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Diah Ayu Maharani
Editor

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CONTENTS

Preface xi

Section 1: Oral Medicine, Orthodontics, and Oral Surgery 1

Chapter 1 Psychological State: A Hidden Factor That Influences the Management of Hyposalivation 3
Anzany Tania Dwi Putri, Imelda Ika Dian Oriza, Marco Meleti and Yuniardini Septorini Wimardhani

Chapter 2 The Challenge in Predicting Malignant Transformation of Oral Lichen Planus 13
Her Basuki Margono and Irna Sufiawati

Chapter 3 Oral Lichen Planus: Impact of Psychological Stress due to Environmental Changes 27
Yohana Alfa Agustina, Anandina Irmagita Soegyanto, Siti Aliyah Pradono, Harum Sasanti and Gus Permana Subita

Chapter 4 Challenges in Establishing a Definitive Diagnosis of the Disease Underlying a Clinical Presentation of Desquamative Gingivitis 37
Rani Handayani, Siti Aliyah Pradono, Diah Rini Handjari, Anak Iamaroon and Yuniardini Septorini Wimardhani

Chapter 5 Orthodontic Camouflage Treatment of Class III Skeletal Malocclusion with Severe Deep Bite and Impacted Upper Canine Using Preadjusted Appliances 47
Ardiny Andriani and Retno Widayati

Chapter 6 Management of Unilateral Cleft Lip and Alveolus with Orthodontic Treatment and Alveolar Bone Graft 59
Devina Yastani and Miesje Karmiati Purwanegara
Contents

Chapter 7  
Class II Furcation Involvement Treatment with Bone Graft and Platelet-Rich Fibrin  
*Ina Hendiani and R. Heni Puspitadewi*  
73

Chapter 8  
Aesthetic Surgical Crown Lengthening in the Anterior Teeth  
*Nita Nurniza and Agus Susanto*  
85

Chapter 9  
Minimizing the Recurrence Risk of Mucocele by Surgical Excision  
*Stella Lesmana, Danar Pradipta Rani and Mochamad Fahlevi Rizal*  
95

Chapter 10  
Comparison of Fibrous Epulis Case Management Techniques Using Conventional and Electrosurgery  
*Stevany Grafiyanti, Herlis Rahdewati, Robert Lessang, Yuniarti Soeroso and Antonius Irwan*  
101

Chapter 11  
Management of Cervico-Facial Subcutaneous Emphysema Following Third Molar Surgery  
*Pagna Chen, Sandeth Phan, John Arvier and Callum Durward*  
113

Chapter 12  
Two Case Reports on the Use of the Buccal Fat Pad to Repair Oral Antral Fistulas  
*Ratanak Sreng and Hok Sim Kor*  
119

Section 2: Periodontology  
127

Chapter 13  
The Evaluation of Fibrous Epulis Excisional Biopsy  
*Nadia Regina Sukmamulyani Kodrat, Yuniarti Soeroso, Fatimah Maria Tadjoedin and Pradono*  
129

Chapter 14  
Open-Flap Debridement Followed by Vestibuloplasty in a Patient with Periodontal Disease  
*Naomi M. C. Sianipar, Stephanie Dwiyanti, Robert Lessang and Yulianti Kemal*  
141

Chapter 15  
Vestibuloplasty in a Patient with Hypertension  
*Chaerita Maulani, Zullia Taifyanti, Isni Yunita Rahayu and Sri Lelyati C Masulili*  
153

