Gaining Adequate Interdental Space with Elastic Separating Rings against Implants: A Case Series

Ami Smidt, DMD, MSc, BmedSc;* Eyal Venezia, DMD, MSc, BmedSc†

ABSTRACT

Background: It is clinically challenging to place and restore an implant when the mesio-distal space is limited or reduced at the occlusal plane and/or the bone level. Placing implants in these cases while ignoring the clinical difficulties and compromising treatment could limit the successful outcome. Treatment options include strategic extractions, sectional orthodontics, and minor orthodontic movements.

Purpose: To discuss the clinical problems and difficulties arising from limited edentulous mesio-distal space interdentally and to present a treatment modality and technique.

Materials and Methods: Orthodontic elastic separating rings are used to open interdental space between teeth and implants, exerting forces against implants for regaining the needed space and restoring implants with ease.

Results: The advantages of this technique are illustrated by clinical cases.

Conclusions: Implants placed in limited interdental edentulous ridges may well assist in regaining lost spaces after loading. Neither an orthodontic background nor special instruments are required for this technique.

KEY WORDS: elastic separating rings, implant planning, interdental space, minor orthodontics

INTRODUCTION

Restoring a partially edentulous ridge using one or more implants with adjacent teeth on both sides is common practice. In selecting this treatment modality, it is important to analyze the three dimensions of the edentulous ridge as well as bone quality and quantity, soft tissues, and neighboring teeth. The mesio-distal space between teeth has crucial clinical implications in implant dentistry and should be retained or created when absent.

This space may decrease Because of drifting of the adjacent teeth to the edentulous area.[1] Placing and restoring an implant where the mesio-distal space is limited or reduced at the occlusal plane and/or at the bone level is a clinical challenge. Making compromises in such cases or ignoring the clinical difficulties by placing implants without considering the reduced mesio-distal space can result in less than satisfactory treatment outcomes. Complications include accessing the implant site and difficulty in reaching the implant platform to place the prosthetic elements. The aim of this study is to examine the clinical complexities of such cases and introduce a method for minor orthodontic movement using elastic rubber separating rings to manage this situation.

MESIO-DISTALLY LIMITED EDENTULOUS RIDGE

Tooth loss leaving one or more teeth without an antagonist may lead to drifting, tipping, rotation, and overeruption of the adjacent teeth.[2] Most cases present migration of these teeth to the edentulous area, reducing the mesio-distal space. Restoring this edentulous area using dental implants requires particular attention. Failing to consider the migration-related space limitation while placing implants may result in proximity of

*Senior clinical lecturer, Head, The Center for Graduate Studies in Prosthodontics, The Hebrew-University-Hadassah, Faculty of Dentistry, Department of Prosthodontics, Jerusalem, Israel; †clinical lecturer, The Hebrew-University-Hadassah, Faculty of Dentistry, Department of Periodontics, Jerusalem, Israel

Reprint requests: Dr. Eyal Venezia, P.O. Box 363, Ha'Anafa Alley, Zur Moshe 42810, Israel; e-mail: eyal.venezia@gmail.com

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the implant shoulder to the adjacent teeth, causing resorption of the interproximal alveolar crest to the level of that of the implant.[3,4] A frequent consequence of such resorption is a decrease in papilla height. According to Tarnow and colleagues,[5] a minimum distance of 1.5 mm between tooth and implant is essential to maintain bone level and proper soft tissue contours.

Another migration-related complication affecting both surgical and prosthetic treatment is limited surgical access. When the mesio-distal dimension decreases following tooth loss, it is often challenging, and at times even impossible, to place an implant. The prosthetic outcome in these cases is compromised, imposing enlarged contact surfaces and altering embrasure spaces, resulting in smaller and pressed papillae. Such restorations limit the ability of the dental team to provide adequate maintenance and the patient to perform appropriate oral hygiene. Other possible difficulties may be encountered if the adjacent teeth require prostheses. These include tooth preparation, tissue retraction and impression taking, fit verification and prosthetic design, and, above all, patient home care routine and professional maintenance.

The limited mesio-distal space may exist whether one implant intends to replace a single missing tooth, or when two implants replace one missing molar or two adjacent teeth.

In cases of missing mandibular first molars, the missing tooth can be restored using one or two implants.[6] Selecting one treatment modality over the other is further complicated when the adjacent teeth tilt toward to the missing molar area, reducing the ridge space or if periodontal problems develop on the mesial aspect of the tipped tooth.[7] Resolution of a periodontal defect with orthodontics and creating a bed for two implants may be the preferred treatment option.[8]

TREATMENT OPTIONS

One treatment alternative for placing dental implants in limited mesio-distal space may be strategic extraction of an adjacent tooth if that tooth has questionable long-term prognosis and maintaining it might compromise treatment results. However, this article will emphasize the feasibility of utilizing orthodontic methods to create adequate space for proper implant placement and restoration. The cases discussed below describe implants placed prior to the orthodontic and the prosthetic phases.

Orthodontic movements are indicated prior to or after implant placement for the following reasons:

1. Creating satisfactory space for ideal implant placement and restoration.
2. Ensuring sufficient horizontal distance (1.5–2 mm) between the implant and the adjacent teeth[5]
3. Ensuring sufficient horizontal distance (3 mm) between adjacent implants[5]

Orthodontic resolution to create appropriate space may be accomplished using two different treatment modalities:

1. Sectional orthodontics prior to implant placement, which may require referral to an orthodontist
2. Minor tooth movements during the prosthetic phase (ie, after implant placement and loading), such as the technique described here

Figure 1 *Top* – Occlusal view of an old porcelain-fused-to-metal prosthesis compensating for a congenitally missing premolar tooth. *Bottom* – Bitewing radiograph of the ill-fitting prosthesis. Note the mesio-distal reduced edentulous ridge and the molar interproximal crowding.

