به نام خدا

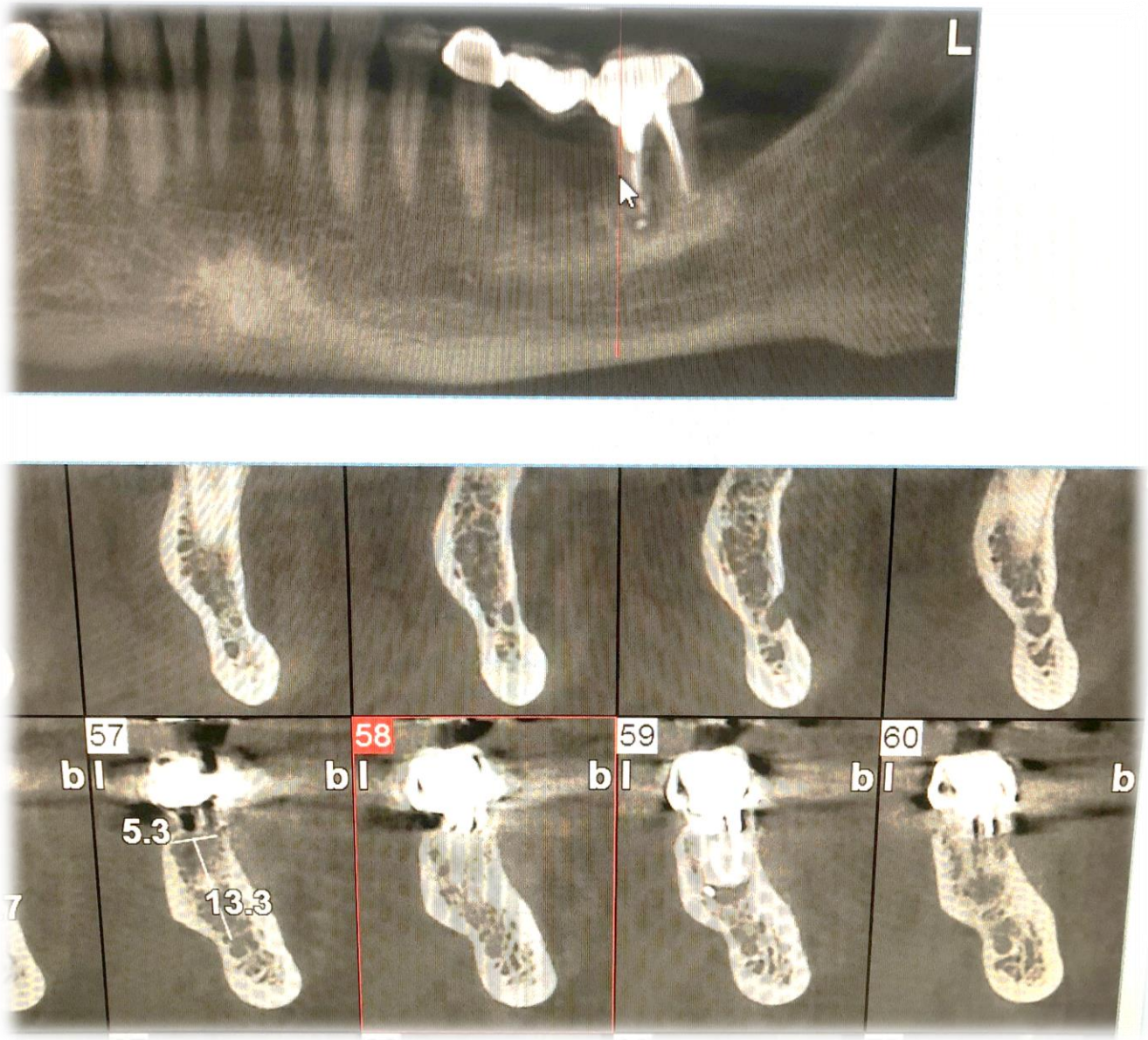
TABLE 15.1

Commonly Used Imaging Techniques for Implant Placement

- Periapical imaging
- Panoramic imaging
- CBCT imaging

CBCT

- ✓ three-dimensional analyses
- ✓ thickness of cortical plates
- ✓ proximity to adjacent anatomic
- ✓ sinus floor elevation
- ✓ grafting procedures
- ✓ surgical guides
- ✓ computer-aided manufacturing (CADCAM) technology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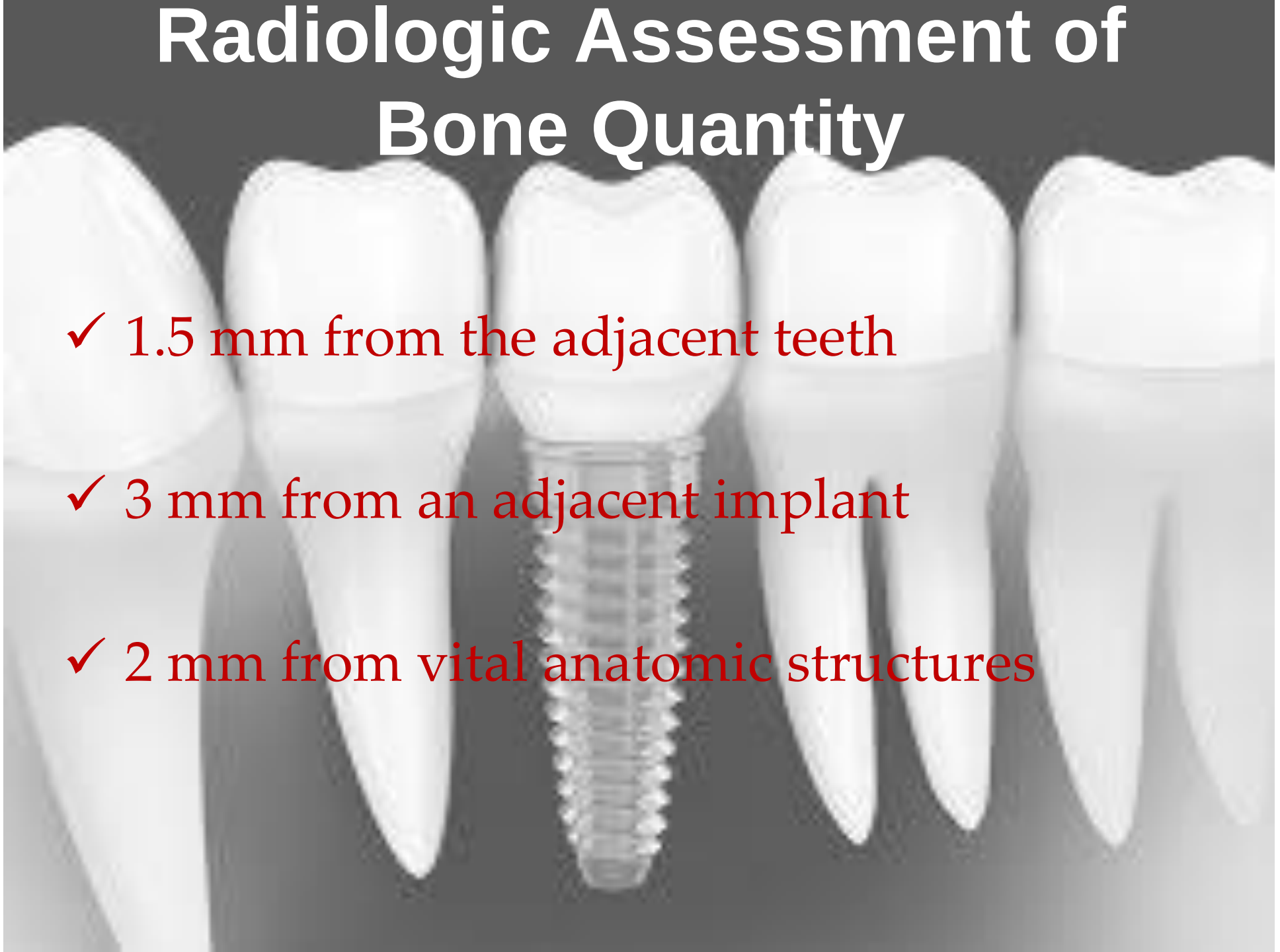
Radiologic Assessment of Bone Quantity



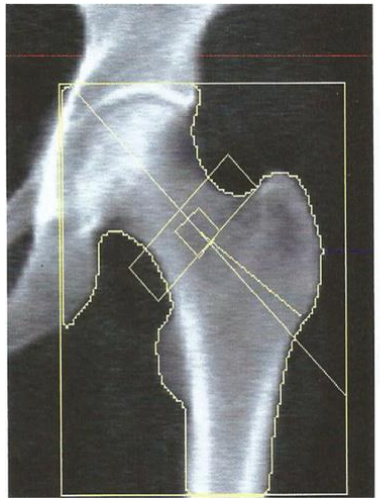
- ✓ 1.5 mm from the adjacent teeth
- ✓ 3 mm from an adjacent implant
- ✓ 2 mm from vital anatomic structures

- ✓ subjective evaluation (CBCT)
- ✓ mineral mass per unit volume (DEXA)

bone density:

in the anterior mandible is higher

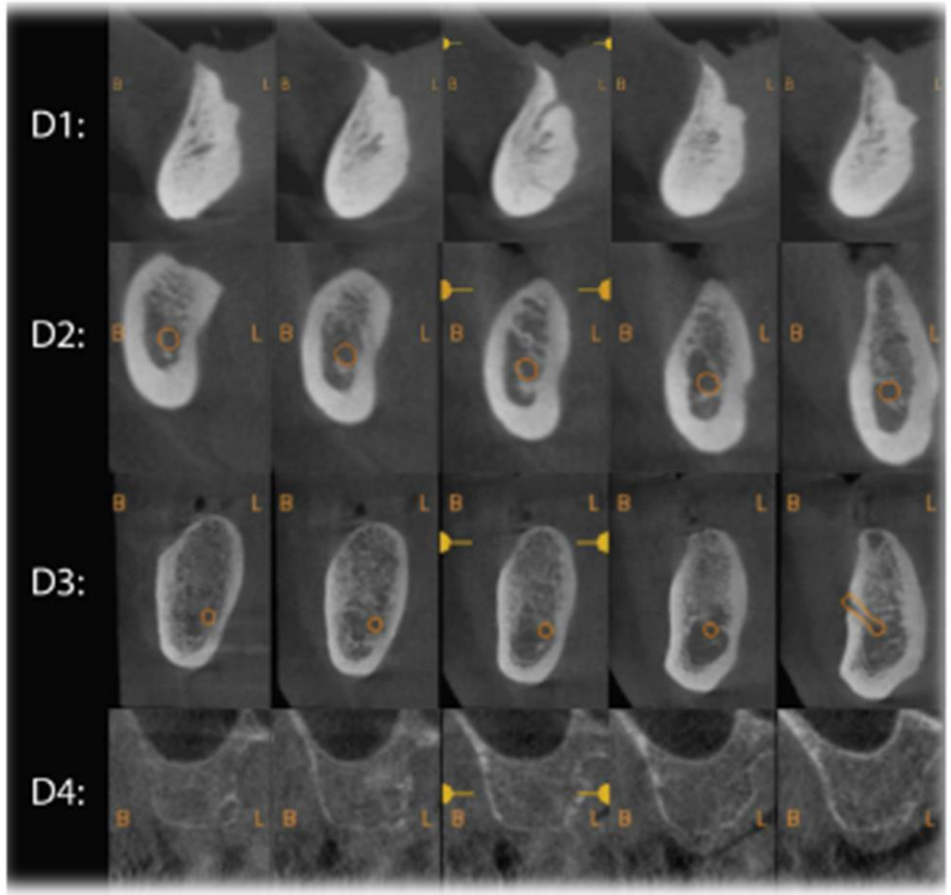
lowest in the posterior maxilla



DXA Results Summary:

