaged over distances) in the no BGPR and PR groups ($P < .05$) but smaller losses for groups BG and BGPR ($P > .05$).
- Treatment groups BG (n = 10) and BGPR (n = 17) showed the smallest amount of facial-palatal dimensional change at all reference points.
- Placing a provisional restoration at the time of immediate implant placement did little to prevent contour change compared with the control group.
- Only 1 mm or less and, in several instances, tenths of millimeters of change was shown for all implant treatment groups in type I extraction sockets that were performed as flapless placement procedures.

Conclusions: The smallest amount of facial-palatal contour change was achieved using bone grafting of the extraction socket at the time of implant placement and stabilization of the graft material either by placing a contoured healing abutment or custom-contoured provisional restoration.

Topic: Immediate implant placement protocol
Authors: Chu SJ., Salama MA., Garber DA., Salama H., Sarnachiaro GO., Sarnachiaro E., Gotta SL., Reynolds MA., Saito H., Tarnow DP.
Title: Flapless Postextraction Socket Implant Placement, Part 2: The Effects of Bone Grafting and Provisional Restoration on Peri-implant Soft Tissue Height and ThicknessA Retrospective Study
Source: Int J Periodontics Restorative Dent. 2015 Nov-Dec;35(6):803-9.
DOI: 10.11607/prd.2178.
Reviewer: Cyrus J Mansouri
Type: Retrospective study
Keywords: -

Purpose:
To compare the changes in peri-implant soft tissue dimensions with immediate implant placement in the anterior between four different post-extraction treatment groups:

i) no BGPR – no bone graft, no provisional restoration
ii) PR – no bone graft, provisional restoration
iii) BG – bone graft, no provisionalization
iv) BGPR – bone graft, provisional restoration

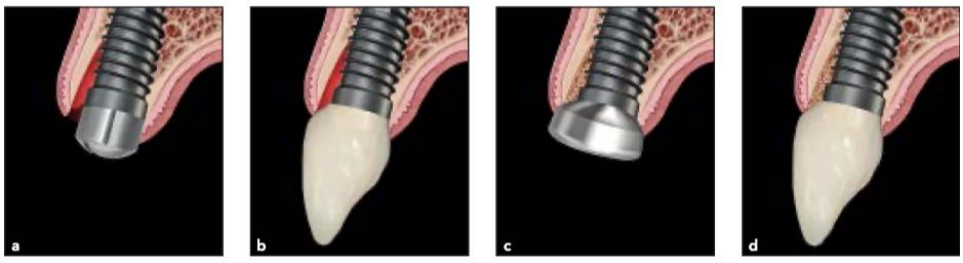


Fig 1 *The peri-implant soft tissue thickness of four treatment groups were evaluated. (a) No BGPR = no bone graft/no provisional restoration. (b) PR = no bone graft/provisional restoration only. (c) BG = bone graft only/no provisional restoration. (d) BGPR = bone graft/provisional restoration.*

Material and methods:
45 anterior maxillary extraction sockets in 44 pts (aged 22-75 years of age) with immediate implant

placement.
70% of sites central incisors.
Teeth and adjacent teeth were periodontally healthy.
Type II and II extraction sockets were excluded.
Surgical interventions:
Teeth were removed with minimal surgical trauma.
Osteotomies was prepared and implants were place flapless and with palatal orientation to the extraction socket. Implants were also placed 3-4 mm apical to the FGM.
Minimum of 25-35 Ncm insertion torque was confirmed to facilitate immediate full-contour provisionalization.
The labial gap between the buccal gap was either grafted (small- particle bone allograft) or left to heal via blood clot formation, according to allocation group.
For provisionalization groups, screw-retained provisional restorations were fabricated using auto-polymerizing acrylic resin in intraocclusion.
At 4-months, non-provisionalized implants received a polyether-ether-ketone (PEEK) abutment with contoured acrylic, soft-tissue was non-surgically contoured, and final impressions were made 3-weeks later.
After 5-months, impressions were made for provisionalized implants, and final restorations were delivered 3-months later.

Vertical distance of the peri-implant soft tissue was measured from the free-mucosal margin to the implant-abutment junction using a periodontal probe and divided into the incisal, middle, and gingival third. Mucosal thickness was measured with a spring-loaded caliper to the nearest 0.1 mm.