Determining satisfactory surgical access and developing a comprehensive treatment plan are key points in deciding whether to place an implant before or after the orthodontic phase. All treatment was performed within the Helsinki Accords.

CASE 1: *CONGENITALLY MISSING MANDIBULAR LEFT SECOND PREMOLAR*

A 46-year-old female patient presented to the clinic complaining on discomfort and pain during mastication in the left posterior mandible. Examination revealed an ill-fitting porcelain crown fused to a metal bridge on the first and second left mandibular molars with a mesial cantilever which replaced the congenital absent mandibular second premolar and a carious, periodontally involved third molar. The treatment plan included extraction of the periodontally involved third molar, restoration of the prosthetic work, and replacing the missing premolar with an implant. Computerized tomography (CT) scan evaluation of the edentulous ridge revealed 6 mm, less than the mesio-distal dimension needed (Figure 1). A standard implant platform diameter is approximately 4 mm, which must fit interproximally at the crest of the alveolar ridge leaving at least 1.5–2 mm for proper healing and for papilla to develop between the implant crown and the adjacent tooth.[9] When this space is limited, a narrower implant and platform should be considered to leave adequate space for the insertion. A regular implant platform (3.75×13 mm, 3I, Palm Beach Gardens, FL, USA) was placed with correct implant-tooth distance on the mesial side of the implant, leaving room there for the creation of sufficient papilla. After the appropriate healing period and integration of the implant, the two left mandibular molars were ready to be tipped back against the integrated implant with rubber separating bands (American Orthodontics, Sheboygan, WI, USA). At first, the bands were placed between the implant and the first molar and between the two molars. After 1 week, the gained room increased the mesio-distal

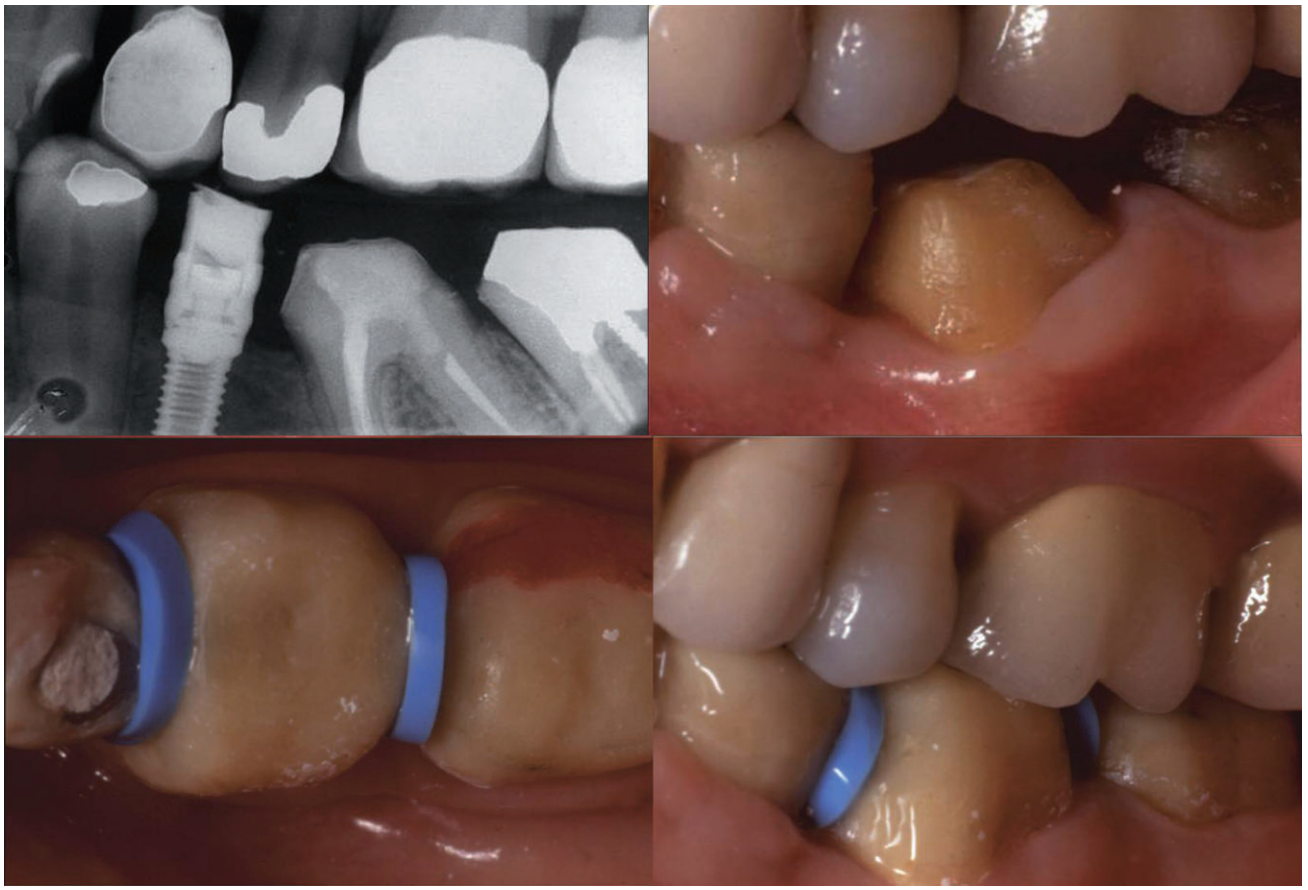

Figure 2 Implant loaded after 3 months of healing and distal movement of the molars was initiated against the implant-supported provisional acrylic crown using separating rubber bands (surgery: Dr. M. Goldstein, Tel Aviv, Israel).

