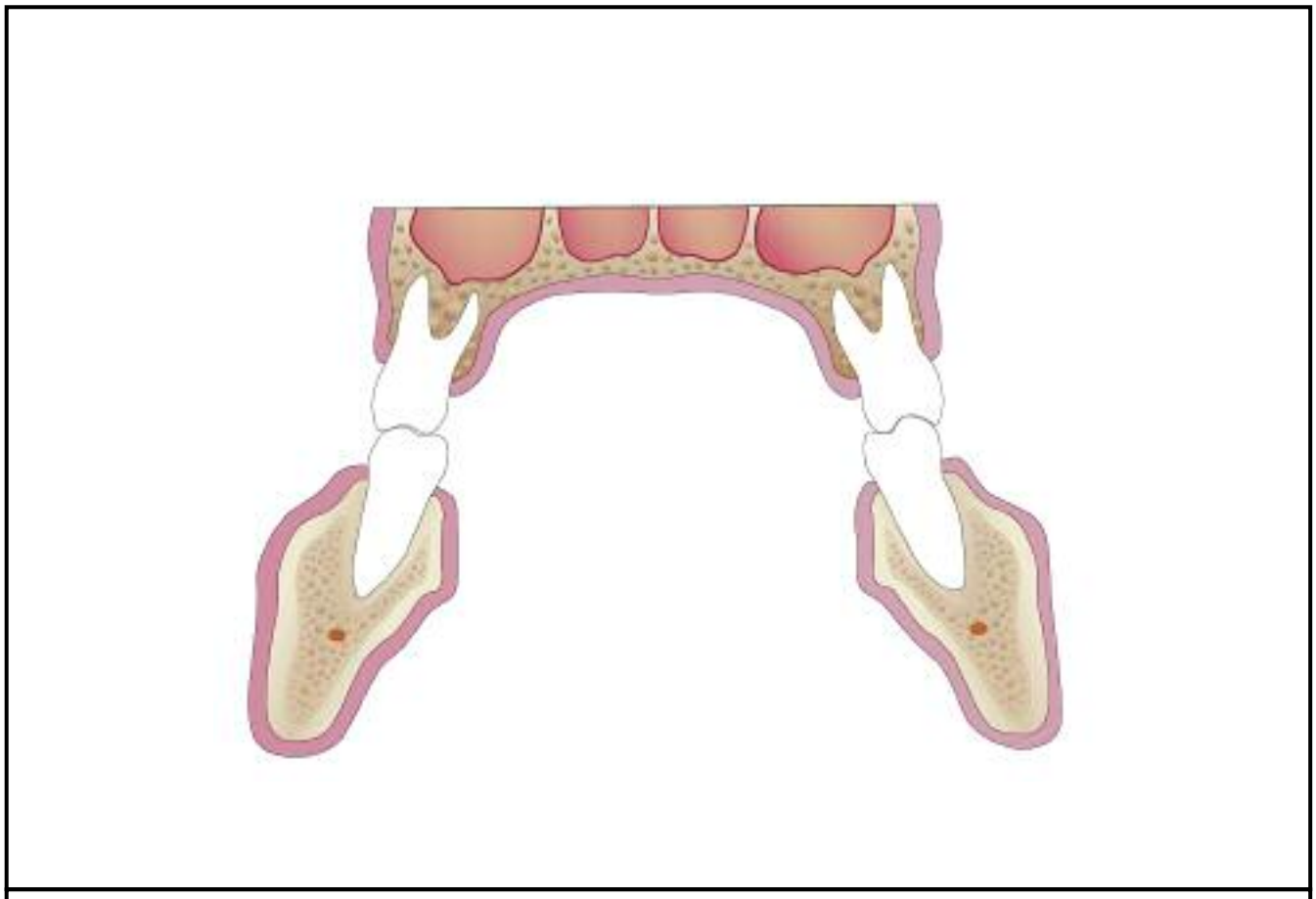

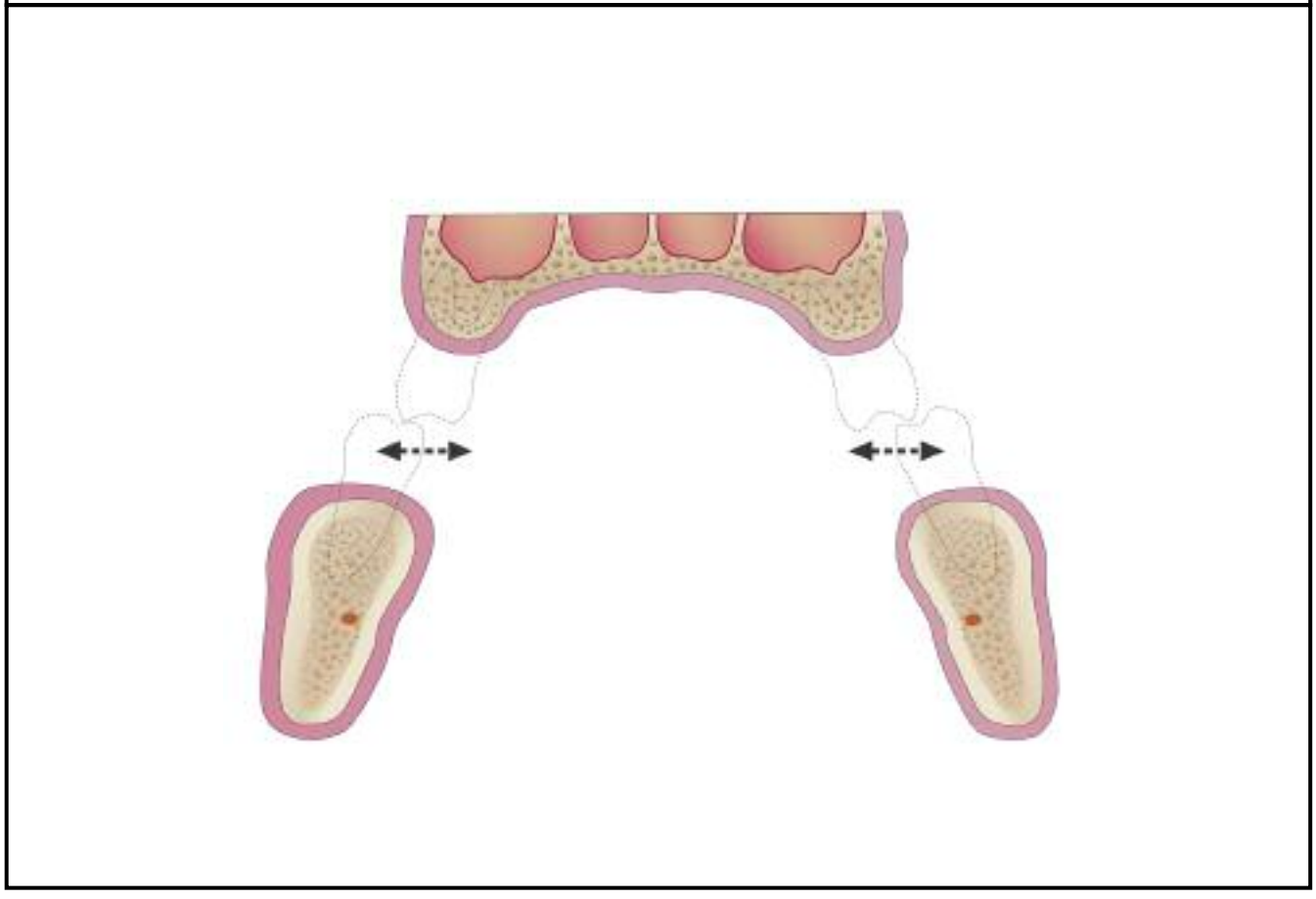

An Interarch Alveolar Ridge Relationship Classification

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Alveolar ridge defects resulting from tooth loss, trauma, periodontal disease, or congenital lesions often require correction prior to dental implant therapy. Numerous classifications proposed to describe alveolar ridge defects have been limited to describe intra-arch relationships. To provide sufficient jaw-to-jaw alveolar ridge (interarch) relationship information for both restorative and surgical treatment decision-making, this article introduces a new interarch alveolar ridge relationship classification system. This article also discusses cone beam computed tomography and multidisciplinary treatment planning options for approaching each classification. (Int J Periodontics Restorative Dent 2010;30:523–529.)