Region	Area (cm^2)	BMC (g)	BMD (g/cm^2)	T-score	Z-score
Neck	4.98	4.30	0.864	-0.5	0.5
Total	39.48	42.62	1.079	0.3	0.8

Total BMD CV 1.0%, ACF = 1.028, BCF = 1.007, TH = 5.496
WHO Classification: Normal
Fracture Risk: Not Increased



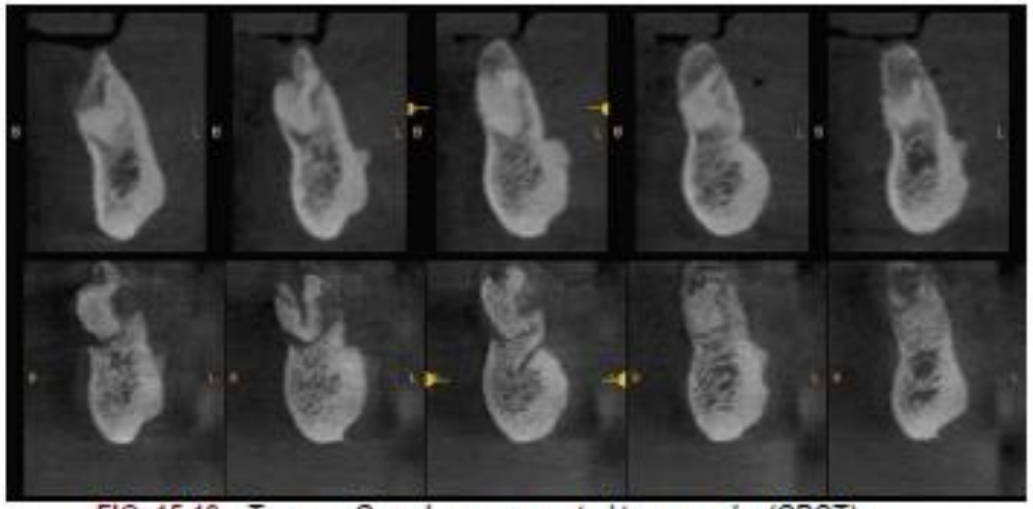


FIG. 15.13 *Top row*: Cone beam computed tomography (CBCT) images of a relatively mature focus of periapical osseous dysplasia in the anterior mandible of a patient evaluated for implant treatment planning. *Bottom row*: Following implant placement, the patient reported pain in the implant area. Two of the implants failed in the immediate postoperative period. Postoperative CBCT sections

- ✓ drill deflection
- ✓ lower vascularity

FIG. 15.12 Cone beam computed tomography section through the posterior left mandible demonstrating a large area of osteosclerosis located in the mesial aspect of an edentulous mandibular left first molar site.

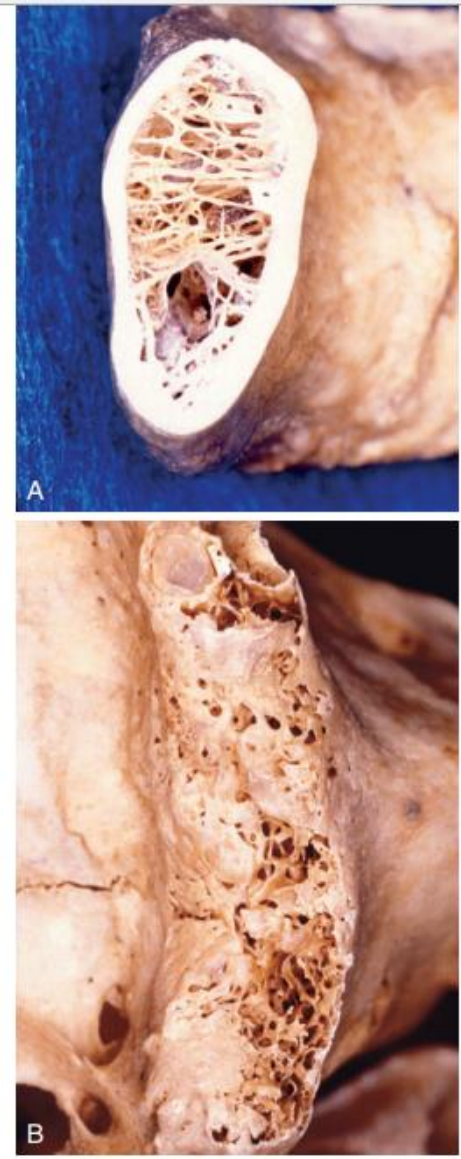


FIG 3.107 (A) and (B), D3 bone has a thin, porous cortical crest and fine trabecular bone within the alveolus. It is frequently found in a posterior mandible. (From Misch CE: *Contemporary implant dentistry,* ed 3, St Louis, 2008, Mosby.)

Postoperative Imaging and Monitoring

- Periapical image: Immediately
- Panoramic image: For multiple implants
- Periapical or bite-wing: During prosthetic phase
- Annual recall imaging: Maintenance phase
- Symptomatic cases: CBCT

TABLE 1.1 Summary of Complication Journal Articles—cont'd

	Category	Study Findings
		INFECTION COMPLICATIONS
Powell (2005)[13]	Dental Implant Infection	• 1.14% infection rate after stage I and stage II surgery
Gynther (1998)[14]	Dental Implant Infection	• 0.7% infection rate after surgery
Greenstein (2008)[15]	Wound Dehiscence	• Incision line opening prevalence ranging from 4.6%–13.7%
Lekovic (1997)[16]	Wound Dehiscence with Membrane	• 30% prevalence of soft tissue dehiscence's was noted when barriers were placed as part of guided bone regeneration procedures
Urban (2012)[17]	Sinus Graft Infections	• 2.3% developed a sinus graft infection post-surgery
Sicilia (2008)[18]	Titanium Alloy Sensitivity	• Type IV hypersensitivity reaction (titanium alloy sensitivity) Ti allergy was reported with a 0.6% prevalence
Davies (1990)[19]	Air Embolism	• Report of three fatal cases of air emboli after implant placement
		SURGICAL COMPLICATIONS
Hämmerle (2002)[20]	Guided Bone Regeneration	• Retrospective studies reporting success or survival rates for implants in regenerated bone ranging from 79.4%–100% after 5 years
Levin (2007)[21]	Autogenous Onlay Grafts Complications	• Survival rate was 96.9%, marginal bone loss around implants ranged from 0 to 3.3 mm only 5% of the implants presented marginal bone loss 1.5 mm over the follow-up time
Chiapasco (2009)[22]	Allograft and Membrane	• In the postoperative period, 20% of the nonresorbable membranes and 5% of the resorbable ones underwent exposure/infection
Chaushu (2010)[23]	Cancellous Block Grafts	• Partial and total bone-block graft failure occurred in 10 (7%) and 11 (8%) of 137 augmented sites
Nkenke (2009)[24]	Sinus Graft Complications	• Sinus graft complications 0%–32%
Di Girolamo (2005)[25]	Benign Paroxysmal Positional Vertigo	• Osteotome sinus technique leading to benign paroxysmal positional vertigo (BPPV) with a prevalence of 3%
Schwartz-Arad (2004)[26]	Sinus Membrane Perforation	• Most common complication during sinus graft procedures is perforation of the Schneiderian membrane during its elevation is 40%

[13]Powell CA, Mealey BL, Deas DE, et al: Post-surgical infections: Prevalence associated with various periodontal surgical procedures. *J Periodontol* 76:329–333, 2005.

[14]Gynther GW, Kondell PA, Moberg LE, et al: Dental implant installation without antibiotic prophylaxis. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 85:509–511, 1998.

[15]Greenstein G, Cavallaro J, Romanos G, et al: Clinical recommendations for avoiding and managing surgical complications associated with implant dentistry: a review. *J Periodontol* 79(8):1317–1329, 2008.

[16]Lekovic V, Kenney EB, Weinlaender M, et al: A bone regenerative approach to alveolar ridge maintenance following tooth extraction. Report

TABLE 1.1 Summary of Complication Journal Articles—cont'd

	Category	Study Findings
	SURGICAL COMPLICATIONS	
Chrcanovic (2009)[27]	Mandibular Fracture	• Mandibular fracture is most likely to occur in the very atrophic mandible with a prevalence of 0.2% of the patients with inserted implants in an edentulous mandible
Galindo-Moreno (2012)[28]	Implant Migration	• In 80% of the cases in the reported study was either performed as sinus augmentation via osteotome approach (33.3%) or no augmentation (46.7%) at all
	PROSTHETIC COMPLICATIONS	
Kourtis (2004)[29]	Prosthetic Complications	• Prosthetic Complication frequency: Screw Loosening – 34%, Broken Screw – 13%, Uncemented Restoration – 20%, Fractured Prosthesis – 20%
McDermott (2003)[30]	General Complications	• 13.9% frequency of complications including inflammatory (10.2%), prosthetic (2.7%), and operative (1.0%)
Sadid-Zadeh (2015)[31]	Single Implant Restoration & Fixed Implant Prosthesis in Partially Edentulous	• Meta-analysis showing an overall incidence of technical or mechanical complications of 10.8% for single implant crowns and 16.1% for partially edentulous implants = over a 5 year period
DeBoever (2006)[32]	Screw Loosening	• 12% incidence of screw loosening within 3 years
Chaar (2011)[33]	Screw Loosening	• Screw Loosening – 4.3% less than 5 years, 10% between 5–10 years
K-T Yao (2011)[34]	Implant Screw Settling Effect	• 2%–10% of the initial preload is lost as a result of settling within the first few seconds or minutes after tightening
Goodacre (2003)[35]	Overdenture Complications	• 30% clip/attachment loosening, relines required 19%, overdenture fracture 12%
Pjetursson (2012)[36]	Fixed Implant Prosthesis	• 5-year – 34% of fixed prosthesis had complications • 10-year survival rate of 77.4% for the gold–acrylic fixed implant prosthesis • The survival rate of implant-supported fixed prosthesis (all types) was 95.4% after 5 years and 80.1% after 10 years of function
Sailer (2007)[37]	Fixed Implant Prosthesis	• Meta-analysis reported 5-year (94.3%) and 10-year (88.9%) survival rate
Schley (2010)[38]	Zirconia Restorations	• Zirconia Restorations – 5-year complication-free rate of 76.41% for technical complications