dimensions of the acrylic provisional implant and molars restorations toward restoring the original anatomy. With the positive improvement in the anatomical provisional crowns, the thick bands were used then, applying additional forces on the tipped molars after examining the occlusion and removing any occlusal interference created from the movement. The rings were replaced weekly, adding acrylics until proper dimensions were obtained (Figure 2). The forces exerted against the implant opened adequate interproximal space between the implant and the first molar with formation of proper papilla and embrasure space distal to the implant. The acrylic provisional restorations were adjusted and the situation was evaluated 4 weeks after movement ended. Healing and stabilization was uneventful, thus an aluminous abutment (CerAdapt, Nobel Biocare, Yorba Linda, CA, USA) was engaged to the implant and the case was completed with an all porcelain crown (Procera AllCeram, Nobel Biocare) on the implant and two porcelain gold crowns on the molars (CAPTEK, Precious Chemicals, Altamonte Springs, FL, USA) (Figures 3 and 4). The patient has been maintained through routine professional follow up since the end of treatment (Figure 5).

CASE 2: *MANDIBULAR LEFT PREMOLARS MISSING*

A 74-year-old female patient presented with missing lower left premolars, which had been extracted 5 years earlier. Clinical assessment, including study models and a computed tomography scan of the edentulous ridge, revealed that the limited mesio-distal space would make it difficult to place two implants. As the distance between the mandibular left canine and the left first molar was 12.5 mm, it was decided to place two standard platform straight neck implants (3.75×13 mm, Seven, MIS Implant Technologies, Ltd., Shlomi, Israel). The anterior implant was planned to be positioned 4 mm from the canine (from root to center of the implant) and the second implant 6 mm from the center of the first one.

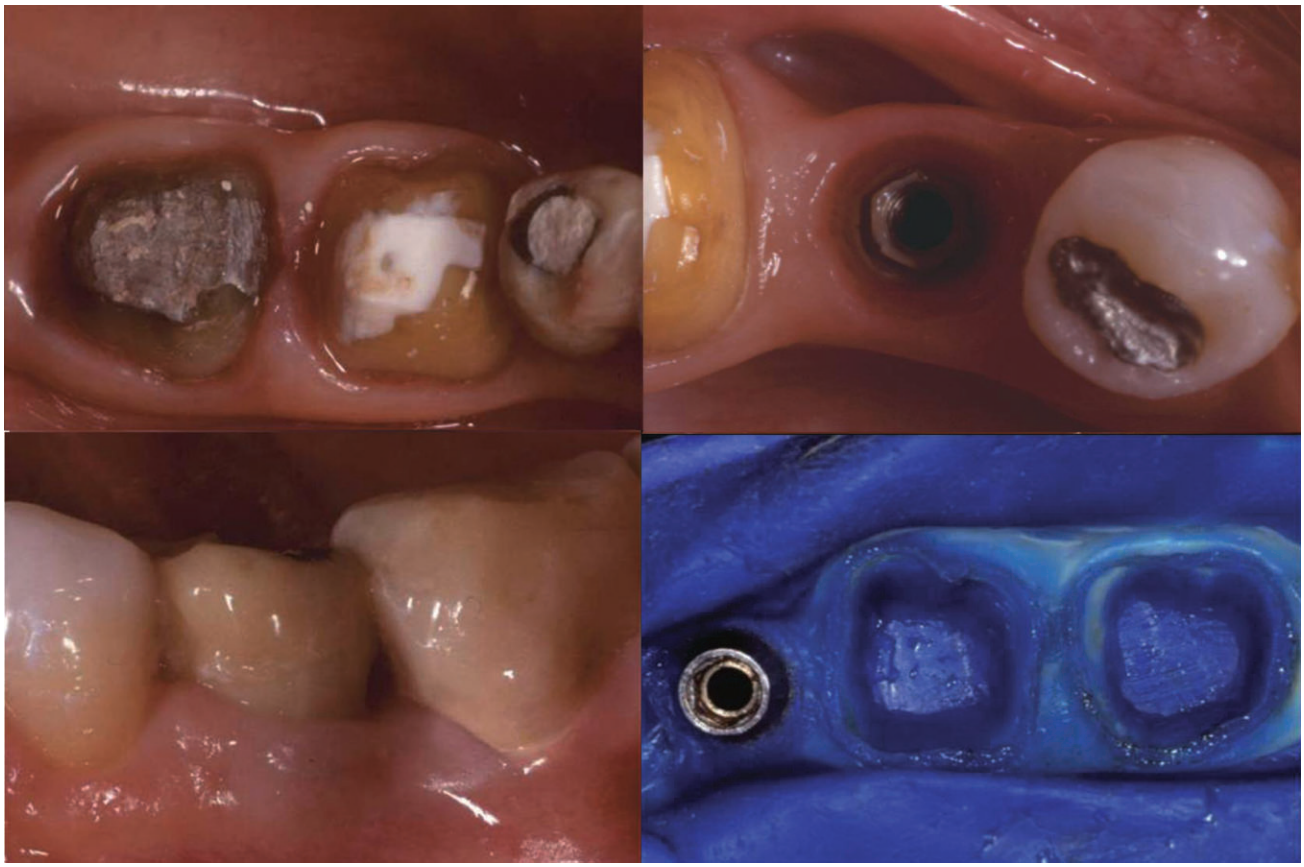

Figure 3 The distal movement of the molars enabled the establishment of proper embrasures, induced tissue health, and allowed convenient impression taking.

