To cite this article: Göral D, Karakan NC. Evaluation of the frequency of hard tissue augmentation material usage in dental implant surgery based on different specialties. Turk J Clin Lab 2025; 1: 217-227.

Research Article

Evaluation of the frequency of hard tissue augmentation material usage in dental implant surgery based on different specialties

Farklı uzmanlık alanlarına göre dental implant cerrahisinde sert doku ogmentasyon materyallerinin kullanım sıklığının değerlendirilmesi

Doğan Göral*, Nebi Cansın Karakan

Department of Periodontology, Afyonkarahisar Health Sciences University Faculty Of Dentistry, Afyonkarahisar, Turkey

Abstract

Aim: This study aimed to investigate the preference profiles of periodontists and oral, dental and maxillofacial (ODM) surgeons regarding graft and membrane biomaterials used in sinus augmentation and horizontal/vertical augmentation procedures.

Material and Methods: This cross-sectional study included 180 specialists in ODM Surgery (n = 90) and Periodontology (n = 90) who were employed in state institutions or the private sector between February 2021 and August 2021. The surveys collected demographic data and information on various factors, including specialty, years of experience as a specialist, the number of implants placed in the past year, the proportion of patients requiring hard tissue augmentation, and the types of biomaterials and barrier membranes used in sinus and horizontal/vertical augmentation procedures.

Results: Periodontists reported more frequent use of autogenous and combined grafts in sinus augmentation procedures, whereas ODM surgeons tended to use these materials occasionally ($p < 0.05$). Xenografts were widely used by both groups, with no significant difference in sinus augmentation. In horizontal augmentation, periodontists favored resorbable collagen membranes, while ODM surgeons more often used non-resorbable barriers. In vertical augmentation, both specialties commonly employed combined grafts and non-resorbable membranes, but periodontists showed a higher preference for xenograft-based combinations.

Conclusion: This study highlights that xenografts and resorbable membranes are the most widely used materials in clinical practice, with preference patterns differing based on the clinician's specialty

Keywords: Augmentation, Barrier membranes, Dental implant, Graft

Corresponding Author*: Doğan Göral, Department of Periodontology, Afyonkarahisar Health Sciences University Faculty Of Dentistry, Afyonkarahisar, Turkey

E-mail: doangoral@gmail.com

Orcid: 0009-0001-7048-5520

Doi: 10.18663/tjcl.1658100

Recevied: 23.09.2024 accepted: 23.01.2025

TJCL Volume 16 Number 1 p: 217-227

Öz

Amaç: Bu çalışmanın amacı periodontistlerin ve ağız, diş ve çene (ADÇ) cerrahlarının sinüs ve yatay/dikey ogmentasyon prosedürlerinde kullanılan greft ve membran biyomalzemelerine ilişkin tercih profillerini araştırmaktır.

Gereç ve Yöntemler: Bu kesitsel çalışmaya Şubat ve Ağustos 2021 tarihleri arasında devlet kurumlarında veya özel sektörde çalışan ADÇ cerrahisi (n = 90) ve Periodontoloji (n = 90) alanında uzman 180 kişi katılmıştır. Anketler aracılığıyla demografik verileri ve uzmanlık alanı, uzman olarak deneyim yılları, geçen yıl yerleştirilen implant sayısı, sert doku artırma gerektiren hasta oranı ve sinüs ve yatay/dikey ogmentasyon prosedürlerinde kullanılan biyomalzeme ve bariyer membran türleri dahil olmak üzere çeşitli faktörlere ilişkin bilgiler toplanmıştır.

Sonuçlar: Periodontistler sinüs ogmentasyon prosedürlerinde otojen ve kombine greftleri daha sık kullandıklarını bildirirken, ODM cerrahları bu materyalleri ara sıra kullanma eğilimindeydi ($p<0,05$). Ksenogreftler her iki grup tarafından yaygın olarak kullanıldı ve sinüs ogmentasyonunda anlamlı bir fark yoktu. Yatay ogmentasyonda periodontistler rezorbe olabilen kolajen membranları tercih ederken, ODM cerrahları daha sık rezorbe olmayan bariyerleri tercih etti. Dikey ogmentasyonda, her iki uzmanlık dalı da genellikle kombine greftler ve rezorbe olmayan membranları tercih etti, ancak periodontistler ksenogreft bazlı kombinasyonlara daha fazla tercih gösterdi.