[27]Chrcanovic BR, Custódio AL: Mandibular fractures associated with endosteal implants. *Oral Maxillofac Surg* 13(4):231–238, 2009.
[28]Galindo-Moreno P, Padial-Molina M, Avila G, et al: Complications associated with implant migration into the maxillary sinus cavity. *Clin Oral*

TABLE 1.1 Summary of Complication Journal Articles—cont'd

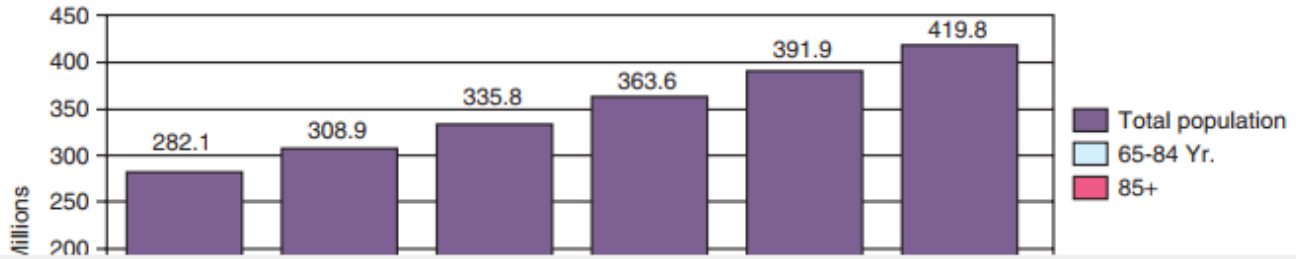
	Category	Study Findings
		PROSTHETIC COMPLICATIONS
Albrektsson (2012)[39]	Technical and Esthetic Complications	• Despite high survival of single implant crowns, technical, biological and aesthetic complications were reported with a rate of 8.8%, 7.1%, and 7.1%, respectively
Albrektsson (2012)[40]	Single Crown Success Rate	• Single implant crowns reported a 5-year (96.3%) and 10-year (89.8%) survival rate of implants and prosthesis
Goodacre (1999)[41]	Phonetic Complication	• Phonetic complication after implant prosthesis in 4%–8% of patients
		IMPLANT FAILURE COMPLICATIONS
Pjetursson (2012)[42]	Implant Failure	• Meta-analysis revealed an estimated survival of implants supporting fixed prosthesis of FDPs 95.6% after 5 years and 93.1% after 10 years
Albrektsson (2012)[43]	Implant Survival	• 5-year implant survival rate was estimated to be 97.7% and based on four prospective studies and 10-year implant survival rate was estimated to be 94.9%
Goodacre (2003)[35]	Implant Loss in Poor Quality Bone	• 16% implant loss in poor quality bone (~D4 Bone)
Lang (2012)[44]	Immediate Implants	• The annual failure rate of immediate implants was 0.82% (95% CI: 0.48%–1.39%) translating into the 2-year survival rate of 98.4%
Bulard (2005)[45]	Small Diameter Implant Failure	• Failure rate average for mini implants used for long-term prosthesis stabilization was 8.83% from 8 months – 5 years
Proussaefs (2004)[46]	Implant Failure After Membrane Perforation	• Implant survival at stage II surgery was 100% for nonperforated sites (100%) and perforated sites (69.6%)
Baig (2007)[47]	Smoking – Implant Failure	• Failure rate of implants in smokers = more than twice that in nonsmokers • Failure rate of implants placed in grafted maxillary sinuses of smokers is more than twice that seen in nonsmokers
Peled (2003)[48]	Diabetes – Implant Failure	• The success rate was 1 year (97.3%) and 94.4% (5 years) following implantation
		PERIODONTAL COMPLICATIONS
Pjetursson (2012)[49]	Soft Tissue Complications	• After 5 years, peri-implantitis and soft tissue complications approximately 8.5%
Jung (2012)[50]	Soft Tissue Complications	• Biological complications, 5-year cumulative soft tissue complication rate of 7.1% on single implant crowns

[39]Albrektsson T, Donos N: Implant survival and complications. The Third EAO consensus conference 2012. *Clin Oral Implants Res* 23(Suppl 6):63–65, 2012.

TABLE 1.1 Summary of Complication Journal Articles—cont'd

	Category	Study Findings
	PERIODONTAL COMPLICATIONS	
Schley (2010)[51]	Soft Tissue Complications	• Zirconia – biological complications, 5-year complication-free rate was 91.72%
Quirynen (2003)[52]	Periapical Pathosis	• 1% of implants placed during a 5-year period developed periapical pathosis
Marrone (2013)[53]	Peri-Mucositis vs. Peri-implantitis	• Prevalence of peri-implant mucositis and peri-implantitis was 31% and 37%, respectively
Fransson (2008)[54]	Peri-Implant Disease	• Prevalence of peri-implant diseases was reported to be 92%
Souza (2016)[55]	Keritinized Tissue	• Cross-sectional analysis reporting lack of adequate keratinized tissue leading to poor gingival health in 40.3% in posterior regions and 30.4% of implants in the anterior region

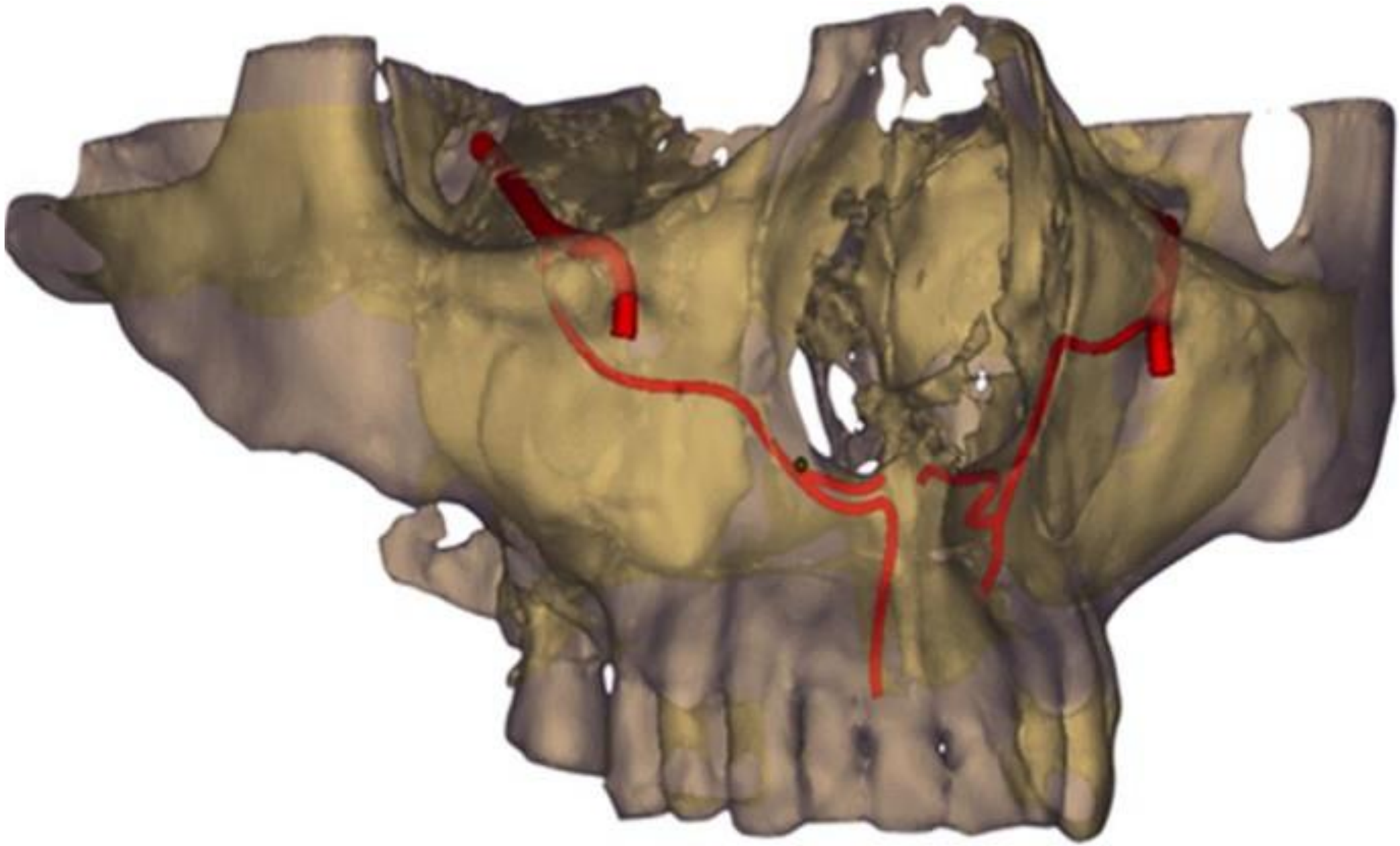
[51]Schley JS, Heussen N, Reich S, et al: Survival probability of zirconia-based fixed dental prostheses up to 5 yr: a systematic review of the literature. *Eur J Oral Sci* 118(5):443–450, 2010.
[52]Quirynen M, Gijbels F, Jacobs R: An infected jawbone site compromising successful osseointegration. *Periodontol 2000* 33:129–144, 2003.
[53]Marrone A, Lasserre J, Bercy P, et al: Prevalence and risk factors for peri-implant disease in Belgian adults. *Clin Oral Implants Res* 24(8):934–940, 2013.
[54]Fransson C, Wennstrom J, Berglundh T: Clinical characteristics at implants with a history of progressive bone loss. *Clin Oral Implants Res* 19(2):142–147, 2008.
[55]Souza AB, Tormena M, Matarazzo F, et al: The influence of peri-implant keratinized mucosa on brushing discomfort and peri-implant tissue health. *Clin Oral Implants Res* 27(6):650–655, 2016.



BOX 2.5 Treatment Protocol for Implant Placement in Radiation Sites

- For sites that have been previously treated with radiotherapy, the authors recommend referral to a dental school, hospital, or clinic that has experience in treating radiotherapy patients.
- If the clinician has experience or can treat the associated complications, the following is recommended:
  Ideal Implant Placement:
  - Preradiation: more than 14 days before radiation
  - During radiation: absolute contraindication[b]
  - Postradiation: <6 month or >24 months—relative/absolute contraindication
  - 6–24 months: relative contraindication[a]

[a]Medical consultation, hyperbaric oxygen, informed consent, aseptic technique (<20 Gy cumulative, approximately <50 Gy technique fractionation).
[b]Radiation therapy medical consultation, possible >20 years ago referral to cancer institution or hospital treatments, for 90 minutes before placement followed by 10 minutes after placement.