Figure 4 Tissue adapts properly, surrounding the alumina implant abutment and the high gold coping, allowing finalizing the case with an all-porcelain implant crown and high gold porcelain fused to metal crowns.

This took into consideration the lack of space between the distal implant and the first molar which would be obtained by applying force against the loaded and healed implants. After the proper healing period, a provisional acrylic restoration was prepared and movement initiated by inserting separating rings between the posterior molars. Four days later, the rings between the second molar and the third molar were replaced by two rings to exert more pressure on the distal molar as the molars were intact. This maneuver allowed gaining more room for the molar's distal movement as the space needed was in the implant–molar area. A week later, a separating ring was inserted between the provisional restoration and the first molar, taking advantage of the initial space created by the rings. After another week, the anterior rings between the implants and the first molar and between the first molar and the second molar were replaced with a thicker dimension, increasing the force (Figure 6). The ring between the second molar and the third molar was not changed. The rings were replaced several times until sufficient space was obtained between the distal implant and the first molar. The acrylic contact point on the provisional restoration was modified as needed

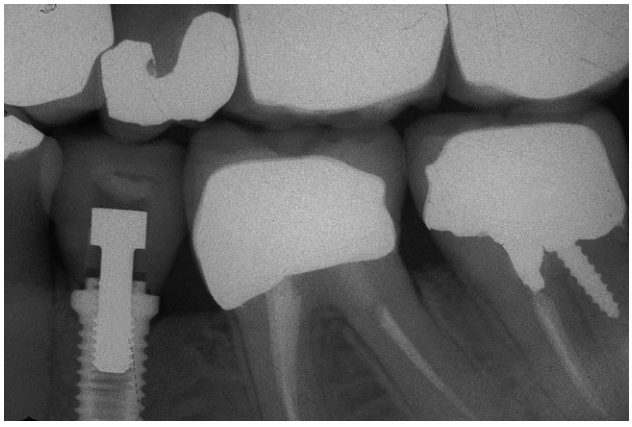

Figure 5 Bitewing radiograph taken nearly 10 years after implant placement illustrating the bone level surrounding the implant and the stability of the treatment.

Figure 6 *Top left* – Radiograph demonstrating the space situation and illustrating the difficulty of placing the second implant in the molar side of the area. *Top right* – Occlusal view of the implants showing the lack of space between the distal implant and the mesial aspect of the molar. *Bottom left* – Occlusal view of the initial implant provisional acrylic restoration and the rubber separating rings. To gain more distalization of the third molar, two rubber rings were placed in between the second and third molar. *Bottom right* – Thicker rings used to preserve the gained place and to exert more pressure on the teeth against the implants. Note the extent of the opening gained.

to ensure the rings remained in position. When the proper space was gained, the provisional restoration was relined and left in place for 4 weeks.

Routine procedures were taken to restore the implants with fixed prosthetic restorations (Figure 7). The lower molars stabilized a short time later without complications.

CASE 3: *MAXILLARY LEFT PREMOLARS MISSING*

A 68-year-old male patient presented with missing left premolars and chronic periodontitis. Following initial examination and periodontal surgery, the treatment plan was to restore the maxillary left premolars with implant-supported fixed restorations. Space evaluation of the edentulous ridge with a CT scan revealed limited space between the roots for restoring two implants with crowns amenable for patient oral hygiene (12.5 mm in crestal level mesio-distally). The implants (3.75×13 mm, Biocom, MIS Implant Technologies, Ltd.) were placed using a surgical stent designed to allow acceptable distances between the canine and the mesial implant and in the interimplant area. The planning dictated proximity between the distal implant and the first molar, a situation resolved after loading the implants by minor orthodontic means (Figure 8). In the second stage surgery, the implants received a provisional acrylic bridge restoration. A rubber separating band was inserted between the distal implant and the adjacent molar tipping it distally (Figure 9). The action was repeated several times as previously described until an acceptable embrasure was created.

Figure 7 *Top left* – Occlusal view presenting the well-established distance between the distal implant and the molar, allowing easy impressions and prosthesis fabrication. *Top right* – Lateral view of the final prosthesis 12 months after delivery. *Bottom left* – Radiograph of prosthesis 12 months after delivery. *Bottom right* – Occlusal view of the prosthesis. Note the prosthesis correct proportions following the movement. The arrested decay in the first molar's mesial marginal ridge was removed and restored with composite material.

After a 4-week retention period, the prosthetic phase was performed.

DISCUSSION

Absence of a tooth or teeth where adjacent teeth are present on both sides of the edentulous ridge may lead to tooth drifting and interdental space loss.[1] Restoring the edentulous ridge using implant-supported restorations requires recreating the lost interproximal space. In doing so, the implants can be properly placed, ensuring optimal functional and aesthetic prosthetic outcomes. Ignoring this limited space and placing an implant in unacceptable proximity to the adjacent teeth may lead to interproximal alveolar crest resorption, decrease of the papilla height, and attachment loss. In addition, decreased mesio-distal space may limit surgical access, thereby complicating implant placement and restoration.

In the anterior area, the space needed for implant-supported restoration can be estimated using the contralateral tooth measurements.[10] In the premolar area, each implant requires a distance of about 7 mm and the distance between the two sites should be no less than 7 mm, measured from center to center of the implants. When considering wide diameter implants for molar restoration, a distance of about 8.5–9 mm is considered adequate.