Sonuç: Bu çalışma, ksenogreftlerin ve emilebilir membranların klinik uygulamada en yaygın kullanılan materyaller olduğunu ve tercih kalıplarının klinisyenin uzmanlık alanına göre farklılık gösterdiğini vurgulamaktadır.

Anahtar Kelimeler: Ogmentasyon, Bariyer membranlar, Diş implantı, Greft

Introduction

Dental implant surgeries are of high importance in the dental care of patients with complete or partial edentulism in their alveolar crests. These interventions restore masticatory functions while addressing aesthetic concerns (1). Among various implant-supported prosthetic treatments, dental implants are widely accepted, particularly for managing total edentulism. However, one of the most common challenges encountered during implant rehabilitation is the insufficient height and thickness of the alveolar bone, often necessitating bone augmentation procedures (2).

The success of augmentation largely depends on the choice of bone graft materials, which include autogenous grafts, xenografts, allografts, alloplastic grafts, or combinations of these materials (3, 4). Various augmentation techniques can be performed either before or simultaneously with implant placement to enhance bone volume and quality. These techniques include inlay or onlay bone augmentation, directed bone regeneration, ridge splitting, alveolar distraction, maxillary sinus floor elevation, sandwich osteotomy (interpositional grafting), and inferior alveolar nerve repositioning (5, 6).

Periodontists and oral, dental and maxillofacial (ODM) surgeons are the two crucial specialists involved in implant surgery and augmentation procedures (7). Differences in training, clinical experience, and working environments contribute to significant variations in augmentation approaches, including the selection of graft materials and barrier membranes (7). While some studies have explored the impact of these factors on implant success, limited data exist regarding specialists' biomaterial preferences and the factors influencing these choices (8, 9). Moreover, there is a limited number of survey-based studies analyzing the clinical practices of specialists regarding biomaterial selection and the factors influencing their decisions (7, 10).

This study aimed to analyze survey data from periodontists and ODM surgeons in Turkey to identify their preferences for graft and membrane biomaterials used in sinus and horizontal/vertical augmentation procedures. Additionally, it examined the potential influence of specialty experience on these preferences.

Material And Methods

This cross-sectional study was carried out at the Department of Periodontology in Afyonkarahisar Health Sciences University between February 2021 to August 2021, adhering to the ethical principles outlined in the Declaration of Helsinki. Approval was obtained from the Afyonkarahisar Health Sciences University Clinical Research Ethics Committee (Date: 04.12.2020, Decision No: 2020/545).

Study Population

Due to the absence of a comprehensive system covering both the private and public sectors, it was impossible to reliably determine the number of oral and maxillofacial surgeons and periodontists working in Turkey. As such, the number of physicians to be included in our study was determined with reference to similar survey studies conducted (7, 10). The required sample size was determined using the G*Power 3.1 program. When effect size was taken as 0.30, based on an alpha level of 0.05 and power of 80%, the targeted sample size was 167 (11).

Participants, including ODM surgeons and periodontists from both state institutions and private sector, were evaluated for study eligibility. The participants were selected based on their professional backgrounds showing experience with these procedures / interventions. Individuals with missing or incomplete responses to any of the survey questions were excluded from the analyses. The analyses included 90 ODM surgery and 90 periodontist specialists who fully completed the survey.

Data Collection

The surveys were created in 'Google Forms' and distributed to specialist dentists via the internet and institutional communication opportunities (emails, social media, affiliations) over a period of approximately 5 months from the beginning of February 2021. The number of participants targeted at study inception was reached by August 2021.

Participants were categorized based on their specialty experience into two groups: 0–5 years and ≥6 years. Additionally, they were classified according to the proportion of patients who underwent hard tissue augmentation in the past year, with the following groups: 0–10%, 11–20%, and >21%.

Survey creation and considerations

The questionnaire created for the purpose of the study includes queries related to demographics (age and sex), specialty (periodontology or oral and maxillofacial surgery), duration of employment as a specialist, number of implants performed within the prior year (12 months at time of survey response), the percentage of patients that required hard tissue augmentation during the same period, and the use of biomaterials, their types, barrier membranes etc. during sinus and vertical/horizontal augmentation procedures.