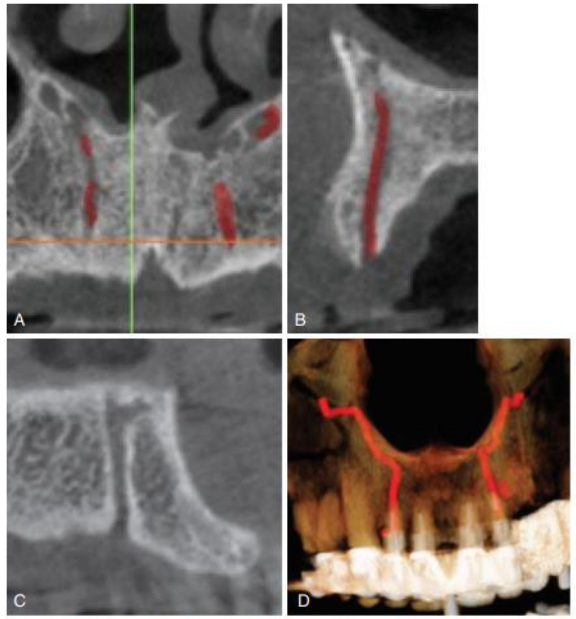
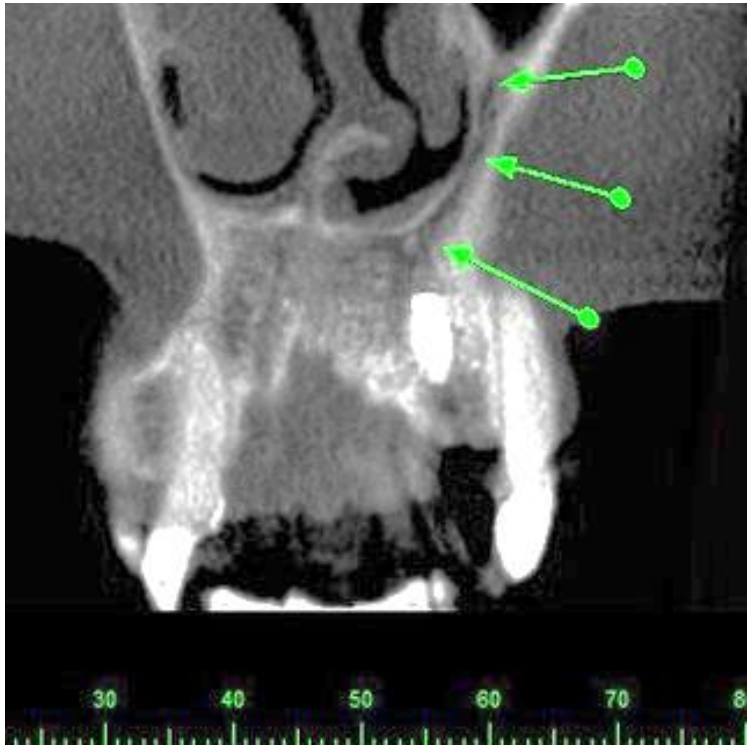
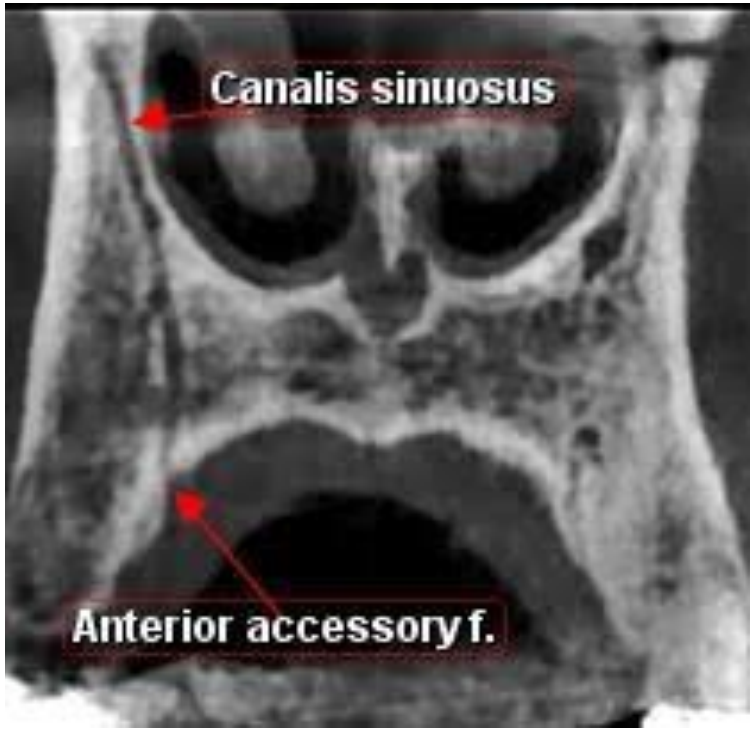
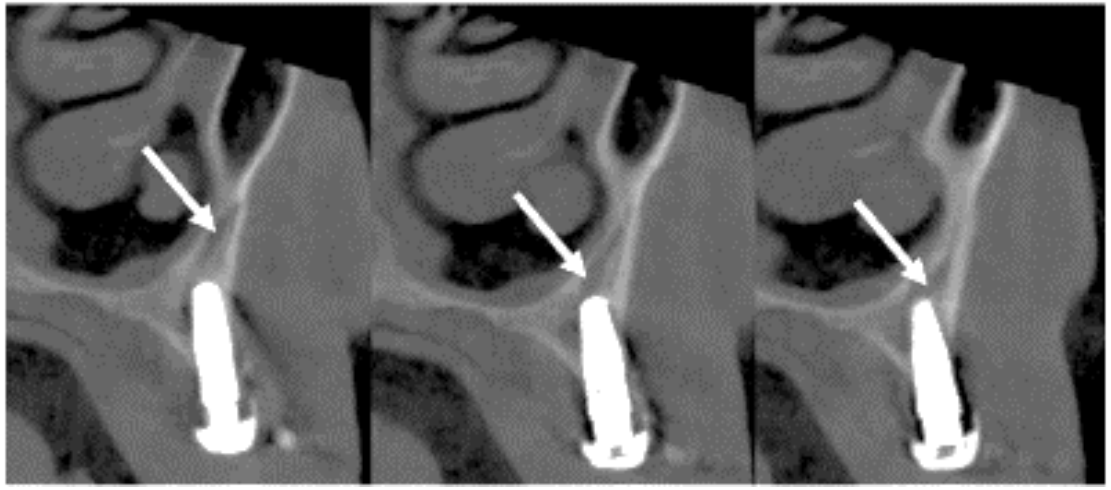


FIG 4.36 Canalis sinuosus. (A) Panoramic image depicting the canalis sinuosus which transmits the anterior superior alveolar vessels; (B–C) cross-sectional image; (D) 3-D image showing course of the canal.







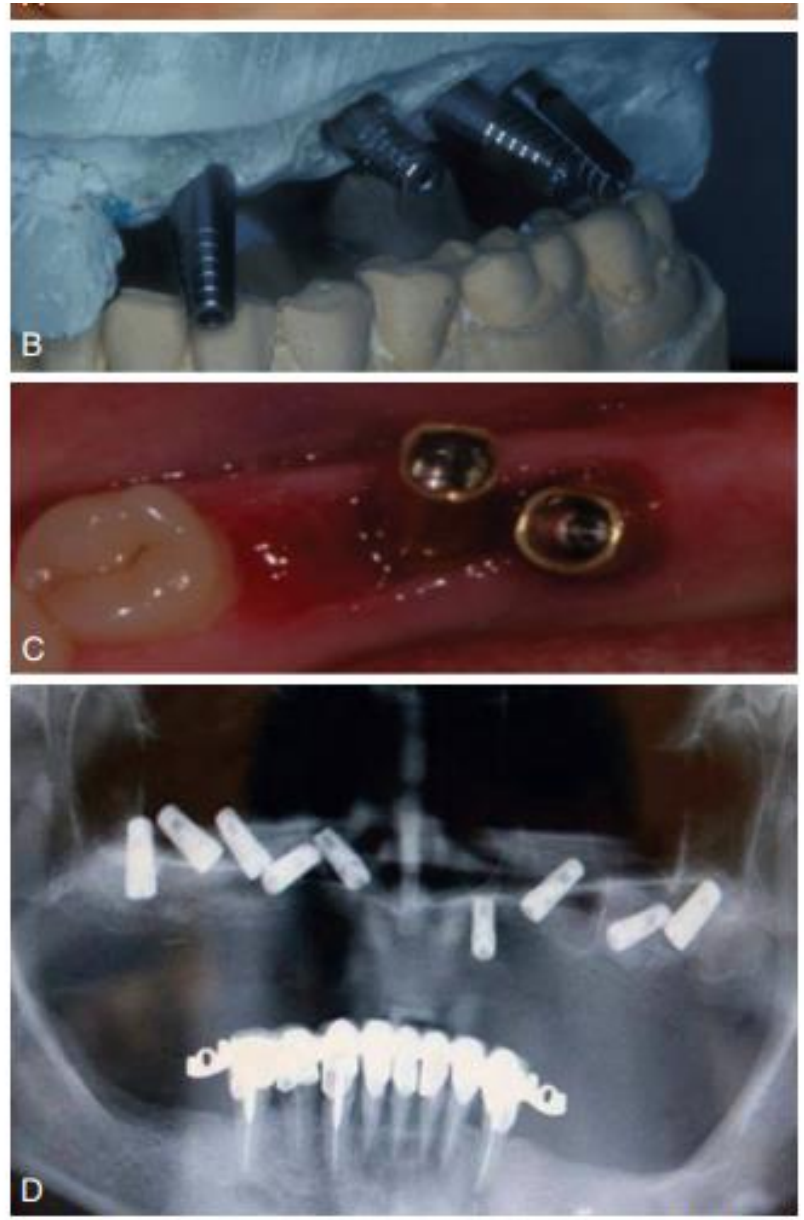


FIG 6.1 (A–D) Various examples of malpositioned implants leading to increased morbidity.