Chapter 16  
Coronally Advanced Flap (CAF) for Treatment of Non-Carious Cervical Lesion Associated Single Gingival Recession  
*Noer Ulfa, Lambang Bargowo, Anneke Paramita, I Komang Evan Wijaksana and Ernie Maduratma Setiawatie*  
163
<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Authors</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td>Gingival Recession Management with a Combination of Non-Surgical and Surgical Therapies</td>
<td>Edward Dwingadi, Fatimah Maria Tadjoedin, Yudha Rismanto and Yuniarti Soeroso</td>
<td>169</td>
</tr>
<tr>
<td>18</td>
<td>Treatment of Generalized Aggressive Periodontitis</td>
<td>Mardiana Andi Adam, Nurfaisah, Surijana Mappangara, Sri Oktawati and Mansjur Nasir</td>
<td>181</td>
</tr>
<tr>
<td>19</td>
<td>Management of Mobile Teeth Caused by Trauma from Occlusion with Coronoplasty</td>
<td>Olivia Nauli Komala, Nadia Regina, Fatimah Maria Tadjoedin, Nadhia Anindhita Harsas and Robert Lessang</td>
<td>191</td>
</tr>
<tr>
<td>20</td>
<td>The Need for Periodontal Dressing after Gingival Depigmentation Procedures</td>
<td>FX Andi Wiyanto, Eric Sulistio, Natalina Haerani, Robert Lessang and Felix Hartono</td>
<td>203</td>
</tr>
<tr>
<td>21</td>
<td>A Resective Procedure on the Furcation Defect of Non-Vital Lower First Molar</td>
<td>Veronica Septnina Primasari</td>
<td>213</td>
</tr>
<tr>
<td>22</td>
<td>Electromyography (EMG) Feedback Approach to Managing Trauma from Occlusion with Chronic Pain</td>
<td>Hasanuddin Thahir, Maisaroh Dinyati, Arni Irawaty and Husnul Mubarak</td>
<td>221</td>
</tr>
<tr>
<td>23</td>
<td>A Regenerative Approach to Managing Bone Defects Caused by Traumatic Occlusion</td>
<td>Arni Irawaty Djais, Sulastrianah, Hasanuddin Thahir, Muliati Yunus and Oryza Sativa</td>
<td>229</td>
</tr>
<tr>
<td>24</td>
<td>Sinus Floor Elevation with Crestal Approach Simultaneously before Implant Placement</td>
<td>Dimas Ilham Hutomo, Syanti Wahyu Astuty, Robert Lessang and Antonius Irwan</td>
<td>239</td>
</tr>
<tr>
<td>25</td>
<td>Alveolar Ridge Preservation Using Allograft and Alloplast Materials</td>
<td>Maximilianus Felix Cipta, Syanti Wahyu Astuty, Fatimah Maria Tadjoedin, Yuniarti Soeroso and Ette S. Tadjoedin</td>
<td>249</td>
</tr>
</tbody>
</table>
Chapter 26  Gingiva Depigmentation Techniques Using Abrasion Diamond Bur Compared with an Er: YAG laser  
Alfonsius Agus Jayadi and Hari Sunarto  

Chapter 27  Tongue Tie Frenectomy Using Erbium-Doped Yttrium Aluminum Garnet (Er: YAG) Laser  
Eric Sulistio and Hari Sunarto  

Chapter 28  Frenectomy Consideration in Root Coverage Procedure with Connective Tissue Graft  
Rachel Yuanithe, Syanti Wahyu Astutty, Fatimah Maria Tadojoedin, Robert Lessang, Yudha Rismanto and Antonius Irwan  

Chapter 29  Root Coverage in Class I Gingival Recession Defects Using a Coronally Repositioned Flap: A Three-Year Follow-Up  
Prajna Metta and Aldilla Miranda  

Chapter 30  Evaluation of Intrabony Defect Treatment Using Allograft and Xenograft  
Robert Fernando, Syanti Wahyu Astutty, Yuniarti Soeroso and Felix Hartono  

Chapter 31  Periodontal Emergency Treatment with Chronic Periodontal Abscess and Secondary Occlusion Trauma  
Surijana Mappangara, Fehri Emelia Naomi Tetelepta, Mardiana Adam, Sri Oktawati and Supiati Sulastrianah  

Chapter 32  The Management of Periodontal Surgery in a Patient with Amlodipine- and Phenytoin-Induced Gingival Enlargement  
Ina Hendiani, Sulistiauwati and Indra Mustika  

Chapter 33  Periodontal Surgical Therapy for Orthodontic Fixed Appliance Complications  
Syanti Wahyu Astutty, Ette S. Tadojoedin and Yuniarti Soeroso  

Chapter 34  Modified Lip Repositioning to Treat Excessive Gingival Display: A Surgical Approach  
Ira Komara, Tisye Chandra Rini and Prajna Metta  