The questions we planned to direct to physicians working in two different specialties were prepared with two different methods. The questions included in the first group were included in the survey questions with reference to previous survey studies, while the second group, which constitutes the majority, was prepared using the 'Lawshe' technique. This technique is based on content validity studies. In the preparation of such scales, it is critical to determine whether the items in the scale are sufficient to cover and collect data that is factual while ensuring that recalled information is reliable, which is accomplished by assessing expert opinions. Content validity studies based on expert opinions are qualitative studies by nature (12). Therefore, the data obtained should be converted into quantitative data as accurately as possible by calculating content validity ratios (CVR) and content validity index (CVI). The appropriateness of the survey question contents was assessed with these metrics during the creation of the survey. The brief procedural steps employed for this process are listed below: (1) formation of the specialty group (periodontists or oral and maxillofacial surgeons); (2) preparation of the candidate scale form and receipt of specialist opinions; (3) data analysis which involves calculation of CVR and CVI; (4) deciding whether each item should be included in the scale according to the CVR and CVI criteria.

The expertise, background and the number of experts (between 5-40) are of great importance in obtaining objective metrics used to assess content validity. While preparing the survey questions, we collected opinions from 7 specialists who were defined as experts in the field. In the Lawshe (1975) technique, expert opinions for each item are graded in three categories as "the item measures the targeted construct", "the item is related to the construct but unnecessary" and "the item does not measure the targeted construct". However, the ratings of expert opinions in Lawshe (1975) technique were rearranged as "Appropriate", "Appropriate but should be corrected" and "Should be removed" (13). In the current study, in order to determine the content validity of the items to be included in the scale, the qualitative data obtained in line with specialist opinions were transformed into quantitative data by calculating the CVR and CVI. In summary, after the necessary scoring was done, the sub-headings, questions, and multiple-choice responses provided for each question were determined with this technique.

Statistical Analysis

The Kolmogorov-Smirnov test was used to examine the conformity of the variables to normal distribution. Descriptive statistics were presented by using mean, standard deviation, median, minimum, maximum for continuous variables, while frequency and percentage were used for categorical variables. Continuous variables were analyzed by using the Mann-Whitney U or Kruskal-Wallis tests, depending on the number of groups being compared. Categorical variables were analyzed

by using appropriate chi-square tests (Pearson, Yate's continuity correction) or the Freeman-Halton extension of the Fisher's Exact test. Pairwise comparisons were adjusted by using Bonferroni correction. We defined $p < 0.05$ as demonstrating statistical significance. IBM SPSS Statistics for Windows, Version 25.0 (IBM Corp., Armonk, NY, USA) was used for statistical analysis.

Results

Demographic characteristics of the participants

The mean age of participants was 33.7 ± 6.3 years (minimum: 25.00; maximum: 53.00) and 55.6% were male. In terms of experience 38.9% of the participants reported 6 years or more. Hard tissue augmentation groups showed that 69 participants (38.3%) had performed augmentation in 0-10% of their patients, 55 (30.6%) in 11-20%, and 56 (31.1%) in >21%. The median number of implants in the last year was 180.0 (range: 0 – 3000). Median number of implantations in the last year was higher in the ODM surgery group compared to periodontist group (250 vs. 65; $p < 0.001$, respectively) (Table 1).

Table 1. Demographic characteristics of the participants and their findings regarding implant applications.

Variables	All population n = 180
Age	33.7 ± 6.3
Gender, n (%)	
Male	100 (55.6)
Female	80 (44.4)
Specialty, n (%)	
Periodontology	90 (50.0)
Oral and Maxillofacial Surgery	90 (50.0)
Duration of work as a specialist, n (%)	
0-5 years	110 (61.1)
≥6 years	70 (38.9)
Percentage of patients who underwent hard tissue augmentation in the prior year, n (%)	
0-10	69 (38.3)
11-20	55 (30.6)
>21	56 (31.1)
Number of implants in the last year	180.0 (0.0 - 3000.0)
Specialty	
Periodontology	65.0 (0.0 - 1100.0)
Oral and Maxillofacial Surgery*	250.00 (0.0 - 3000.0)

Data are mean±standard deviation or median (IQR), or number (%).*p<0.05 indicates statistical significance.