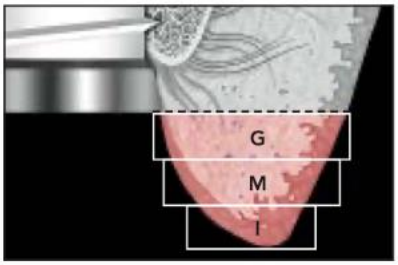


Fig 10 *With a default implant depth of 3.0 mm at the time of placement, 3 zones approximately 1.0 mm in vertical height could be measured in its mid-most region.*

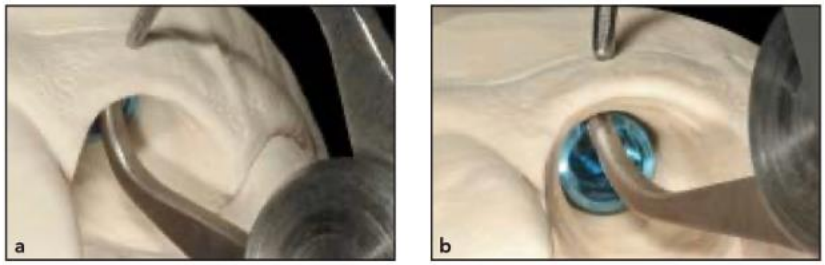


Fig 11 *Spring-loaded calipers were used to measure the gingival zone of the peri-implant soft tissue thickness.*

Results:
The vertical soft tissue was greater for grafted than nongrafted sites (2.72 vs 2.28 mm). The facial soft tissue thickness at the gingival third was also greater for grafted than nongrafted sites (2.90 vs 2.28 mm) and for provisionalized vs nonprovisionalized sites (2.81 vs 2.37 mm).

Conclusion:
For immediate implant placement, grafting the gap and immediate provisionalization increases both the height of the free mucosal margin and the mucosal thickness by 0.5 – 1.0 mm compared to not grafting or provisionalzing.

Topic: Soft tissue thickness and height
Author: Chu SJ, Saito H, Salama MA, Garber DA, Salama H, Sarnachiaro GO, Reynolds MA, Tarnow DP
Title: Flapless Postextraction Socket Implant Placement, Part 3: The Effects of Bone Grafting and Provisional Restoration on Soft Tissue Color Change-A Retrospective Pilot Study.
Source: Int J Periodontics Restorative Dent. 2018 Jul/Aug;38(4):509-516.
DOI: 10.11607/prd.3571.
Type: Clinical Study
Reviewer: Veronica Xia
Keywords: dental implant, soft tissue, thickness, height

Purpose:
- Present results of a retrospective cross-sectional comparative cohort evaluation of vertical and

horizontal changes in peri-implant soft tissue dimensions associated with four different treatment types

Materials and Methods:

- 44 patients treated with immediate implants
- Four groups:
  - No bone graft and no provisional restoration (No BGPR)
  - Provisional restoration only (PR)
  - Bone graft only (BG)
  - Both bone graft and provisional restoration (BGPR)
- Soft tissue height and thickness were measured

Results:

- Average soft tissue height (FGM to implant-abutment junction): 2.5mm
  - Greater for grafted vs not grafted (2.72 vs 2.29mm)
- Average soft tissue thickness (over decrease from incisal to gingival)
  - Gingival zone: 2.7mm
  - Middle zone: 2.1mm
  - Incisal zone: 1.3mm
  - Greater for graft vs not grafted (2.28mm vs 2.9mm)
  - Greater for sites with provisional restorations vs no restoration (2.81mm vs 2.37mm)
  - Greater for BGPR vs no BGPR (3.09mm vs 2.03mm)
- All treatment groups compared to no BGPR
  - 0.5mm vertical collapse/recession of peri-implant soft tissue
  - Soft tissue thickness always greater than 2 mm
- NSSD between PR and BG on vertical/horizontal dimensions at incisal/middle levels

Conclusion:

- Placing bone graft and provisional restoration at the time of immediate postextraction implant placement results in greater peri-implant soft tissue height and thickness
  - Net gain in soft tissue height/thickness about 0.5mm-1mm in BGPR group