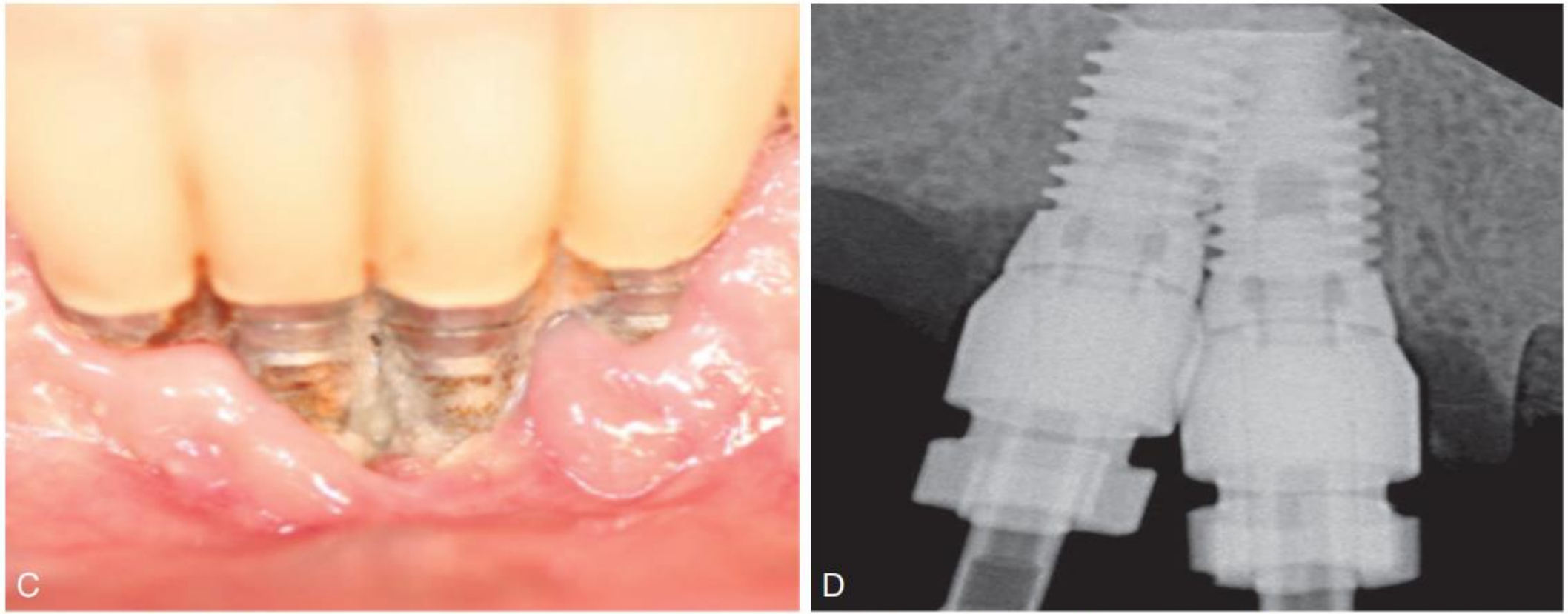


FIG 6.17 Implant-implant distance. (A) Ideal spacing of 3 mm. (B) Lack of implant-implant distance showing minimal space for prosthesis and maintaining bone health. (C) Lack of space results in difficulty in hygiene with resultant soft tissue complications. (D) When implants are placed too close together, difficulty in obtaining accurate transfer impressions results. In some cases, the transfer impression copings may be altered to obtain final seating. A radiograph confirming the complete seating of the transfer copings should be completed prior to the impression.

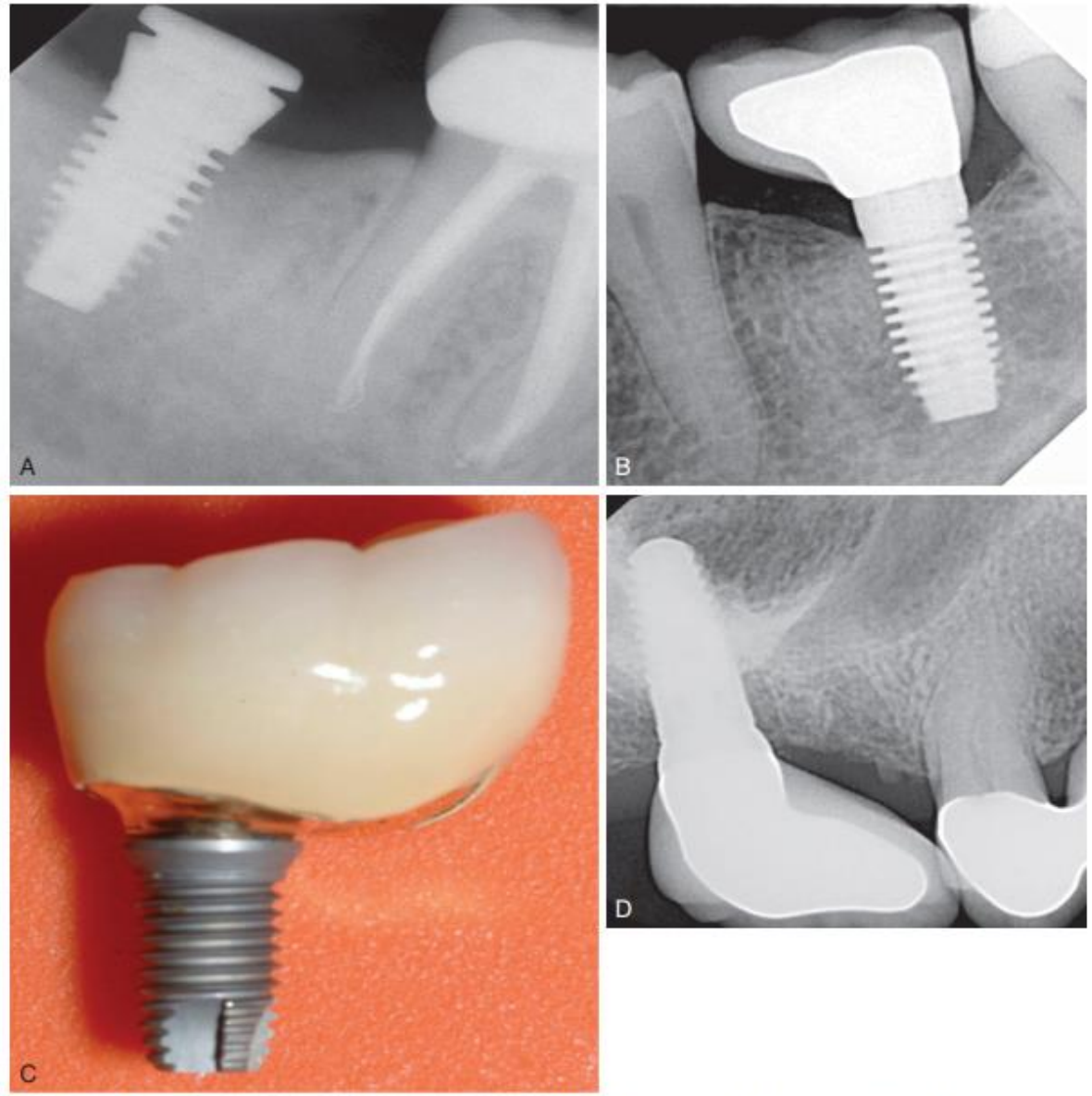


FIG 6.12 Implant positioning too far from tooth. (A) Implant placement too far from adjacent crown resulting in an excessively large, cantilevered crown. (B) Resultant prosthesis gives rise to overcontouring/cantilever effect. (C–D) Atypical prosthesis because of nonideal implant placement and need to obtain contact area, which results in biomechanical complications and food impaction.

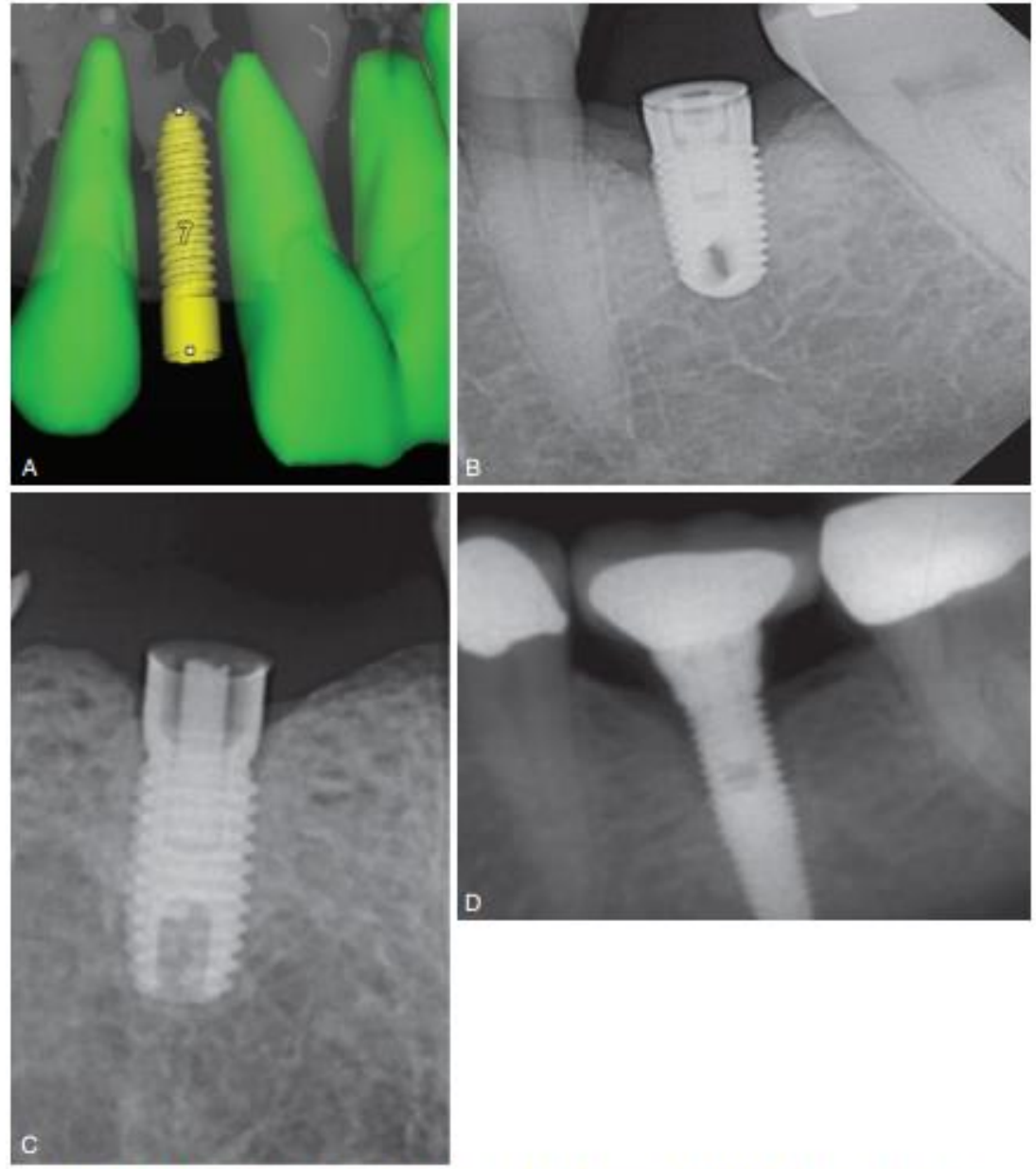


FIG 6.28 Implant placement too shallow. (A–B) Too high above the free gingival margin (FGM) and cemento-enamel junction (CEJ). (C) Resultant fracture screws. (D) Poor emergence profile because of lack of crown height space.