The mesio-distal aspect is important for various reasons:

1. Assists in the establishment of soft tissue contour with an intact interproximal papilla and a gingival

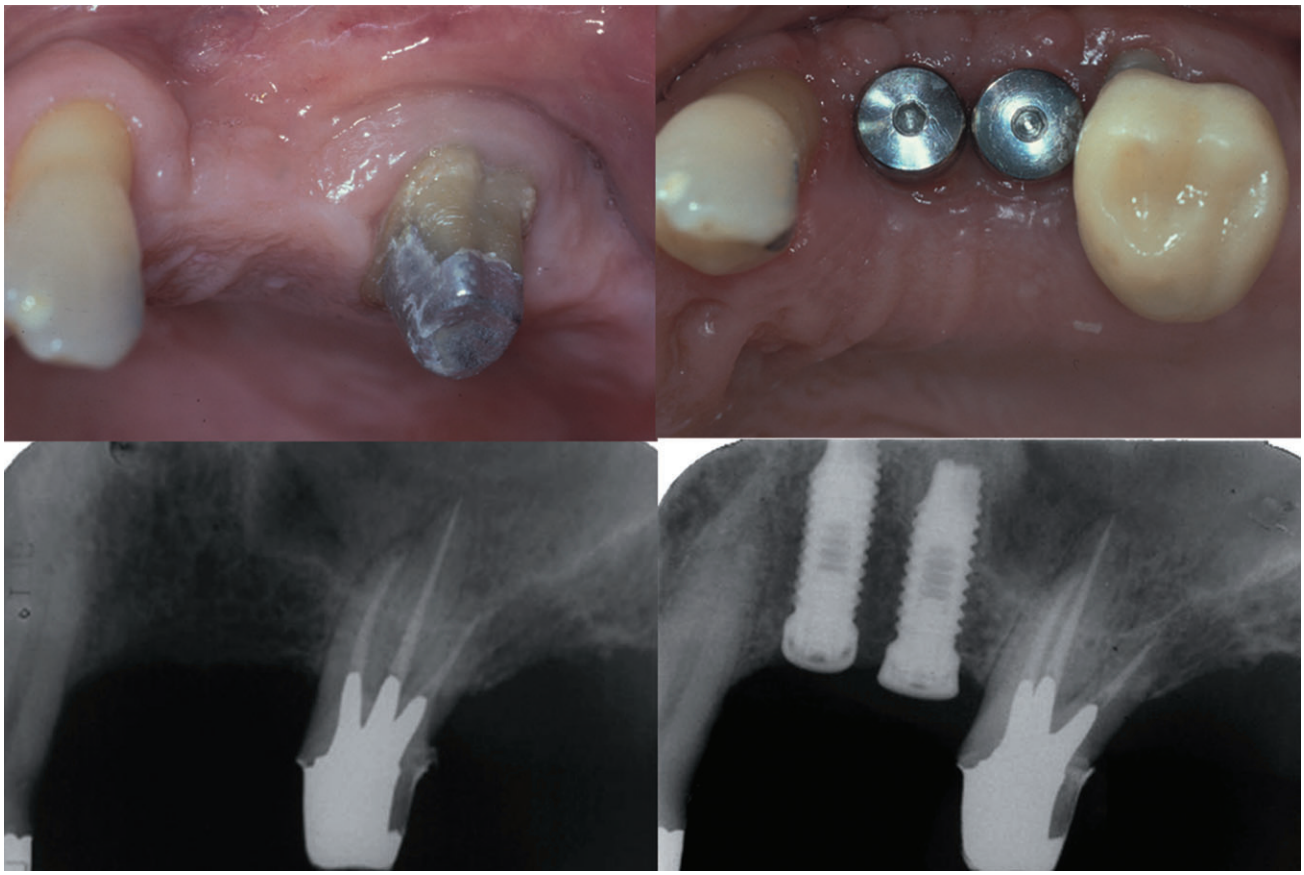

Figure 8 Lateral view of the edentulous ridge before and after placement of two regular implants. Note the space problem between the distal implant and the mesially inclined molar. The postoperative radiograph shows the lack of space and the closed sinus lift procedure.

outline in harmony with the gingival margin of the adjacent healthy dentition[11]
2. Helps maintain the crestal bone level around two or more implants[5]
3. Allows recreation of correct anatomy and contact points with the adjacent teeth or implant-supported restorations

As previously stated, there are three main treatment alternatives for limited ridge space. Strategic extraction is a common treatment modality, followed by a multiple unit fixed partial denture or an implant-assisted restoration. Even if extraction is the treatment of choice, enlarging the interdental space orthodontically prior to or after extraction is sometimes recommended, followed by a reevaluation of the situation for implant placement. The theory behind this approach is the topographical improvements gained by the movement.[8] A second option is sectional orthodontics, a highly predictable treatment modality, but one requiring professional orthodontic skills and instrumentation that not all general practitioners possess. It is also more time consuming and requires more anchorage than the alternative technique using elastic separating rings against an implant (Figure 10).

The third treatment option is the technique using elastic separating rings discussed here. This is a simple procedure and can be performed by general practitioners without using fixed orthodontic appliances. Moreover, from an anchorage point of view, it is preferable to tip a tooth for separation purposes using an adjacent implant or a tooth[12] rather than using a greater arch to enable the movement.