Topic: Immediate Implant Placement
Authors: Shuji Yoshino, Joseph Y K Kan, Kitichai Rungcharassaeng, Phillip Roe, Jaime L Lozada
Title: Effects of connective tissue grafting on the facial gingival level following single immediate implant placement and provisionalization in the esthetic zone: a 1-year randomized controlled prospective study
Source: Int J Oral Maxillofac Implants. 2014 Mar-Apr;29(2):432-40
DOI: 10.11607/jomi.3379.
Type: Randomized controlled trial
Reviewer: Trisha Nguyen-Luu
Keywords: esthetics, esthetic zone, gingival biotype, gingival recession, immediate loading, immediate provisionalization, immediate tooth replacement, papilla
Background:

- Immediate implant + provisionalization has high success rate but avg 1.0 mm of facial gingival recession after the 1st year of function

Purpose: To compare the facial gingival level (FGL), implant success rate and peri-implant tissue response in patients that receive a single immediate implant placement and provisionalization (IIPP) with or without SCTG,

Material and methods:

- Extraction of a single tooth in the maxillary esthetics zone
  - Control: 10 patients received IIP without SCTG
  - Test: 10 patients received IIP with SCTG
- Bone level Straumman implant was placed to achieve min ITV 25Ncm
- Bio-Oss was used to fill
- Provisional shell was relined with composite resin to recreate the emergence profile

- Remove all centric + eccentric contacts + cemented.
- Test: SCTG 1.5 mm thickness is harvested from palate and placed in the full thickness envelope flap between the facial bone plate + overlying gingiva + secured with suture
- Final implant level impression at 6 months
- Customized Zirconica abutment was made + torqued to 35 Ncm + all ceramic restoration was cemented
- Clinical and radiographic evaluation before, immediately

Results:
- At 1 year all implants were osseointegrated – 100% success rate
- Overall marginal bone changes: NSSD btw test vs. control and at or between time intervals
    - Test: -0.01 mm
    - Control: 0.14 mm
- Mean Facial Gingival level: SS more
    - Test: -0.25 mm
    - Control: -0.70 mm
- 50% papilla fill observed in 75% of test sites + 80% of control sites
- NSSD in plaque index, bleeding index, ISQ values

Conclusions
- Platform switched is beneficial for maintaining peri-implant MBL biologically + mechanically
- Adding SCTG to IIIPP does not adversely affect the peri-implant marginal bone response
- Proper 3D implant positioning + bone grafting of the socket gap + SCTG with IIPP may minimize facial recession
- Implant papilla level is dictated by proximal bone level of adjacent teeth + may be maintained by providing immediate papilla support after tooth removal

Topic: soft tissue grafting + immediate DIs
Authors: Migliorati M, Amorfini L, Signori A, Biavati AS, Benedicenti S
Title: Clinical and Aesthetic Outcome with Post-Extractive Implants with or without Soft Tissue Augmentation: A 2-Year Randomized Clinical Trial
Source: Clin Implant Dent Relat Res. 2015 Oct;17(5):983-95.
DOI: 10.1111/cid.12194
Type: randomized clinical trial
Reviewer: Erin Schwoegl
Keywords: extraction socket; flapless implant surgery; randomized controlled trial; single-tooth implants; soft tissue grafting

Purpose: To analyze ridge width and thickness changes after immediate DIs w and w/o soft tissue grafts

Material and methods:
- Included 48 healthy pts treatment planned for DIs in the anterior maxilla
- Pts had facial KMW of 2+ mm and the same soft tissue level as the contralateral tooth. Smokers were excluded
- Preop abx given orally 1hr prior: amox, 2 g, or clindamycin, 600 mg, for PCN-allergic pts
- Intrasulcular incisions made, teeth extracted with periotomes and forceps. Sockets debrided with hand instruments
- Pts were included only if facial wall was intact or had a dehiscence of 3mm or less. Fenestrations were included as long as the marginal bone was intact
- Bone level Straumann DIs were placed in a more palatal position to avoid pressure on facial bone and deproteinized bovine bone mineral (Bio-Oss Collagen) was used to full the gap.
- Control group had no soft tissue grafting. Experimental group received palatal subepi CTGs, ~7mm long, 4mm wide, and 1-2mm thick. Graft stabilized w horizontal mattress sutures
- Both groups had screw-retained provisional acrylic crowns. w/o any occlusal contacts
- After 8wks, provisional crowns were gradually enlarged, if needed, in order to optimize the tissue contour
- Pts referred for definitive restoratives 3-4mp postop