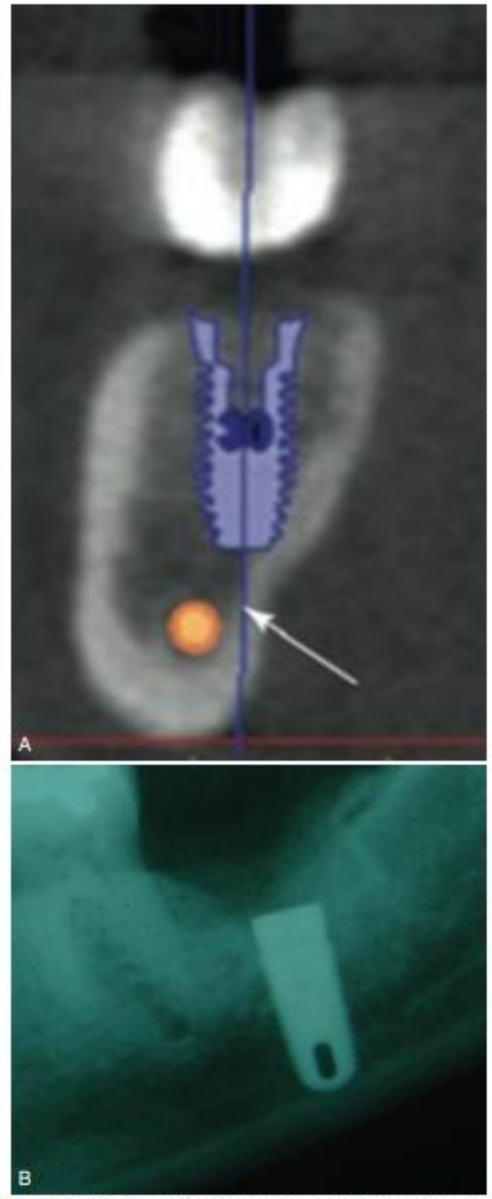


FIG 6.30 Distance from the (A) inferior alveolar nerve canal or mental foramen. (B) Placement of implant too deep, violating the inferior alveolar canal.

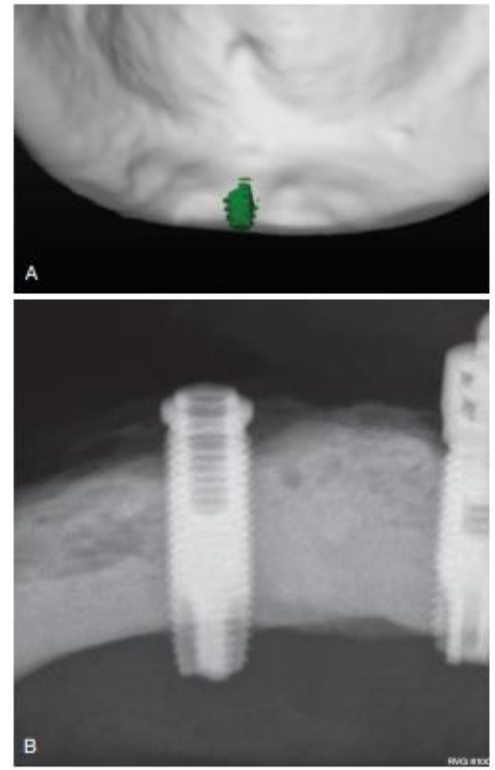


FIG 6.31 (A–B) Over preparation in the anterior mandible leading to possible sublingual bleeding.

of gingival recession and esthetic issues, especially in the anterior part of the mouth. Thin biotype patients are more susceptible to malpositioning issues and greater emphasis should be noted on ideal conditions. If needed, soft tissue augmentation should be completed prior to implant placement.

Condition of the Adjacent Teeth

Prior to implant placement in edentulous sites, the adjacent natural teeth should be evaluated for restorability and existing pathology that may be present. A 5- to 10-year prognostic window should be established for each natural tooth prior to the completion of an implant treatment plan. If a tooth does not possess a favorable 5- to 10-year prognosis, extraction should be discussed or alternative treatment options.

Presence of Pathology

The intended implant site should be carefully evaluated for the presence of pathology at the site or latent adjacent pathology associated with natural teeth, which may lead to increased

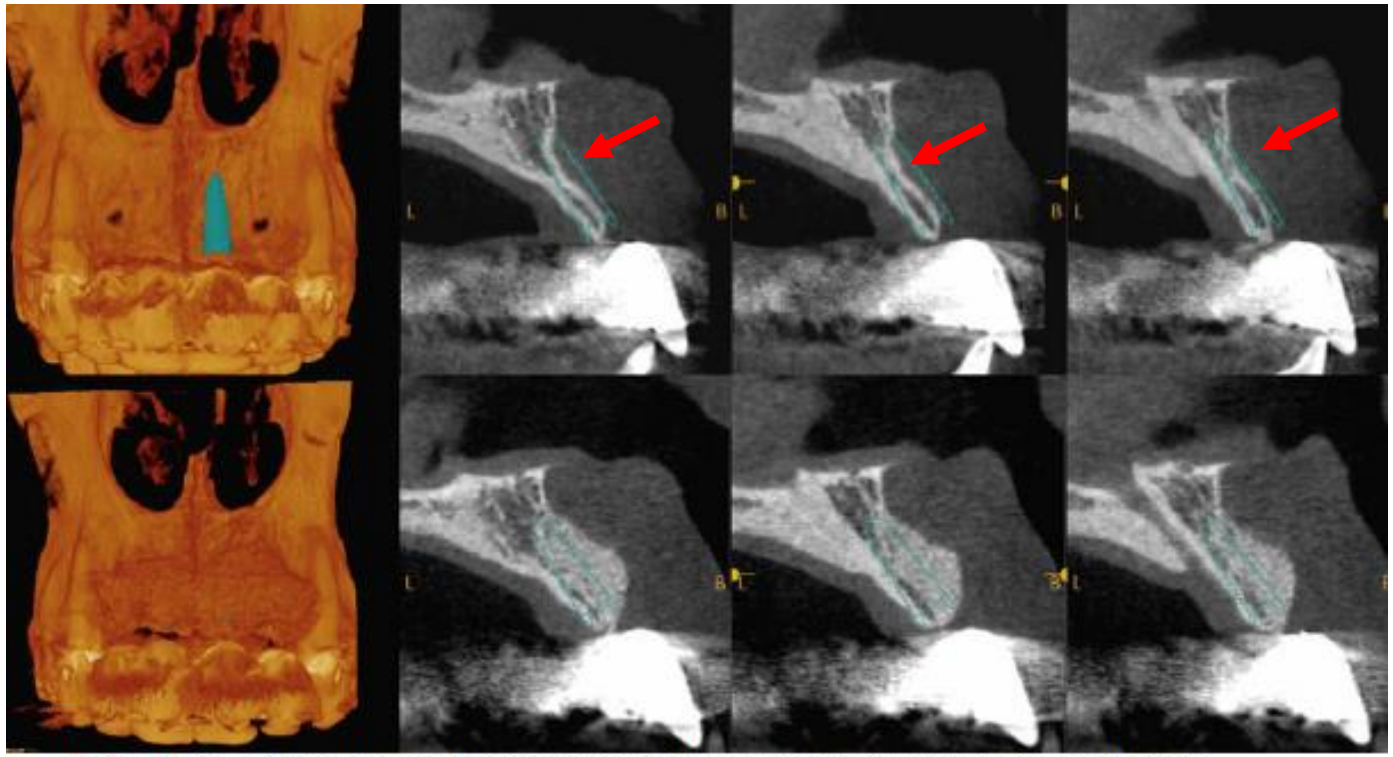


FIG. 15.5 *Top*: Three-dimensional volume rendering and buccolingual cross-sections of an edentulous maxillary left central incisor site. Note the prominent buccal concavity of the alveolar process, which prevents the desired implant to be placed without significant esthetic compromises. The virtual implant shows extensive buccal thread exposure if placed in the ideal inclination, identifying the need for buccal bone augmentation prior to implant placement. *Bottom*: Cone beam computed tomography sections following buccal bone grafting. Note how the desired implant size is now fully embedded in bone.

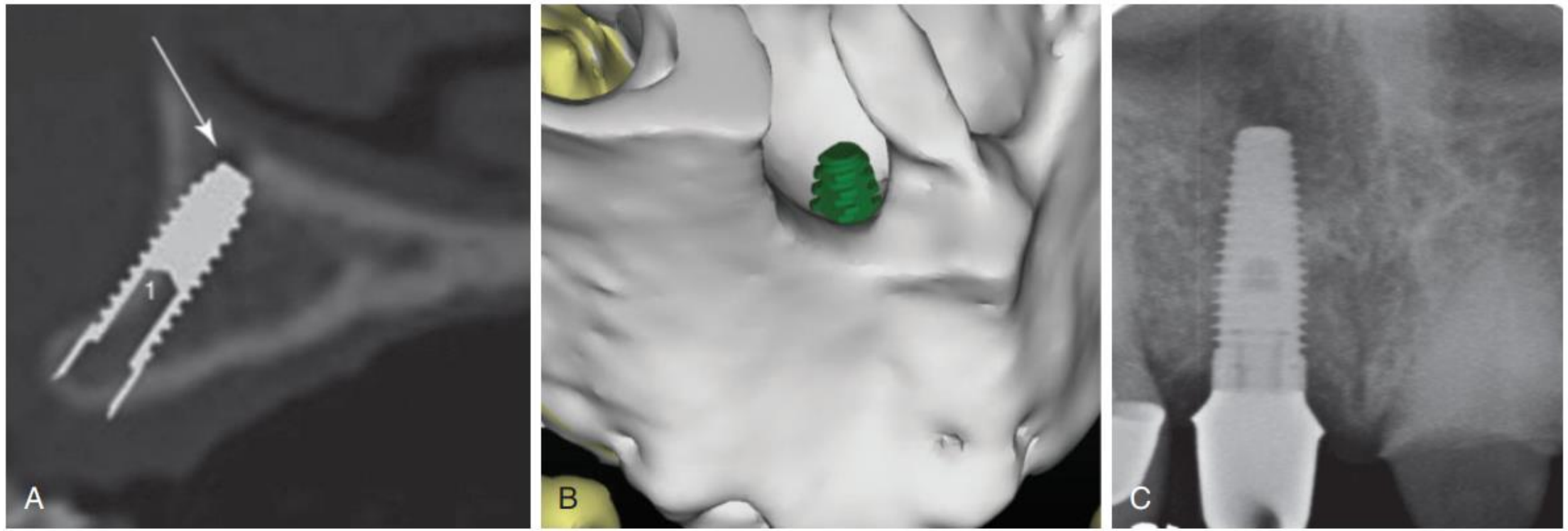


FIG 6.32 Anterior maxilla. (A) Ideal placement *(arrow)*. (B–C) Penetration into the nasal cavity.