The elastic separating ring technique utilizes the increasing space gained by replacing one ring with two

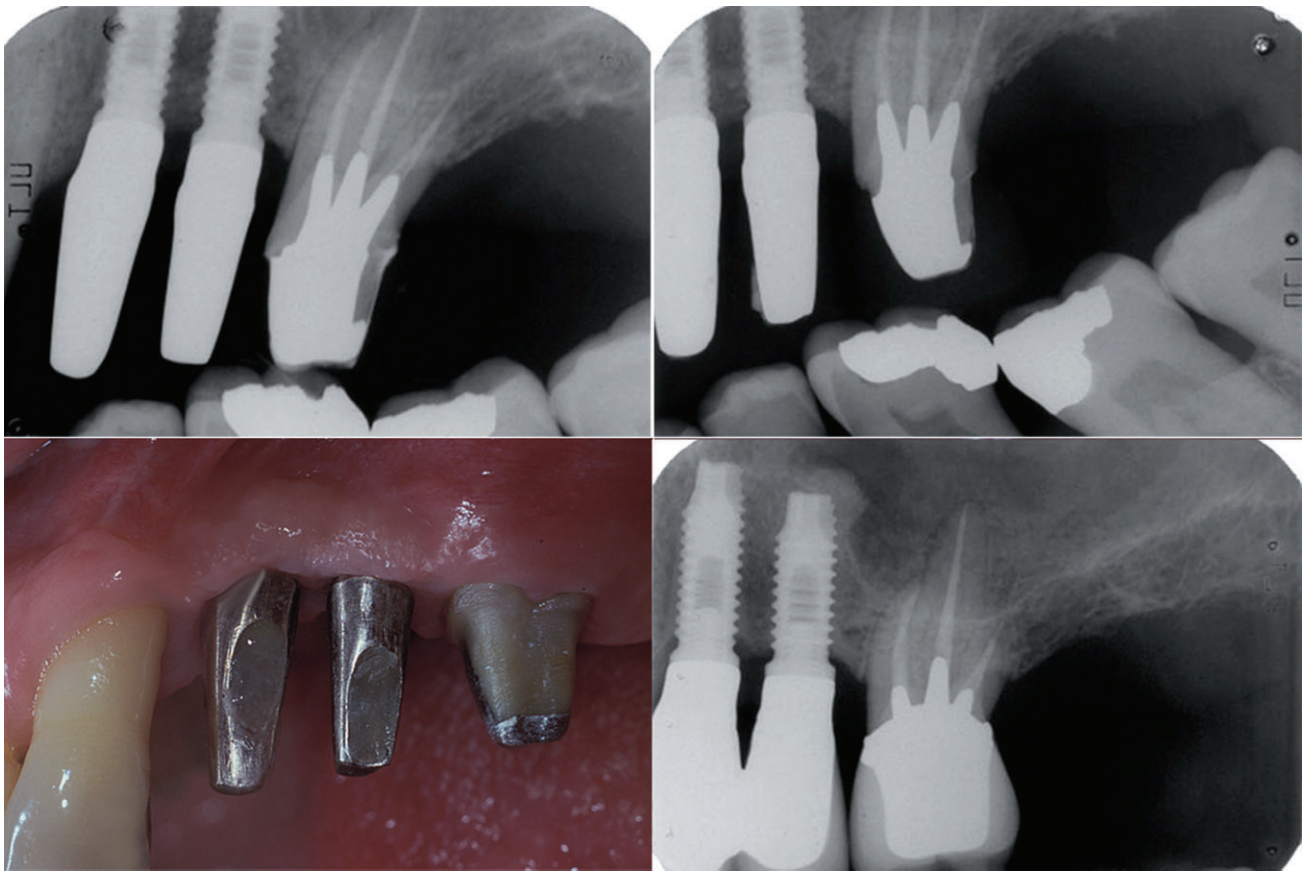

Figure 9 Following healing, the implants were exposed and loaded with a provisional acrylic restoration. The molar was tipped distally with separating rings, establishing correct interproximal relations. Note the change gained after the movement, both clinically and in the radiographs, which made the way for the final restoring procedures.

rings or consecutively a thicker one until the desired space is obtained. When a provisional acrylic resin crown is combined with this separation action, the space may be further expanded by adding self-polymerizing acrylic resin to the proximal side, increasing the crown dimension before each ring replacement. Once the adequate space is gained and after several weeks of retention by provisional restorations with tight contact points, prosthetic procedures may be completed.

For the patient, this technique is easy to tolerate, although some pain and inconvenience may be experienced. Care should be taken, especially when using the thicker rings, as they can cause local occlusal disturbances.

The main disadvantage is the tendency of the elastic separating rings to loosen and become displaced as space is created. Therefore, the rings should remain in place only for a few days and close professional follow-up is important. It is possible that a ring may be forced down into the interproximal space and cause irreversible periodontal damage (this is less probable with thicker rings). It is recommended to advise the patient to immediately report any ring displacement.

As previously mentioned, appointments should be at intervals of several days. Under no circumstances should the separators be left in place for more than 2 weeks.[13] The decision to cease treatment is made on clinical and radiographic evaluation, keeping in mind the restorative requirements.

A question may be brought up, why to bother with separating rings as instead, one can simply slice the interfering proximal wall of an inclined adjacent tooth. The authors oppose that approach as sacrificing tooth material will never change the