Chapter 35  Treatment of an Endodontic-Periodontic Lesion on a Periapical Cyst in an Anterior Tooth  
Indra Mustika Pribadi, Zavani Nur Hikmah, Denny Nurdin and Hendra Dian Adhita
<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>36</td>
<td>Multidisciplinary Treatment of Endodontic-Periodontal Lesions in a Post-Trauma Patient</td>
<td>349</td>
</tr>
<tr>
<td></td>
<td>Sri Oktawati, Dian Setiawati, Mardiana Adam, Surijana Mappangara and Asdar Gani</td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>Cementation of a Crown Outside the Mouth to Maintain Periodontal Tissue Around an Implant</td>
<td>357</td>
</tr>
<tr>
<td></td>
<td>Dyah Nindita Carolina and Setyawan Bonifacius</td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>Comparison of Gingival Depigmentation in a Split Mouth Design with a Rotary Instrument (Bur) and Laser</td>
<td>365</td>
</tr>
<tr>
<td></td>
<td>Melissa Patricia, Media Sukmalia, Natalina Haerani and Yuniarti Soeroso</td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>Surgical Management of Gingival Enlargement on Patients with Orthodontic Treatment</td>
<td>377</td>
</tr>
<tr>
<td></td>
<td>Mfitha Chairina Lubis, Pitu Wulandari and Rini Octavia Nasution</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>Correction of Occlusal Vertical Dimension in an Adolescent Patient with Compromised Anterior Prosthesis Space</td>
<td>391</td>
</tr>
<tr>
<td></td>
<td>Ariyanti Rezeki and Roselani W. Odang</td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>Improving Denture Stability in a Severely Resorbed Mandibular Ridge Using the Neutral Zone Technique</td>
<td>407</td>
</tr>
<tr>
<td></td>
<td>Ariyanti Rezeki and Lindawati S. Kusdhany</td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>Prosthetic Rehabilitation in a Partially Edentulous Patient with a Loss of Vertical Dimension</td>
<td>419</td>
</tr>
<tr>
<td></td>
<td>Fakhirra Ariani Ayub and Laura S. Himawan</td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>Esthetic Rehabilitation with a Porcelain Laminate Veneer</td>
<td>429</td>
</tr>
<tr>
<td></td>
<td>Fakhirra Ariani and Farisza Gita</td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>The Window Technique Impression for a Maxillary Flabby Ridge</td>
<td>437</td>
</tr>
<tr>
<td></td>
<td>I. Gusti Ayu Ratih U. Mayun, Henni Koesmaningati and David Maxwell</td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>Lingualized Occlusion in a Complete Denture Patient with a Low Edentulous Ridge</td>
<td>445</td>
</tr>
<tr>
<td></td>
<td>Karina and Lindawati S. Kusdhany</td>
<td></td>
</tr>
</tbody>
</table>
Contents

Chapter 46 Porcelain Laminate Veneer Treatment Using Smile Design Analysis with Visagismile Software
Michael Nathanael Mahama and Farisza Gita

Chapter 47 Restoring Esthetic and Function with Prosthodontics
Hsiao Ting Ong, Norziha Yahaya and Natasya Tarib

Chapter 48 Full-Mouth Rehabilitation: Treatment Plan with the Visagism Concept of Smile Design
Steffi Raphaeli, Farisza Gita and Leonard Nelwan

Chapter 49 Crestal Sinus Lift for Single Implant Supported Restoration
Steffi Raphaeli and Ratna Sari Dewi

Chapter 50 Rehabilitation of Non-Syndromic Oligodontia in a Young Adult
Vivi V. W. Wira, Laura S. Himawan, Roselani W. Odang,
Chaidar Masulili and Leonard C. Nelwan

Chapter 51 Using the Neutral Zone Technique for Better Denture Cleansing
Yenny Pragustine and Muslita Indrasari

About the Editor

Index
Chapter 30

EVALUATION OF INTRABONY DEFECT TREATMENT USING ALLOGRAFT AND XENOGRAFT

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ABSTRACT

Periodontitis causes the destruction of the alveolar process, which is characterized by clinical attachment loss and the formation of osseous deformities, including furcation involvement and intrabony defects. Guided tissue regeneration (GTR) is a surgical procedure that aims to regenerate the periodontal tissue. Objective: To evaluate the success of the periodontal intrabony defect treatment using the allograft and xenograft. Four cases of periodontal intrabony defects with one-wall and two-wall defects were treated through the GTR technique using the allograft (Regen-Oss) and xenograft (Osteoxenon) methods. Periodontal pocket depth (PPD), recession and clinical attachment level (CAL) were assessed before surgery and after six months. This case report describes the management of intrabony defects with the help of surgical interventions, including bone graft materials and the GTR membrane. This combined treatment results in healthy a periodontium with clinical measurement evidence gains in both cases. This case series demonstrates that the removal of etiological factors and utilizing the combined treatment modalities restore the health and function of the tooth.