Sinus augmentation

The occasional ("sometimes") use of autogenous grafts was reported more frequently by ODM surgeons than by periodontists (38.9% vs. 24.4%, $p = 0.006$). However, the proportion of participants reporting frequent ("often" or "always") use of autogenous grafts was higher in the periodontist group compared to the ODM surgeon group (40.0% vs. 26.7%, $p < 0.05$). The frequency of xenograft use did not differ significantly between periodontists and ODM surgeons. Occasional use of combined grafts was more frequently reported by ODM surgeons than by periodontists (42.2% vs. 15.6%, $p < 0.001$). However, the proportion of participants reporting frequent ("often" or "always") use of combined grafts was higher among periodontists than ODM surgeons (58.9% vs. 33.3%, $p < 0.05$). The frequency of resorbable membrane use did not differ significantly between periodontists and ODM surgeons. The proportion of participants who never used non-resorbable membranes was higher in the ODM surgeon group than the periodontist group (53.3% vs. 28.9%, $p = 0.005$). However, the proportion of participants reporting frequent ("often" or "always") use of non-resorbable membranes was higher in the periodontist group than the ODM surgeon group (18.9% vs. 5.6%, $p < 0.05$) (Table 2).

Lateral (horizontal) hard tissue augmentation

The frequency of autogenous grafts and non-resorbable titanium mesh membranes use did not differ significantly between periodontists and ODM surgeons. The proportion of participants reporting frequent ("often" or "always") use of xenograft was lower in the ODM surgeon group compared to the periodontist group (23.3% vs. 55.6%, $p < 0.05$). The occasional ("sometimes") use of combined grafts was reported more frequently by ODM surgeons than by periodontists (23.3% vs. 12.2%, $p = 0.001$). Also, the "often" use of combined grafts was reported by 45.6% of periodontists and 60% of ODM surgeons. Nonetheless, the proportion of participants who reported "always" using combined grafts was greater among periodontists (24.4% vs. 6.7%; $p = 0.001$). The frequency of resorbable membrane use was higher in the periodontist group compared to the ODM surgeon group (71.1% vs. 37.8%, $p < 0.05$). The proportion of participants reporting frequent ("often" or "always") use of non-resorbable membranes (d-PTFE, e-PTFE, titanium-reinforced) was higher in the ODM surgeon group compared to the periodontist group (44.4% vs. 25.5%, $p < 0.05$) (Table 3).

Vertical Hard Tissue Augmentation

The occasional ("sometimes") use of autogenous graft was reported more frequently by ODM surgeons than by periodontists (37.8% vs. 15.6%, $p = 0.001$). The occasional

Table 2. Comparison of graft and membrane biomaterial usage frequency in sinus augmentation based on specialty.

Variables	Specialty		p
	Periodontology n = 90	ODM Surgery n = 90	
Use of autogenous graft biomaterials			
Never	18 (20.0)	6 (6.7)	0.006*
Rare	14 (15.6)	25 (27.8)	
Sometimes	22 (24.4)	35 (38.9)	
Often	29 (32.2)	19 (21.1)	
Always	7 (7.8)	5 (5.6)	
Use of xenograft biomaterials			
Never	9 (10.0)	8 (8.9)	0.115
Rare	7 (7.8)	12 (13.3)	
Sometimes	17 (18.9)	10 (11.1)	
Often	46 (51.1)	56 (62.2)	
Always	11 (12.2)	4 (4.4)	
Use of combined graft biomaterials			
Never	12 (13.3)	7 (7.8)	<0.001*
Rare	11 (12.2)	15 (16.7)	
Sometimes	14 (15.6)	38 (42.2)	
Often	39 (43.3)	26 (28.9)	
Always	14 (15.6)	4 (4.4)	
Use of resorbable membrane biomaterials			
Never	3 (3.3)	5 (5.6)	0.087
Rare	5 (5.6)	5 (5.6)	
Sometimes	11 (12.2)	13 (14.4)	
Often	49 (54.4)	59 (65.6)	
Always	22 (24.4)	8 (8.9)	
Use of non-resorbable d-PTFE, e-PTFE, titanium-reinforced membrane biomaterials			
Never	26 (28.9)	48 (53.3)	0.005*
Rare	28 (31.1)	19 (21.1)	
Sometimes	19 (21.1)	18 (20.0)	
Often	16 (17.8)	5 (5.6)	
Always	1 (1.1)	0	