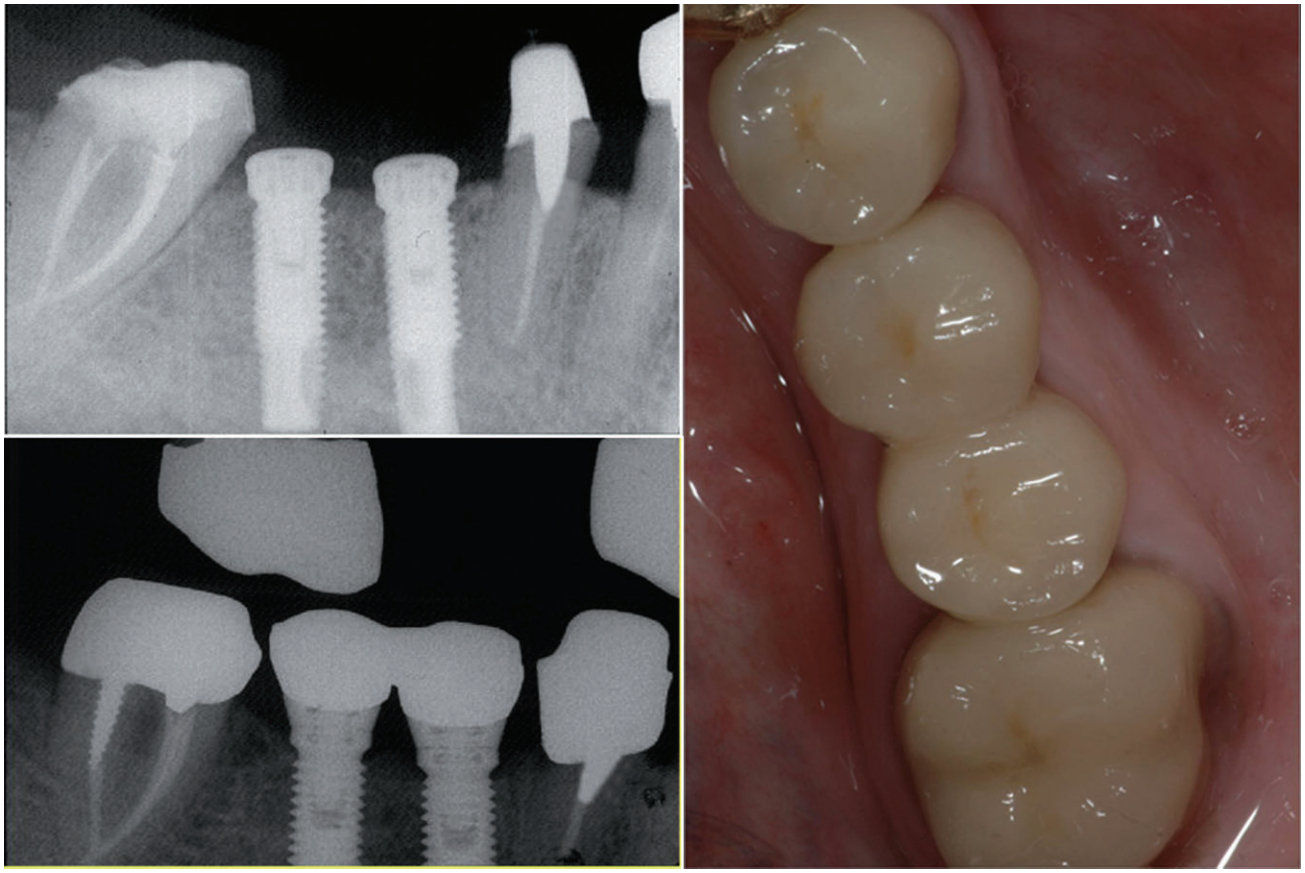

Figure 10 A missing right mandibular first molar area. Two implants were placed. The space between the distal implant and the adjacent second molar was gained with separating rings, applying forces against the healed and loaded implant.

compromised mesio-distal distance in the crestal level and sometimes demands an unacceptable tooth material reduction. Such an action, will interfere with achieving the correct prosthetic anatomy and hence, the patient's ability to keep proper oral hygiene. Also, sacrificing proximal tooth material may weaken the tooth, be the cause for teeth hypersensitivity, and may increase the risk for caries. The irreversible proximal reduction of tooth material definitely minimizes the embrasure space which is crucial for the existence of normal papilla and maintaining periodontal health.[14,15]

SUMMARY

Prosthetic failure is frequently related to inadequate oral hygiene measures and infrequent professional maintenance. Many of these failures can also be attributed to an inadequate contact point and proximity of the teeth. The main goal of prosthodontics is to restore lost anatomic structures. The technique using modified elastic separating rings enhances treatment results. The tipping action improves the interproximal topography and facilitates prosthetic procedures.

The cases presented here demonstrate that the use of modified elastic separating rings is an easy and simple technique that can be used by the general practitioner in daily practice. It is more convenient to the patient, less time consuming, less expensive, and does not require referral out of the clinic. Therefore, patient compliance is likely to be better than with the conventional orthodontic appliance. A flow chart is presented to help the practitioner in taking the right measures toward solving the crowding problem (Figure 11).