- Pts were followed for 2 years

Results:
- 1 drop out in the control group; 24 experimental and 23 control completed study
- No postop complications occurred
- Teeth were extracted due to fractures of restored teeth (54.1%), external root resorption (17.6%), endo failure (10.6%), vertical root fracture (9.4%), trauma (7.1%), or bone loss from previous perio dz (2.1%)
- At every time point, NSSD between two groups for PPD, plaque control, BOP, or mesial and distal radiographic bone levels
- SSD between groups for PES score (sig lower in control group) and NSSD for WES
    - PES test group: 16 sites w scores of 8 or more, (optimum soft tissue aesthetics). No sites w suboptimal aesthetics.
        - Avg score of 8
    - PES control group: 4 sites w scores of 8. 4 sites had poor aesthetic outcomes
        - Avg score of 6.65
    - Sig lower PES scores for thin biotype subgroup, no differences w WES scores
- Soft tissue remodeling:
    - Control group: −10% in thickness, −18% in highness
    - Test group: +35% in thickness, −11% in highness.

Conclusions:
- Two years post-immediate DI placement, the grafted group had better aesthetics and more stable facial soft tissue vs non-grafted group

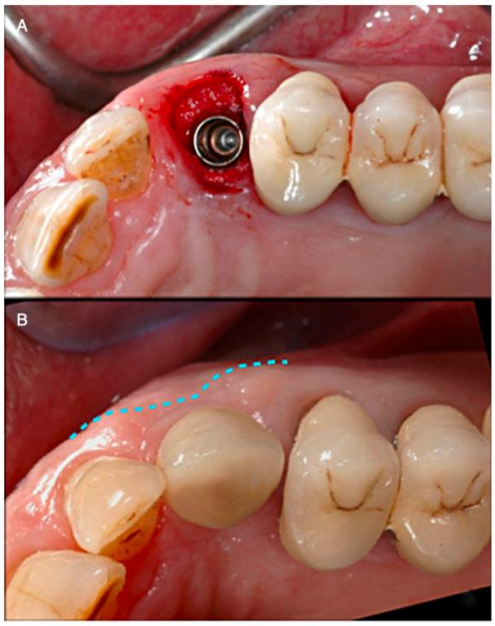


Figure 2 Test group: *A*, Connective tissue graft inserted with the tunnel technique. *B*, Incisal view at the 2-year follow-up visit showing a good maintenance of peri-implant tissues and their physiologic vestibular curvature.

Topic: Buccal bone thickness
Author: Wu XY, Shi JY, Buti J, Lai HC, Tonetti MS
Title: Buccal bone thickness and mid-facial soft tissue recession after various surgical approaches for immediate implant placement: A systematic review and network meta-analysis of controlled trials.
Source: J Clin Periodontol. 2023 Apr;50(4):533-546.
DOI: 10.1111/jcpe.13771
Type: Systematic Review and Meta-analysis

Reviewer: Brook Thibodeaux
Keywords: Surgical techniques, systematic review, type 1 implant placement

Purpose: To compare and rank surgical techniques used for type 1 implant placement.
Materials and methods:

- Systematic review and meta-analysis.
- Electronic search via pubmed, embase, cochrane CENTRAL. Randomized controlled trials included.
- PICO question: In patients requiring immediate implant placement in the premolar-to-premolar area, which surgical intervention (whether to elevate flap, or to perform HTA and/or STA) was better regarding implant survival (primary outcome), BBT reduction, and mid-facial soft tissue recession (MSTR)".
- Outcome: implant survival, buccal bone thickness reduction, mid-facial soft tissue recession
- 22 studies included, 5 surgical approaches- flap elevation with no tissue augmentation, flap elevation with no hard tissue augmentation, flapless surgery with no tissue augmentation, flapless surgery with hard tissue augmentation, and flapless surgery with hard and soft tissue augmentation

Results:

- 8 studies reported 14 DI failures (all early failure)
- Flapless surgery with hard tissue augmentation was the best approach for buccal bone thickness preservation
- Flapless surgery with hard and soft tissue augmentation was the best approach for mid facial soft tissue preservation.
- Flapless surgery with hard and soft tissue augmentation prevented mid facial recession but had slightly more buccal bone thickness reduction.