* Corresponding Author Email: yuniarti_22@yahoo.co.id.
The treatment results of the periodontal intrabony defects using allograft are the same as the treatment results for the periodontal intrabony defects using the xenograft after six months.

**Keywords:** allograft, xenograft, intrabony defect, regeneration

## 1. INTRODUCTION

Periodontitis is a complex disease where disease expression involves intricate interactions between the biofilm and the host immune-inflammatory response, as well as subsequent alterations in the bone and connective tissue homeostasis [1, 2]. Periodontal disease causes alveolar bone loss and eventual loss of teeth [3, 4]. Intrabony periodontal defects are a frequent sequela of periodontitis and, if left untreated, may significantly affect the long-term prognosis of the affected teeth [5]. Various treatment modalities encompassing conventional or regenerative approaches have been proposed for their treatment [3, 6, 7].

Biological healing after conventional periodontal therapy is mainly characterized by a long junctional epithelium and no or very limited regeneration of root cementum, periodontal ligament (PL) and the alveolar bone [8]. Despite the fact that conventional periodontal surgery may indeed lead to a decrease in probing depth and a reduction or elimination of bony defects, the healing is often associated with the presence of residual pockets or substantial loss of the tooth’s supporting tissues [5].

Various regenerative techniques have been introduced to avoid the shortcomings associated with conventional periodontal surgery. Such techniques aim to reduce probing depths and reconstruct the tooth’s supporting tissues by simultaneously limiting soft tissue recession [9]. Regenerative periodontal surgery includes the use of various types of grafting materials, root surface conditioning, guided tissue regeneration (GTR), growth and differentiation factors and various combinations thereof, in conjunction with surgical approaches designed to allow for maximum preservation of soft and hard tissues [9]. Periodontal regeneration is accomplished following the use of intraoral or extraoral autografts, demineralized freeze-dried bone allografts, GTR and xenografts [10, 11]. Allograft and xenograft are used in many periodontal regenerative procedures because the use of autografts for regenerative periodontal therapy is limited by its source and an increase in patient morbidity. Therefore, the purpose of the present study is to evaluate the success of periodontal intrabony defect treatment using the allograft and xenograft.
2. CASE REPORT

2.1. Case 1

A healthy 41-year-old man presented to the clinic of periodontology at Rumah Sakit Khusus Gigi dan Mulut (RSKGM), Faculty of Dentistry at the Universitas Indonesia, with a chief complaint that the mobile maxillary central incisor and gums tended to bleed when he brushed his teeth. The tooth became mobile six months ago. He brushed his teeth twice a day and never used mouth rinses or dental floss. The last time he visited the dentist, deciduous teeth were extracted. He had never experienced scaling before. The patient was in a healthy condition and did not smoke.

Clinically, the patient had bad oral hygiene with plaque, supra and subgingival calculus in every region (Figure 1). The periodontal pocket depth was approximately 4–10 mm and at the maxilla anterior approximately 14–24. The marginal recessions were approximately 1–4 mm. The clinical attachment level (CAL) was 4–12 mm, and the mobility grade was 2 on 11 and 21. The radiograph examination showed middle third horizontal alveolar bone loss on 13, 12, 11, 21, 22 and 23, and vertical alveolar bone loss on 14 and 24 (Figure 2). Based on the clinical and radiographic examinations, the prognosis for this tooth was fair.

Figure 1. Clinical condition before treatment.
Before surgery, the patient was given dental health education, particularly on the importance of oral hygiene maintenance. Scaling and root planning were performed, and the patient was instructed to use mouth rinse of 0.12% chlorhexidine gluconate to help improve his oral hygiene. The patient was very cooperative with the oral hygiene program, and he successfully improved his oral hygiene.

The first surgery was performed in regions 14–24. Asepsis was carried out using a povidone-iodine solution on the surgery site. Local anesthesia was provided topically using Benzocaine and infiltration was provided using Mepivacaine Hydrochloride 2% with adrenaline. A sulcular incision was made from 15–25. After the full thickness flap was raised, scaling and root planning was executed thoroughly to remove the calculus, residual granulation tissue and contaminated and exposed cementum (Figure 3). A crater defect was found in interdentals 14, 15, 24 and 25.