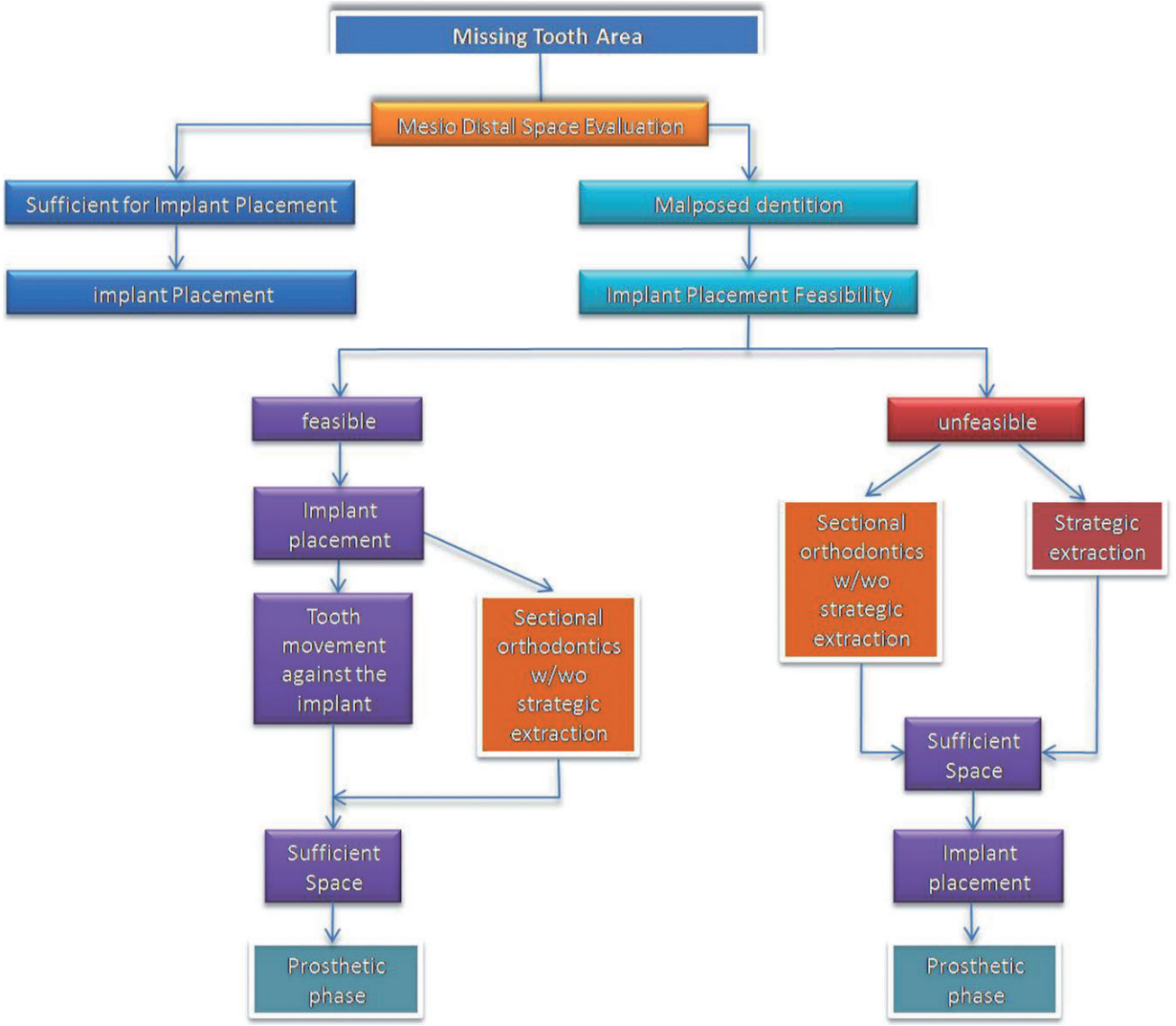

Figure 11 Sequence of decision-making when evaluating a missing tooth area with adjacent teeth.

REFERENCES

1. Stern N, Revah A, Becker A. The tilted posterior tooth. Part I: etiology, syndrome, and prevention. J Prosthet Dent 1981; 46:404–407.
2. Amsterdam M. Periodontal prosthesis. Twenty-five years in retrospect. Alpha Omegan 1974; 67:8–52.
3. Esposito M, Ekestubbe A, Gröndahl K. Radiological evaluation of marginal bone loss at tooth surfaces facing single Brånemark implants. Clin Oral Implants Res 1993; 3:151–157.
4. Andersson B, Odman P, Lindvall AM, Lithner B. Single-tooth restorations supported by osseointegrated implants: results and experiences from a prospective study after 2 to 3 years. Int J Oral Maxillofac Implants 1995; 10:702–711.
5. Tarnow DP, Cho SC, Wallace SS. The effect of inter-implant distance on the height of inter-implant bone crest. J Periodontol 2000; 71:546–549.
6. Balshi TJ, Hernandez RE, Pryszlak MC, Rangert B. A comparative study of one implant versus two replacing a single molar. Int J Oral Maxillofac Implants 1996; 11:372–378.
7. Lubow RM, Cooley RL, Kaiser D. Periodontal and restorative aspects of molar uprighting. J Prosthet Dent 1982; 47:373–376.
8. Brown IS. The effect of orthodontic therapy on certain types of periodontal defects. I. Clinical findings. J Periodontol 1973; 44:742–756.
9. Gastaldo JF, Cury PR, Sendyk WR. Effect of the vertical and horizontal distances between adjacent implants and between

a tooth and an implant on the incidence of interproximal papilla. J Periodontol 2004; 75:1242–1246.
10. Chiche G, Pinault A. Esthetics of anterior fixed prosthodontics. Hanover Park, IL: Quintessence Publishing, 1994.
11. Choquet V, Hermans M, Adriaenssens P, Daelemans P, Tarnow DP, Malevez C. Clinical and radiographic evaluation of the papilla level adjacent to single-tooth dental implants. A retrospective study in the maxillary anterior region. J Periodontol 2001; 72:1364–1371.
12. Smidt A, Venezia E. Gaining adequate interdental space with modified elastic separating rings: rationale and technique. Quintessence Int 2002; 33:409–414.
13. Proffit WP. Contemporary orthodontics. 2nd ed. St. Louis, MO: CV Mosby, 1996:350.
14. Heitz-Mayfield LJ. Peri-implant diseases: diagnosis and risk indicators. J Clin Periodontol 2008; 35(Suppl 8):292–230.
15. Porter JA, von Fraunhofer JA. Success or failure of dental implants? A literature review with treatment considerations. Gen Dent 2005; 53:423–432.