Conclusion: Immediate implants have good survival rates in cases of extraction socket buccal bone wall preservation. Buccal bone thickness is better preserved with a flapless and hard tissue augmentation approach for immediate (type 1) DI placement. Mid-facial soft tissue level is better maintained with the addition of soft tissue augmentation. The most appropriate surgical intervention could not be identified due to limitations of the study.

Topic: thick vs thin phenotype
Authors: Tatum CL, Saltz AE, Prihoda TJ, DeGroot BS, Mealey BL, Mills MP, Huynh-Ba G.
Title: Management of Thick and Thin Periodontal Phenotypes for Immediate Dental Implants in the Esthetic Zone: A Controlled Clinical Trial.
Source: Int J Periodontics Restorative Dent. 2020 Jan/Feb;40(1):51-59
DOI: 10.11607/prd.4317
Reviewer: Amber Kreko
Type: clinical trial
Keywords:

Purpose: To compare the outcome of immediate single implant placement is esthetic sites of patients with thick or thin tissue phenotypes

Material and methods:

- 41 patients needing extraction of a single nonrestorable tooth and implant placement were included.
- Soft tissue phenotype was evaluated by probe visibility through the sulcus of study site
- Surgical procedure:
    - Following minimally traumatic tooth extraction, the patient was included in intact socket wall was present with fenestration or dehiscence less than 3mm
    - Full thickness envelop flap was reflected. Implants were placed freehanded (Straumann bone level). FDBA (OraGraft) was placed in residual gap and layered on external aspect of facial plate. Collagen membrane was placed (BioGide).
    - For thin phenotype, SCTG was harvested and positioned over facial aspect of

augmented implant site. Primary closure was not a requirement.
    - After 3 months of healing, patients returned for stage two uncovery procedure.
- Hard tissue and soft tissue measurements were completed and pink and white esthetic scores were done.

Results:
- 26 patients completed 12 month follow up (14 thick and 12 thin)
- Thick phenotype gained 0.01mm midfacial soft tissue height, thin phenotype lost 0.20mm.
- NSD for buccal plate thickness, pink and white esthetic scores, radiographic bone levels, and clinical paramenters.

Conclusions: Immediate implants placed with CTG in patients with thin tissue phenotype and ideal postextraction site can achieve esthetic outcomes that are not significantly different from that of a thick tissue phenotype. Addition of contour bone grafting led to facial plate thickenss of 2mm or more in the vast majority of cases and may favor maintenance of marginal tissue levels.

Topic: connective tissue graft and immediate implants
Authors: Seyssens L, De Lat L, Cosyn J
Title: Immediate implant placement with or without connective tissue graft: A systematic review and meta-analysis
Source: J Clin Periodontol. 2021 Feb;48(2):284-301
DOI: 10.1111/jcpe.13397
Reviewer: Tam Vu
Type: systematic review and meta-analysis
Keywords: connective tissue graft, immediate implant placement, recession, bleeding

Purpose: to assess the effect of connective tissue graft (CTG) on vertical mid-facial soft tissue change when placing single immediate implant placement (IIP).

Material and methods: electronic and manual search until Jan 2020, with focus question: “In pts treated with immediate implant placement, does insertion of buccal CTG compared to no CTG result in different vertical mid-facial soft tissue change?”

Results:

- 289 pts, 310 implants evaluated at end of study
    - Follow up range: 12-108 mo
    - IIP + CTG: 162 implants
    - IIP: 148 implants
- Meta-analysis showed sig difference favoring soft tissue augmentation (IIP + CTG) by about 0.41 mm
    - IIP only: vertical mid-facial soft tissue change: -0.70 to -0.50 mm
    - IIP + CTG: vertical mid-facial soft tissue change: -0.32 to +0.10 mm
- Secondary outcome variables
    - Frequency of ≥1 mm asymmetry in mid-facial vertical soft tissue level
        - CTG has sig protective effect, 12x less
    - Inconclusive results for horizontal mid-facial soft tissue and papilla height change
    - Pink aesthetic score, marginal bone level, and probing depth showed NSD between groups
    - BOP was lower in CTG group
- There is moderate recommendation for CTG following IIP
    - Should be based on gingival biotype, integrity and thickness of buccal bone, and aesthetic priority of implant site

Conclusion: CTG contributes to mid-facial soft tissue stability following IIP. Consideration should be taken when elevated risk for mid-facial recession is expected in the aesthetic zone (thin gingival biotype, <0.5 mm buccal bone thickness).