Allograft (Regenoss) powder was hydrated with saline and placed into the defect. A barrier collagen membrane (Membratape) was used to contain the grafting material. A tension-free flap extension and primary closure were achieved through periosteal releasing incisions. The flap was closed and stabilized with simple interrupted sutures (Blue Nylon 5.0, 3/8). Healing was uneventful, and the primary closure was sustained. A clinical measurement was taken after six months, and the patient had good oral hygiene (Figure 4). Periodontal pocket depth was reduced to approximately 3–4 mm at the bone graft site. The marginal recessions increased to 2 mm, and the CAL gained 2–4 mm. There was no mobility on 11 or 21.
2.2. Case 2

A healthy 45-year-old man presented to the clinic of periodontology at Rumah Sakit Khusus Gigi dan Mulut (RSKGM), Faculty of Dentistry at Universitas Indonesia, with a chief complaint of a mobile mandibular central and second right incisor and gums that tended to bleed when he brushed his teeth. The teeth became mobile three months ago. He brushed his teeth twice per day and never used mouth rinses or dental floss. His last visit to the dentist was three years ago for scaling. The patient was in a healthy condition and was smoking eight cigarettes per day.

Clinically, the patient had bad oral hygiene with plaque, supra and subgingival calculus on every region (Figure 5). The periodontal pocket depth was approximately 3–5 mm in the mandibular anterior region from 33–43. The marginal recessions were approximately 3 mm. The CAL was 6–8 mm. The mobility grade was 3 on 42, and the mobility grade was 2 on 41 and 31. A radiograph examination showed apical third vertical alveolar bone loss on 43, 42, 41, 31, 32 and 33 (Figure 6). Based on the clinical and radiographic examinations, the prognosis for this tooth was bad.
The patient was given dental health education, particularly on the importance of oral hygiene maintenance and smoking cessation. He reduced the number of cigarettes he was smoking per day and replaced them with bubble gum. Scaling and root planning were performed, and the patient was instructed to use mouth rinse of 0.12% chlorhexidine gluconate to help increase his oral hygiene status. The wire splinting in the mandibular anterior region from 34–44 was performed to stabilize the mobile teeth. Occlusal adjustment with selective grinding was performed on teeth 32 and 42 to eliminate the trauma from occlusion due to blocking.

Open-flap debridement surgery was performed on regions 34–44. Asepsis was carried out using the povidone-iodine solution on the surgery site. Local anesthesia was given topically using Benzocaine and infiltration was provided using Mepivacaine Hydrochloride 2% with adrenaline. A sulcular incision was made from 13–23, and a vertical incision was made parallel to the line angle of mesial teeth 34 and 44 (Figure7). The full thickness of the flap was raised, and scaling and root planning were executed thoroughly to remove calculus, residual granulation tissue and contaminated and exposed cementum. A crater defect was founded in the interdental 41, 42, 33 and 34.

Xenograft (Osteoxenon) powder was hydrated with saline and placed into the defect. A barrier collagen membrane (Pericardium) was used to contain the grafting material. A tension-free flap extension and primary closure were achieved through periosteal releasing incisions. The flap was closed and stabilized using simple interrupted sutures (Blue Nylon 5.0, 3/8). Healing was uneventful and primary closure was sustained. After six months, clinical measurement and periapical radiograph were taken, and the patient had good oral hygiene (Figure8). The periodontal pocket depth was reduced to 3 mm at the bone graft site, and the marginal recessions did not increase. The CAL gained 2 mm, and there was no mobility on 41 or 42.
Figure 7. Open flap debridement with sulcular and vertical incision with Xenograft.

Figure 8. Clinical condition and periapical radiograph after 6-month evaluation.

3. DISCUSSION

Regeneration is the most desirable outcome for any therapy; however, it is also the most difficult result to achieve. Regenerative procedures frequently include the use of barrier membranes and bone grafting materials to encourage the growth of key surrounding tissues, while excluding unwanted cell types, such as epithelial cells.
Although regenerative therapies have great potential, they remain unpredictable in their ability to consistently produce acceptable outcomes in all situations [12].