Data are number (%).*p<0.05 indicates statistical significance. d-PTFE: High-density polytetrafluoroethylene, e-PTFE: Expanded polytetrafluoroethylene

("sometimes") use of xenograft was reported more frequently by ODM surgeons than by periodontists (54.4% vs. 26.7%, p < 0.001). However, the proportion of participants reporting frequent ("often" or "always") use of xenograft was higher in the periodontist group compared to the ODM surgeon group (43.4% vs. 14.4%, p < 0.001). The proportion of participants who reported "often" using combined grafts was higher in the ODM surgeon group compared to the periodontist group (60.0% vs. 42.2%; p = 0.001). However, the proportion of participants who reported "always" using combined grafts was higher in the periodontist group compared to the ODM surgeon group (27.8% vs. 4.4%; p = 0.001). The proportion of participants reporting frequent ("often" or "always") use of resorbable membrane biomaterials was higher in the periodontist group compared to ODM surgeon group (56.6% vs. 28.9%, p < 0.05). The frequency of non-resorbable membranes (d-PTFE, e-PTFE, titanium-reinforced) use did not differ significantly between periodontists and ODM surgeons. The frequent of participants who reported "often or always" using non-resorbable titanium mesh membranes was higher in the periodontist group compared to the ODM surgeon group (31.1% vs. 11.1%, p < 0.05) (Table 4).

Table 3. Comparison of graft and membrane biomaterial usage frequency in lateral (horizontal) hard tissue augmentation based on specialty.

Variables	Specialty		p
	Periodontology n = 90	ODM Surgery n = 90	
Use of autogenous graft biomaterials			
Never	5 (5.6)	3 (3.3)	0.101
Rare	15 (16.7)	5 (5.6)	
Sometimes	24 (26.7)	32 (35.6)	
Often	35 (38.9)	42 (46.7)	
Always	11 (12.2)	8 (8.9)	
Use of xenograft biomaterials			
Never	8 (8.9)	8 (8.9)	<0.001*
Rare	11 (12.2)	20 (22.2)	
Sometimes	21 (23.3)	41 (45.6)	
Often	42 (46.7)	21 (23.3)	
Always	8 (8.9)	0	
Use of combined graft biomaterials			
Never	4 (4.4)	6 (6.7)	0.001*
Rare	12 (13.3)	3 (3.3)	
Sometimes	11 (12.2)	21 (23.3)	
Often	41 (45.6)	54 (60.0)	
Always	22 (24.4)	6 (6.7)	
Use of resorbable membrane biomaterials			
Never	3 (3.3)	5 (5.6)	<0.001*
Rare	6 (6.7)	20 (22.2)	
Sometimes	17 (18.9)	31 (34.4)	
Often	51 (56.7)	26 (28.9)	
Always	13 (14.4)	8 (8.9)	
Use of non-resorbable d-PTFE, e-PTFE, titanium-reinforced membranes biomaterials			
Never	10 (11.1)	15 (16.7)	0.003*
Rare	19 (21.1)	17 (18.9)	
Sometimes	38 (42.2)	18 (20.0)	
Often	21 (23.3)	40 (44.4)	
Always	2 (2.2)	0	
Use of non-resorbable titanium mesh membranes biomaterials			
Never	26 (28.9)	23 (25.6)	0.614
Rare	19 (21.1)	21 (23.3)	
Sometimes	33 (36.7)	39 (43.3)	
Often	11 (12.2)	7 (7.8)	
Always	1 (1.1)	0	

Data are number (%).*p<0.05 indicates statistical significance. d-PTFE: High-density polytetrafluoroethylene, e-PTFE: Expanded polytetrafluoroethylene

Table 4. Comparison of graft and membrane biomaterial usage frequency in vertical hard tissue augmentation based on specialty.