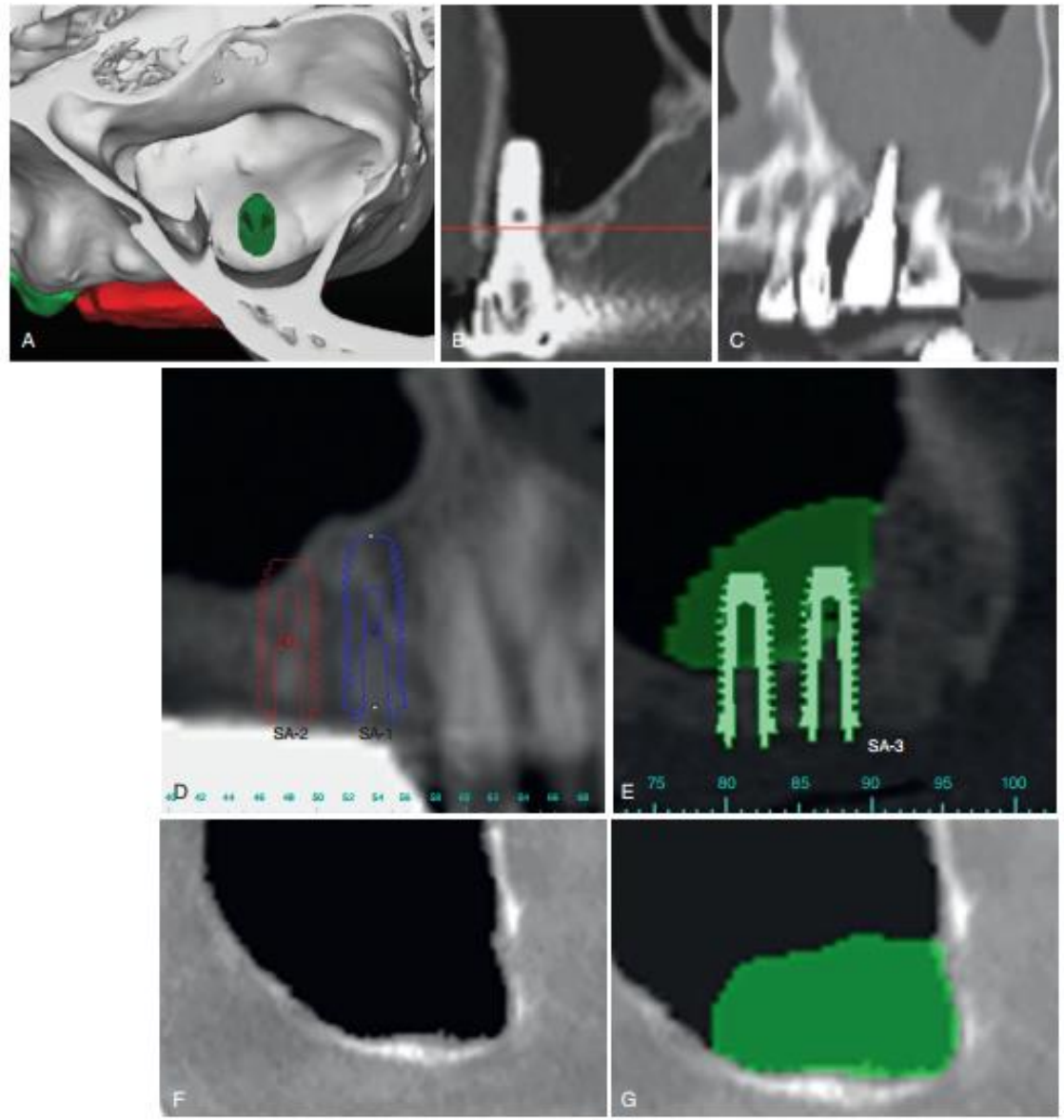


FIG 6.33 (A–B) Implant penetration into the sinus cavity. (C) Implant-induced rhinosinusitis. (D–G) Posterior maxilla treatment planning: SA-1 and SA-2 (D and E), SA-3 (F), and SA-4 (G). (D–G From Misch CE: *Dental implant prosthetics*, ed 2, St Louis, 2015, Mosby.)

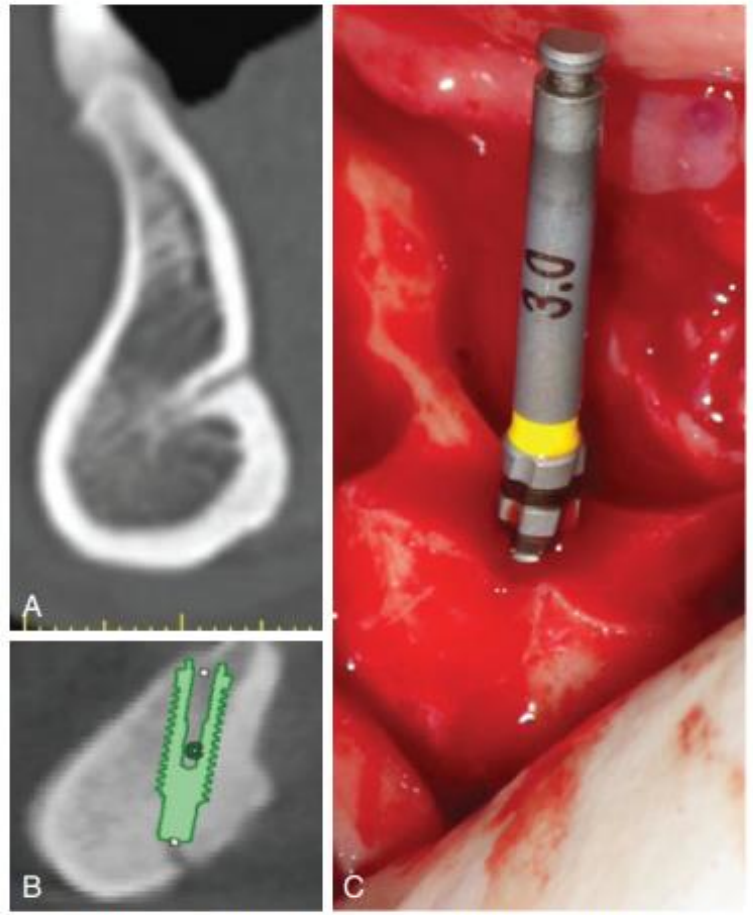


FIG 7.20 Median vascular canal. (A) Canal exhibiting the anastomosis of the right and left sublingual arteries. (B) Implant placed in the midline area may cause significant intraosseous bleeding. (C) Treatment includes placing in the osteotomy site the surgical drill, direction indicator, or implant to stop the bleeding.

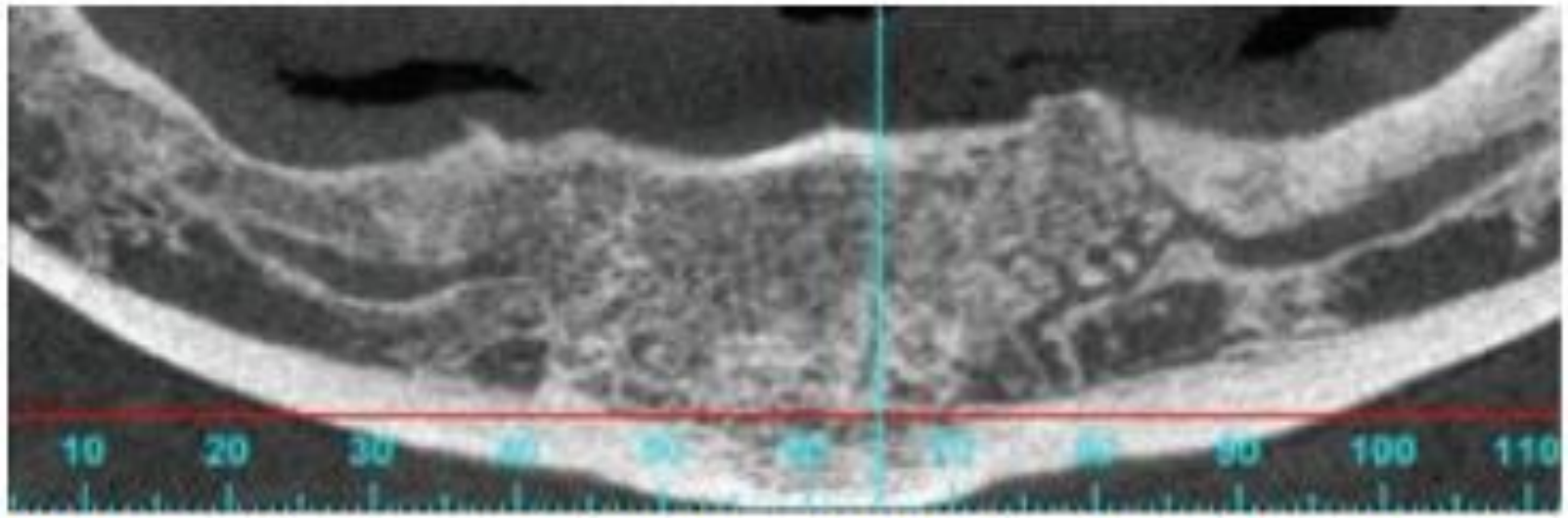


FIG 7.22 Incisive canal. Placement of implants in the interforaminal area may lead to increased bleeding; it is usually self-limited.

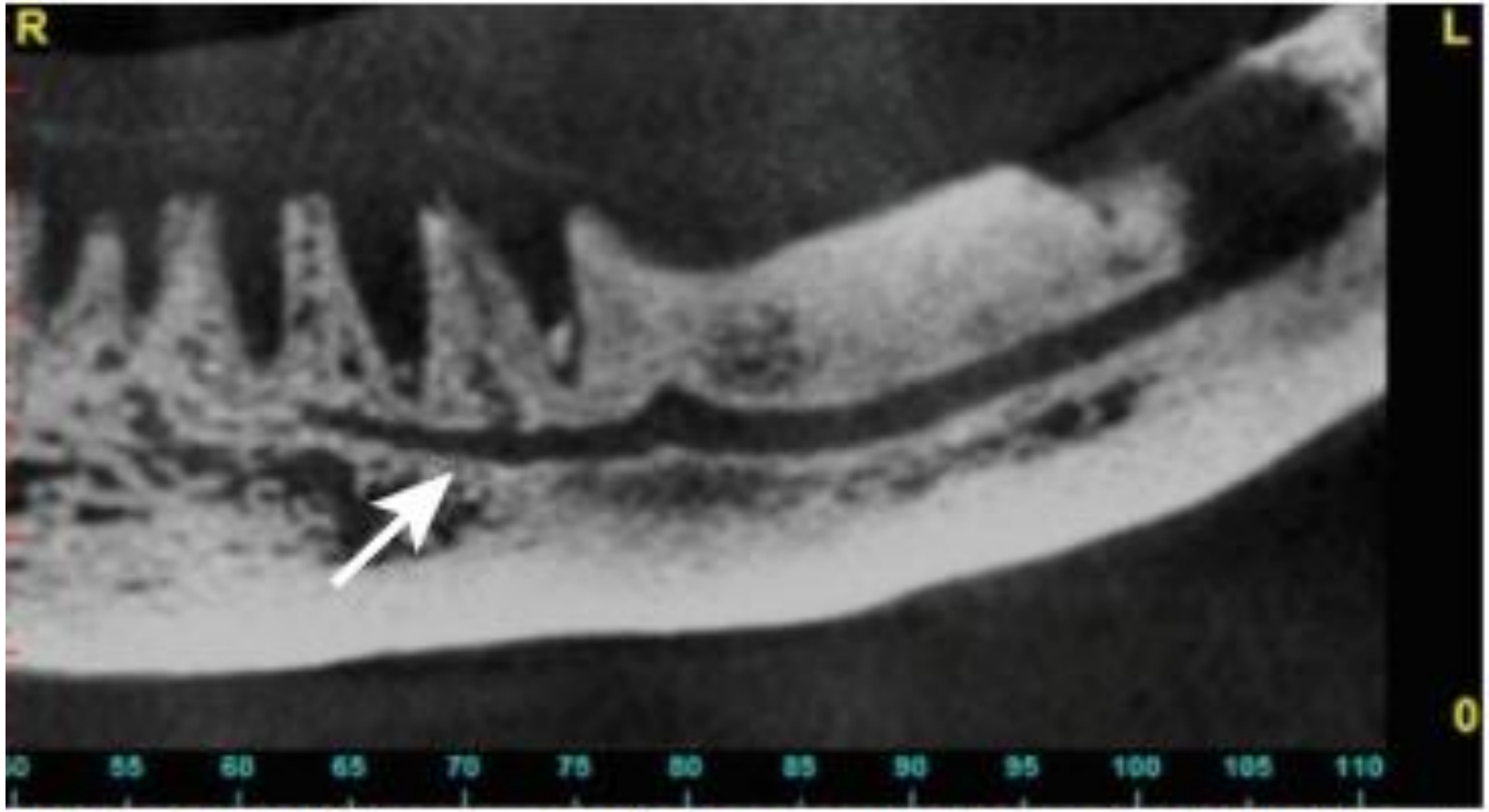


FIG 9.27 CBCT panoramic image depicting incisive branch of IAN *(arrow)*.