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The classification of alveolar ridge defects most familiar to the dental profession include that originally proposed by Seibert.[1] In such a classification system, a Class I defect represents buccolingual loss of tissue contour and normal apicocoronal ridge dimensions, a Class II defect represents apicocoronal loss of tissue contour and normal buccolingual ridge dimensions, and a Class III defect represents a combination of both width and height deficiencies.[1] However, Seibert's classifications only address the ridge defect within a single arch (intra-arch alveolar ridge defect).[2] Several other classification systems[3–9] and studies[10–14] have evaluated the edentulous ridge, extraction socket, or site preparation for further restorative or surgical treatment plans. However, these classifications and information are also limited to intraarch ridge defects. Since treatment options for an edentulous gap may today include dental implants, the clinician must consider interarch alveolar relationships. With the widespread use of dental implants, evaluating the alveolar bony ridge volume and dimensions should incorporate

Fig 1 (left) *Normal interarch alveolar ridge relationship.* (center) *Posterior and* (right) *anterior sections of a normal interarch relationship.*

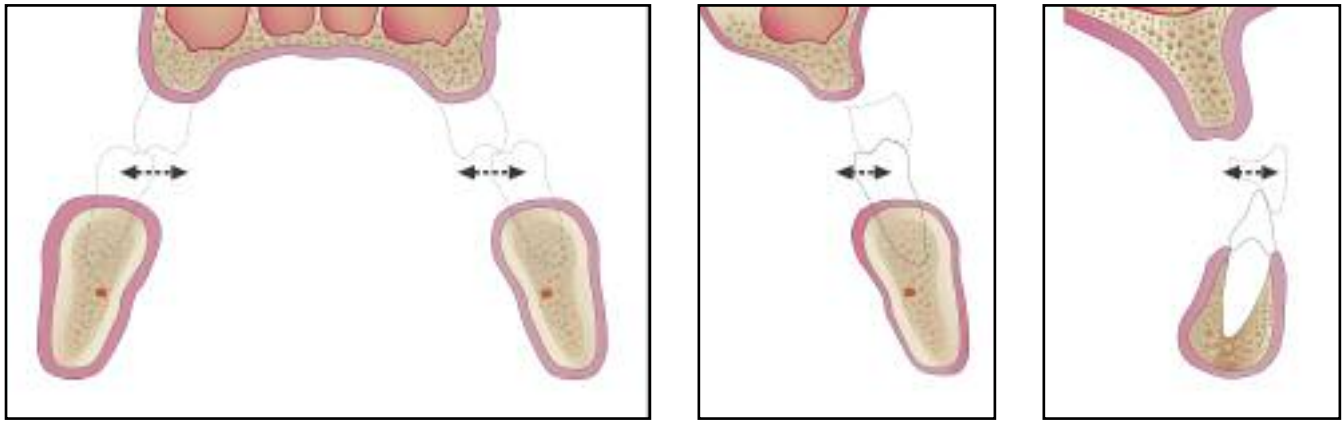

Fig 2 (left) *Class I interarch relationship—horizontal discrepancy.* (center) *Posterior and* (right) *anterior sections of a Class I interarch relationship.*

the interarch relationship to achieve a successful surgical and restorative outcome.

Interarch alveolar ridge classification system

The interarch alveolar ridge classification scheme described here is outlined in Figs 1 to 4. The interarch alveolar ridge Class I relationship represents a discrepancy in the buccolingual direction between that of the maxillary and mandibular alveolar ridge relationship and the normal apicocoronal ridge relationship (Fig 2). The interarch alveolar ridge Class II relationship represents a discrepancy in the apicocoronal direction between that of the maxillary and mandibular alveolar ridge relationship and the normal buccolingual ridge relationship (Fig 3). The interarch alveolar ridge Class III relationship is a combination of the discrepancies of both the apicocoronal and buccolingual directions between that of the maxillary and mandibular alveolar ridge relationship (Fig 4).

Surgical, restorative, and orthodontic treatment options for each interarch classification are described and summarized in Table 1.