Variables	Specialty		p
	Periodontology n = 90	ODM Surgery n = 90	
Use of autogenous graft biomaterials			
Never	5 (5.6)	3 (3.3)	
Rare	15 (16.7)	3 (3.3)	
Sometimes	14 (15.6)	34 (37.8)	0.001*
Often	44 (48.9)	36 (40.0)	
Always	12 (13.3)	14 (15.6)	
Use of xenograft biomaterials			
Never	8 (8.9)	13 (14.4)	
Rare	19 (21.1)	15 (16.7)	
Sometimes	24 (26.7)	49 (54.4)	<0.001*
Often	33 (36.7)	11 (12.2)	
Always	6 (6.7)	2 (2.2)	
Use of combined graft biomaterials			
Never	6 (6.7)	11 (12.2)	
Rare	7 (7.8)	5 (5.6)	
Sometimes	14 (15.6)	16 (17.8)	0.001*
Often	38 (42.2)	54 (60.0)	
Always	25 (27.8)	4 (4.4)	
Use of resorbable membrane biomaterials			
Never	7 (7.8)	6 (6.7)	
Rare	11 (12.2)	27 (30.0)	
Sometimes	21 (23.3)	31 (34.4)	0.002*
Often	40 (44.4)	21 (23.3)	
Always	11 (12.2)	5 (5.6)	
Use of non-resorbable d-PTFE, e-PTFE, titanium-reinforced membranes biomaterials			
Never	11 (12.2)	14 (15.6)	
Rare	12 (13.3)	14 (15.6)	
Sometimes	23 (25.6)	13 (14.4)	0.091
Often	38 (42.2)	48 (53.3)	
Always	6 (6.7)	1 (1.1)	
Use of non-resorbable titanium mesh membranes biomaterials			
Never	19 (21.1)	19 (21.1)	
Rare	17 (18.9)	19 (21.1)	
Sometimes	26 (28.9)	42 (46.7)	0.010*
Often	25 (27.8)	10 (11.1)	
Always	3 (3.3)	0	

Data are number (%).*p<0.05 indicates statistical significance. d-PTFE: High-density polytetrafluoroethylene, e-PTFE: Expanded polytetrafluoroethylene.

Discussion

This study represents one of the few comparative analyses of periodontists and ODM surgeons and revealed significant differences in their preferences for hard tissue augmentation materials in implant procedures. In sinus augmentation, periodontists reported more frequent use of autogenous and combined grafts as well as non-resorbable membranes, whereas ODM surgeons tended to use these materials occasionally. In hard tissue augmentation, periodontists consistently favored xenografts, resorbable membranes, and non-resorbable titanium mesh membranes, while ODM surgeons showed greater reliance on non-resorbable membranes and more variable use of autogenous materials.

In sinus augmentation procedures, our findings showed that both periodontists and ODM surgeons commonly utilized xenograft bone substitutes and resorbable collagen membranes, with no significant difference in their frequency of use. This aligns with the established clinical preference for xenografts in sinus grafting due to their osteoconductive properties and ability to maintain long-term volume stability, as well as the routine application of resorbable membranes to prevent soft tissue invasion and support graft protection (14, 15). However, a notable distinction emerged in the use of autogenous and combined grafts. Periodontists reported significantly more frequent use of both, which may reflect their stronger emphasis on biologically oriented regeneration. Autogenous bone, known for its osteogenic, osteoinductive, and osteoconductive capabilities, remains the gold standard in bone augmentation procedures, offering viable cells and growth factors for new bone formation (16). Despite its superior biological potential, autogenous bone is subject to donor site morbidity and higher resorption rates over time, particularly in sinus grafts (17). These limitations have led many clinicians—especially periodontists—to favor combining autogenous bone with xenografts, leveraging the early bone-forming capacity of the former with the volumetric stability of the latter (18). Conversely, ODM surgeons, who often manage large-scale or full-arch implant cases, may prioritize procedural efficiency and reduced morbidity. The use of xenografts alone with resorbable membranes eliminates the need for a second surgical site, aligning well with their broader surgical workflow (19, 20). Although non-resorbable membranes offer superior structural stability—particularly in large sinus windows—periodontists appeared more inclined to accept the additional surgical step required for their removal, possibly due to their focus on maximizing regenerative outcomes in localized defects (19, 21).