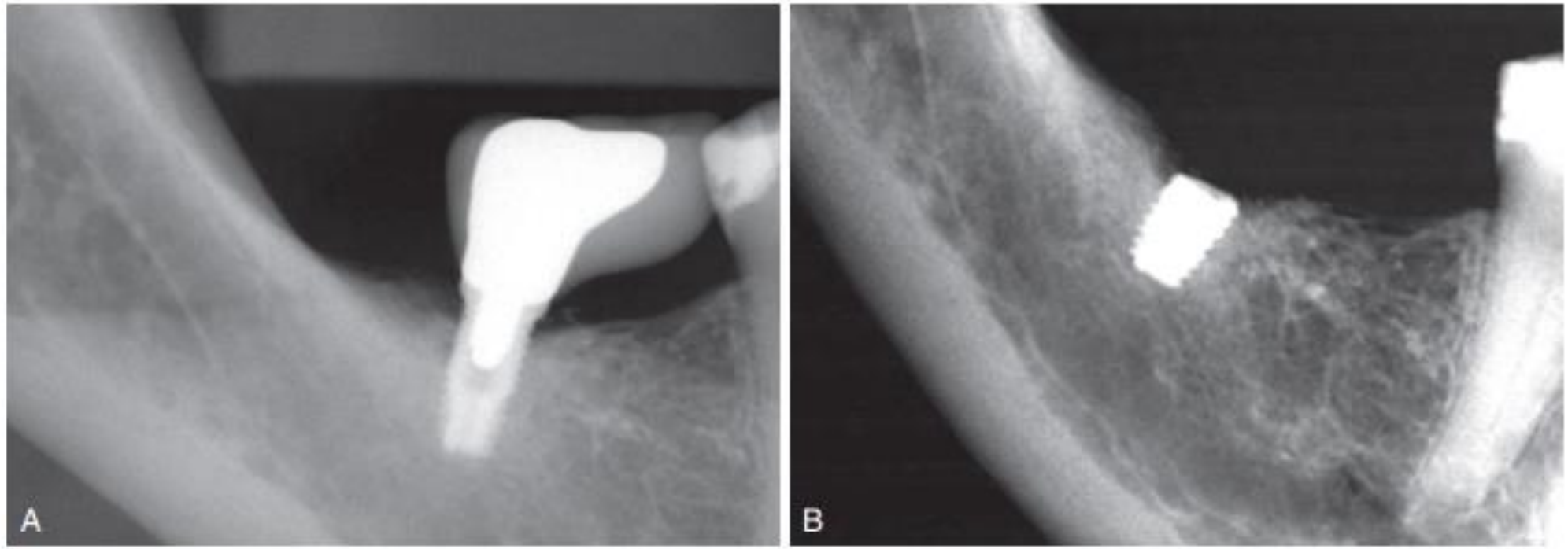


FIG 6.13 (A) A posterior implant with a cantilevered crown to the mesial. (B) The implant fractured within a few years. It is often more predictable to join an implant to a natural tooth than to cantilever from one implant. (From Misch CE: *Dental implant prosthetics,* ed 2, St. Louis, 2015, Mosby.)

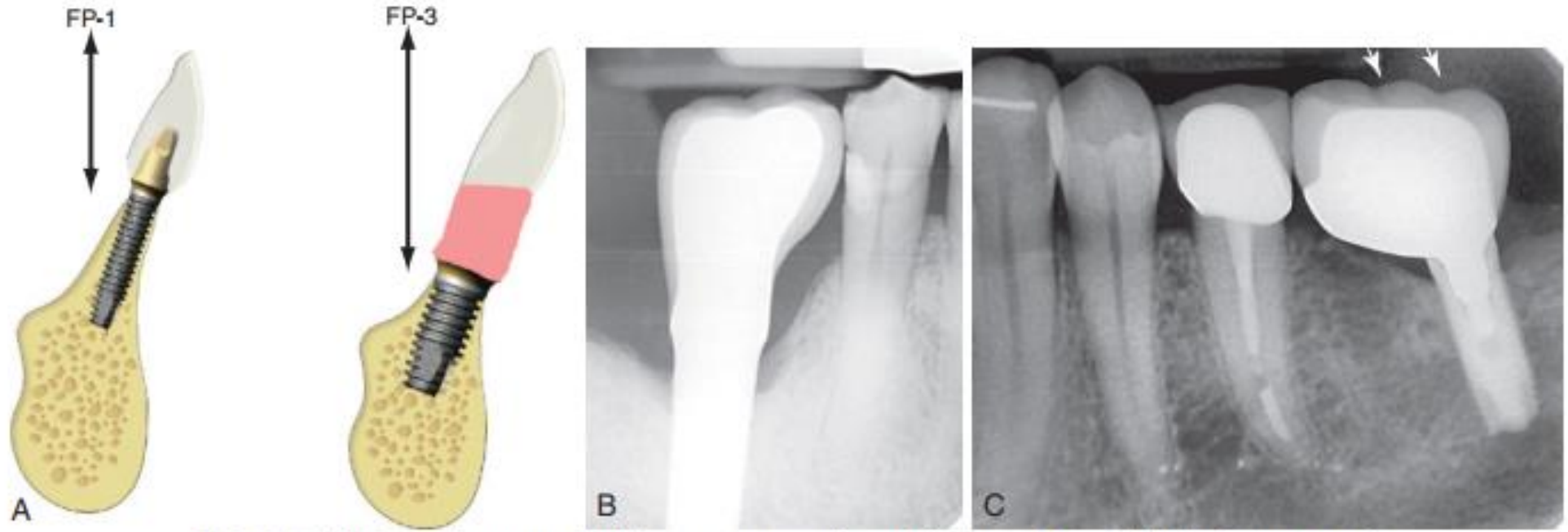


FIG 16.2 (A) Excessive crown height space comparing an FP-3 to a FP-1, which leads to a vertical cantilever to any angle load. (B) Apical placement of implant results in greater force to the prosthesis and abutment screw leading to an increased incidence of screw loosening. (C) Poor implant positioning (e.g., implant placement too far posterior) leading to excessive resultant force from cantilever effect and greater stress on the screw system. Note the significant cusp height and opposing cusp concavity, which increases the shear component of force on the implant system. ([A] From Misch CE: *Dental implant prosthetics,* ed 2, St Louis, 2015, Mosby.)

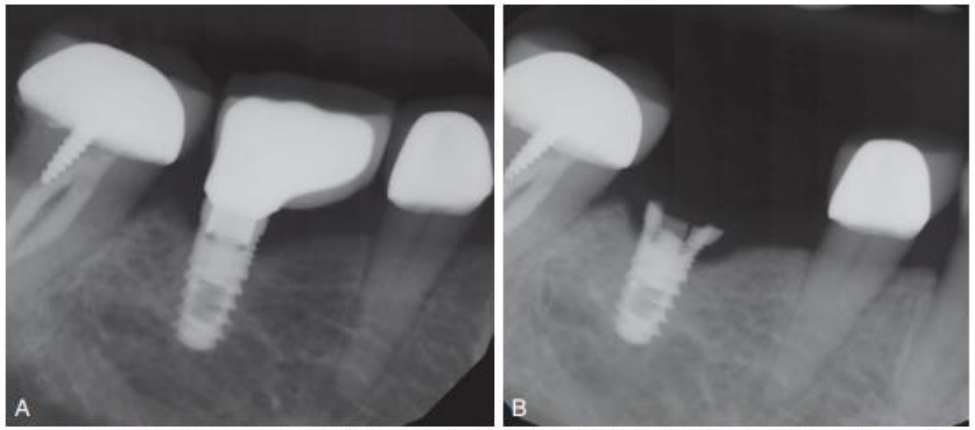


FIG 3.42 Cantilever. (A) Implant distally placed in mandibular right first molar position that resulted in a mesial cantilever. (B) Focre-related fatigue resulted in fracture of the implant body.

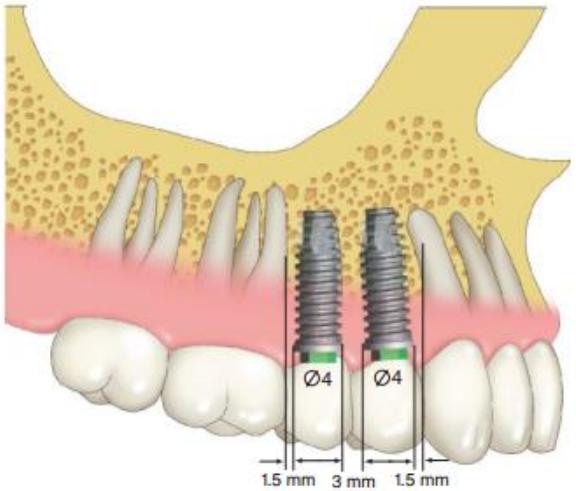


FIG 3.43 When two adjacent teeth are missing in the esthetic

with a cantilever or extension of 20 mm, the mechanical advantage is 2 (20 mm/10 mm). In this example, a 25-lb force on the cantilever results in a 50-lb tensile force on the farthest abutment from the cantilever (25 lb × 2 = 50 lb). The abutment closest to the cantilever (fulcrum) receives a compressive force equal to the sum of the other two forces, or, in this example, 75 lb (25 lb + 50 lb). In other words, the force on the cantilever increases the force on the implants by two to three times (Fig. 3.46). Cantilevers magnify forces to all the abutments supporting the prosthesis.

When a cantilevered force exists, a greater load to the implant farthest from the cantilever results in a tensile or shear type of force, and any part of the implant system is at an increased risk of biomechanical failure (e.g., porcelain fracture, uncemented prosthesis, abutment screw loosening, crestal bone loss, implant failure, implant component or body fracture). This is especially observed when parafunction or increased CHS exists.

To eliminate posterior cantilevers, bone augmentation is