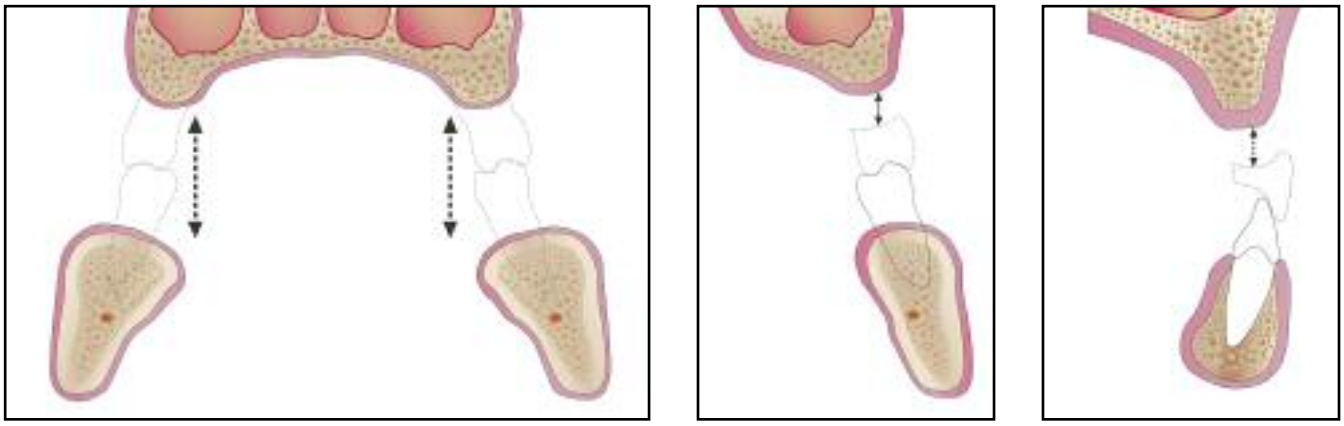

Fig 3 (left) *Class II interarch relationship—vertical discrepancy.* (center) *Posterior and* (right) *anterior sections of a Class II interarch relationship.*

Fig 4 (left) *Class III interarch relationship—both horizontal and vertical discrepancies.* (center) *Posterior and* (right) *anterior sections of a Class III interarch relationship.*

Surgical perspectives

Hard tissue augmentation

- Guided bone regeneration (GBR): Under GBR, bone graft materials and barrier membranes are used to maintain space for bone cells to grow into the defect.[15] There is no statistically significant difference in implant success rates between implants placed in grafted and nongrafted native sites.[16] Tissue engineering materials such as bone morphogenetic protein or platelet-derived growth factor have reported promising implant success rates with GBR procedures in pilot studies.[17,18]
- Monocortical inlay/onlay grafting from intraoral or extraoral sources: The graft material is laid over the defective area to increase width, height, or both of the alveolar jaw bone. The mean lateral augmentation is about 5 mm and vertical augmentation is about 2.2 mm at 6-month reentry.[19] Implant placement in augmented areas presents reasonable survival and radiographic success rates.[20]
- Alveolar ridge splitting: The alveolar ridge is split longitudinally and parted to widen it and allow placement of an implant, graft materials, or both in the void. The

Table 1 Treatment options for each interarch classification

Treatment options	Class I interarch discrepancy*	Class II interarch discrepancy†	Class III interarch discrepancy‡
Surgical			
Hard tissue augmentation	X	X	X
Soft tissue augmentation	X	X	X
Orthognathic surgery	X	X	X
Restorative			
Angled abutment (or custom abutment)	X		X
Restored with crossbite occlusion	X		X
Restored with cantilever prosthesis	X		X
Pink porcelain/pink materials		X	X
Alter the vertical dimension		X	X
Orthodontic			
Forced extrusion		X	X
Maxillary site development	X		X

*Horizontal discrepancy; †vertical discrepancy; ‡horizontal and vertical discrepancy.

implant survival rate at the ridge splitting site is approximately 90%.[21,22] Using Piezosurgery may be beneficial for wound healing and precise cutting.[23]