The most commonly used technique for regeneration is the bone replacement graft, which can promote tissue and bone regeneration through a variety of mechanisms [13]. Some grafts contain cells that lay down a bone matrix, which ultimately results in new bone formation. These grafts are referred to as having osteogenic properties [14]. Other grafts release growth factors and other mediators that signal the host to produce native bone. These grafts are considered osteoinductive [14]. Furthermore, other graft materials might act as a scaffold on which the host bone might grow. This property is referred to as osteoconductive [14] there are many different sources of bone replacement grafts, each with different advantages, disadvantages and success rates. In general, grafts can be categorized into autogenous, allograft, alloplast and xenograft sources [12].

A bone allograft refers to graft between genetically dissimilar members of the same species. The grafts are often obtained from tissue banks that process the donor tissues. Depending on the manner in which these tissues are processed, allografts might be osteoconductive or osteoinductive [15]. These grafting materials have relatively high success rates and have an additional advantage in that no additional surgical procedure is required to procure bone from a donor site. Disadvantages potentially include a foreign body immune response, cost and the contamination of the graft during processing. The most commonly used forms of allografts are freeze-dried bone allografts (FDBA) and decalcified freeze-dried bone allografts (DFDBA) [8].

A xenograft refers to tissue taken from one species and placed into another species. For intraoral bone replacement grafts, the most common animal sources are bovine and porcine [16]. Because antigenicity is a concern with this type of graft, the tissues are processed to remove all organic constituents, leaving only an inorganic matrix. Thus, xenografts are osteoconductive by nature. Typically, these grafting materials resorb very slowly and might sequester or undergo fibrous encapsulation [17].

The present case study evaluates the clinical efficacy of the allograft and xenograft in the treatment of intrabony defects and whether they showed an improvement in clinical parameters after six months. Both showed nearly similar results. Intrabony defect treatment with the allograft showed a reduction in the mean probing pocket depth (PPD) of 3.5 mm and a gain in the mean CAL of 3 mm after six months. The gingival recession increased by 2 mm. The intrabony defect treatment with the xenograft resulted in a reduction in the probing pocket depth of 3 mm and a mean CAL gain of 2 mm after six months. There was no increase in a gingival recession.

Case selection is very important for the success of regenerative techniques, which might explain some of the inconsistencies in the literature. Studies that evaluate the clinical success of FDBA report bone fill between 1.3–2.6 mm in periodontal defects [12]. Mellonig found at least 50% bone fill in 67% of periodontal defects if FDBA was used, and this percentage increased to 78% if FDBA was combined with autogenous bone. Studies evaluating
DFDBA show similar bone filling compared with FDBA, with an average range of 1.7–2.9 mm [12].

Positive clinical results have been reported for xenografts in the treatment of infrabony, furcation, and endodontic-related surgical defects [18]. However, tissue and bone regeneration with xenografts might be unpredictable. In a study of eight infrabony defects treated with anorganic bovine bone, seven showed some evidence of regeneration, whereas one defect healed completely through repair [17].

The long-term stability of positive clinical outcomes of regenerative procedures was found to be dependent upon the patient and defect-related variables, such as smoking status or participation in periodontal maintenance programs or the radiographic angle of the defect [19]. Furthermore, adequate tissue thickness and keratinized gingiva support favorable outcomes [20]. Membrane exposure can prevent optimal healing during the healing phase [12]. Other factors that might also negatively affect the healing process include occlusal trauma, improper surgical techniques, such as excessive flap tension, early mechanical disruption, and contamination during surgery [12]. Wang and Boyapati suggest four factors called the ‘PASS principle’ that are critical for predictable bone regeneration: (1) primary wound closure, (2) angiogenesis as a blood supply and source of undifferentiated mesenchymal cells, (3) space maintenance and (4) stability of the wound. Finally, space maintenance involves the creation of space for periodontal tissues to grow into. This can involve the use of tenting screws, rigid membranes or even a host bone in the case of three-wall defects [21].

**CONCLUSION**

The treatment results of periodontal infrabony defects using the allograft are no different from the treatment results of periodontal infrabony defects using the xenograft after six months. The successful treatment of periodontal defects with regenerative surgical modalities is greatly affected by the control of plaque bacteria and carefully timed nonsurgical supportive care. It has been found that proper oral hygiene resulting in decreased plaque levels results in more successful regenerative procedure results than that of patients with higher plaque levels. Patients with good oral hygiene preserve the clinical attachment gain achieved through regenerative procedures for many years. Understanding the necessity of strict plaque control coupled with the knowledge of the varying stages of healing of the different tissues in the surgical site will allow for the most optimal treatment outcome.
REFERENCES