In horizontal ridge augmentation, periodontists demonstrated a significantly higher frequency of xenograft use compared to ODM surgeons. This preference aligns with existing data showing that xenografts—particularly of bovine origin—can achieve predictable horizontal bone gains with high implant survival rates, making them a reliable alternative to autografts in many clinical situations (22-25). A systematic review reported that xenogenous grafts can achieve substantial horizontal bone gains (~4–5 mm on average) with high implant success rates, validating xenografts as a feasible alternative to autograft in many cases (26). Periodontists also reported more frequent use of resorbable collagen membranes, a trend supported by studies indicating that up to 80% of periodontal specialists routinely apply collagen membranes in guided bone regeneration (GBR) procedures (25). These membranes are favored in periodontal practice for their ease of use, soft-tissue compatibility, and elimination of the need for a second surgical procedure for removal (19). ODM surgeons, on the other hand, showed a higher tendency to use non-resorbable polymer-based membranes, such as d-PTFE or titanium-reinforced barriers. These membranes provide superior space maintenance and structural rigidity, which are often required in extensive horizontal defects. Their usage is consistent with the training and surgical orientation of ODM surgeons, who commonly treat complex cases and may follow staged protocols that accommodate membrane retrieval procedures. While non-resorbable membranes carry risks such as exposure or infection, ODM surgeons are generally equipped to manage these complications due to their operative background. Ultimately, membrane selection in horizontal augmentation appears to reflect each specialty's clinical priorities. Periodontists tend to prioritize minimally invasive protocols with emphasis on soft-tissue healing and ease of handling, whereas ODM surgeons favor structural predictability and mechanical stability in larger or more complex cases.

Vertical ridge augmentation remains one of the most technically demanding procedures in implant dentistry, often requiring the use of autogenous bone due to its superior regenerative capacity. In our study, over half of the participants in both specialties reported using autogenous grafts in vertical augmentation, a finding that aligns with current recommendations favoring at least 50% autogenous content in such procedures to ensure sufficient osteogenic stimulation (27). Nevertheless, periodontists demonstrated a higher

frequency of xenograft use compared to ODM surgeons. This may reflect a preference for volume-stable grafts with slower resorption profiles, particularly when aiming to preserve ridge dimensions while minimizing the need for extensive harvesting (28). The frequent use of combined grafts—mixing autogenous and xenograft materials—by both groups underscores a shared clinical strategy aimed at balancing biological activity and volumetric stability. This approach is also supported by systematic reviews reporting enhanced outcomes in vertical augmentation when composite grafts are used in conjunction with barrier membranes (29). Regarding membrane selection, both resorbable and non-resorbable options were used. While non-resorbable membranes such as d-PTFE, e-PTFE, and titanium-reinforced barriers were more frequently applied in vertical augmentation, we found no significant difference between the two specialties in the use of titanium mesh. Prior studies have shown that titanium mesh, when used alongside collagen membranes and combined grafts, can yield predictable vertical bone gains (29-31). These results reinforce the trend observed in our data: both specialties adopt a combined biomaterial approach in vertical augmentation, tailoring graft and membrane selection to the complexity and dimensional needs of the defect.

This study has several limitations that should be acknowledged. First, as a survey-based investigation, it is subject to potential sampling bias, which may affect the representativeness and generalizability of the findings. The voluntary and anonymous nature of participation, while protecting confidentiality, may have allowed for variability in response accuracy. Recall bias is another concern, as participants were asked to report their clinical preferences retrospectively, which may not always reflect actual behavior. Additionally, there is a possibility that some participants accessed literature data to fine-tune their responses to accommodate for clinical practice guidelines (despite anonymous participation). The cross-sectional design also limits temporal interpretation, as responses represent a single time frame. Variations in biomaterial availability, institutional protocols, and evolving clinical technologies across different centers and regions may have influenced participant responses. Furthermore, the significant differences in the number of implants placed annually among respondents could have introduced confounding effects on material preference patterns. Finally, the scarcity of comparable studies in the literature posed challenges for direct comparison and contextualization of the results.