- Distraction osteogenesis: The technique has been used intraorally for many years. Implant survival rates at distraction osteogenesis–treated sites are similar to those of implants placed in native bone.[24] However, the surgical techniques and complications of distraction osteogenesis are relatively aggressive and advanced.[25]
- Sinus lift procedures: Sinus lift procedures will not alter the interarch alveolar ridge relationship. However, grafting the floor of the maxillary sinus can increase maxillary alveolar bone height internally prior to the placement of endosseous dental implants.[26,27] The two most commonly used surgical techniques are an external approach, such as lateral window sinus bone augmentation,[28] and an internal approach, such as osteotome-assisted transalveolar sinus floor elevation.[29] From a meta-analysis, the average survival rate of implants placed in augmented sinuses of all interventions was found to be 92.6%.[27]

Soft tissue augmentation

- Interpositional (inlay) and onlay soft tissue grafts are indicated for the treatment of small to medium soft tissue defects.[30–32] For large defects, multiple grafting procedures may be needed.[9]
- A roll technique or various connective tissue pouch techniques may be applied.[1,3,33,34]
- An acellular dermal matrix allograft[35] or another bioengineered human dermal replacement[36] may be used in large defects.

Fig 5 (left) *Posterior and* (right) *anterior cone beam computed tomography images used to evaluate the interarch alveolar ridge relationship.*

Orthognathic surgery

In the cases of an extreme deficiency, orthognathic surgery combined with bone grafts may be needed to correct the discrepancy.[37–40]

Restorative perspectives

Implant prostheses give patients and clinicians more treatment options, but also present challenging decisions regarding implant surgery.

Nonaxial loading (angled abutment)

Angled abutments are the treatment of choice when anatomical limitations preclude the axial placement of an implant. Studies were conducted to determine the effect of abutment angulation and the results showed no significant differences between angled and standard abutments for probing depths, gingival level, Gingival Index, and mobility.[41,42] However, to date, no long-term published studies have assessed the effect of nonaxial loading on bone-supported dental implants.[43,44]

Crossbite occlusion

The use of crossbite occlusion with palatally placed posterior maxillary implants can reduce the buccal cantilever and improve axial loading.[45,46]

Cantilever prostheses

Various designs of cantilever prostheses have been discussed and recommended in the literature. However, the fixed implant-supported prosthesis with shorter cantilevers will yield a better survival rate than that with longer cantilevers.[47] However, a long-term follow-up study may be needed to confirm the clinical outcome of cantilever prostheses.[43,48]

Pink porcelain/pink materials

Pink porcelain (materials) may be used to solve the esthetic problems created by moderate ridge resorption and loss of the papilla.[49,50]

Altering the vertical dimension

In the fully edentulous patient or full-mouth reconstructive patient, altering the vertical dimension within the physiologic range may reduce the vertical discrepancy.

Orthodontic perspectives

Forced extrusion

Orthodontic extrusion prior to tooth extraction may be attempted for the correction of a small vertical discrepancy.[51–53]

Maxillary site development

An orthodontic functional device can be used to develop the maxilla in a patient with a minor buccopalatal discrepancy. However, case selection is very critical.[54]

Diagnostic tools

Mounting maxillary and mandibular casts on an articulator with a diagnostic wax-up is the traditional method of evaluating discrepancies. Maximum intercuspation is often used in patients with stable occlusion. However, other jaw-to-jaw relationships, such as retruded contact position, may be applied in patients in need of a full-arch reconstruction. In addition, cone beam computed tomography has been an invaluable tool for not only alveolar topography and pathology detection, but also for implant placement treatment planning.[55] The cone beam computed tomography images were also taken under maximum intercuspation in patients with stable occlusion. Furthermore, the image of the interarch alveolar ridge relationship can be used to evaluate the interarch alveolar ridge relationship (Fig 5).

Conclusion

Interarch alveolar ridge classification may be used as a decision-making tool for periodontists, oral surgeons, restorative dentists, and orthodontists who are involved in dental implant treatment planning. To achieve a successful treatment outcome for both patients and clinicians, cone beam computed tomography images may be used as a diagnostic tool not only for intraarch alveolar ridge topography, but also for interarch alveolar ridge relationship classifications.

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