Conclusion

This study indicate that specialty significantly influences clinical decision-making regarding graft and membrane selection. Periodontists were more likely to utilize autogenous and combined grafts, particularly in sinus and vertical augmentation, and showed a preference for resorbable membranes aligned with guided bone regeneration protocols. In contrast, ODM surgeons demonstrated more variable use of graft types and a higher tendency toward non-resorbable membranes, particularly in complex cases requiring extensive reconstruction. These differences reflect not only procedural preferences but also distinct educational philosophies and clinical workflows between the two specialties. Understanding such variations is essential for promoting interdisciplinary collaboration, optimizing treatment planning, and developing evidence-based guidelines for material selection in implant dentistry.

Funding

The authors declared that this study has received no financial support.

Conflicts of Interest

The authors declare they have no conflicts of interest.

Ethics Approval

The study was performed in accordance with the Declaration of Helsinki, and was approved by the Afyonkarahisar Health Sciences University Clinical Research Ethics Committee (Date: 04.12.2020, Decision No: 2020/545).

Availability of Data and Material

The data that support the findings of this study are available on request from the corresponding author.

Authors' contribution

Conceptualization – D.G., Design – N.B.K., Data curation – D.G. and N.B.K., Validation – N.B.K., Formal analysis – .G. and N.B.K., Resources – .G. and N.B.K., Writing – D.G., Critical review – N.B.K. All authors read and approved the final version of the manuscript.

References

1. Toti P, Marchionni S, Menchini-Fabris GB, Marconcini S, Covani U, Barone A. Surgical techniques used in the rehabilitation of partially edentulous patients with atrophic posterior mandibles: A systematic review and meta-analysis of randomized controlled clinical trials. J Craniomaxillofac Surg. 2017;45(8):1236-45.

2. Esposito M, Felice P, Worthington HV. Interventions for replacing missing teeth: augmentation procedures of the maxillary sinus. Cochrane Database Syst Rev. 2014;2014(5):Cd008397.
3. Meloni SM, Lumbau A, Spano G, Baldoni E, Pisano M, Tullio A, et al. Sinus augmentation grafting with anorganic bovine bone versus 50% autologous bone mixed with 50% anorganic bovine bone: 5 years after loading results from a randomised controlled trial. Int J Oral Implantol (Berl). 2019;12(4):483-92.
4. Gultekin BA, Cansiz E, Borahan O, Mangano C, Kolerman R, Mijiritsky E, et al. Evaluation of volumetric changes of augmented maxillary sinus with different bone grafting biomaterials. Journal of Craniofacial Surgery. 2016;27(2):e144-e8.
5. Felice P, Marchetti C, Piattelli A, Pellegrino G, Checchi V, Worthington H, et al. Vertical ridge augmentation of the atrophic posterior mandible with interpositional block grafts: bone from the iliac crest versus bovine anorganic bone. Eur J Oral Implantol. 2008;1(3):183-98.
6. Elgali I, Omar O, Dahlin C, Thomsen P. Guided bone regeneration: materials and biological mechanisms revisited. Eur J Oral Sci. 2017;125(5):315-37.
7. Korsch M, Walther W, Robra BP, Sahin A, Hannig M, Bartols A. Pre-implantological treatment routines for alveolar ridge atrophy - an investigation among maxillofacial and oral surgeons in southern Germany. BMC Oral Health. 2020;20(1):195.
8. Al-Moraissi EA, Alkhutari AS, Abotaleb B, Altairi NH, Del Fabbro M. Do osteoconductive bone substitutes result in similar bone regeneration for maxillary sinus augmentation when compared to osteogenic and osteoinductive bone grafts? A systematic review and frequentist network meta-analysis. Int J Oral Maxillofac Surg. 2020;49(1):107-20.
9. Jensen OT, Bell W, Cottam J. Osteoperiosteal flaps and local osteotomies for alveolar reconstruction. Oral Maxillofac Surg Clin North Am. 2010;22(3):331-46, vi.
10. Young MP, Sloan P, Quayle AA, Carter DH. A survey of clinical members of the association of dental implantology in the United Kingdom. Part II. The use of augmentation materials in dental implant surgery. Implant Dent. 2001;10(2):149-55.
11. Faul F, Erdfelder E, Lang AG, Buchner A. G*Power 3: a flexible statistical power analysis program for the social, behavioral, and biomedical sciences. Behav Res Methods. 2007;39(2):175-91.
12. Shuttleworth M. Content validity. Retrieved Apr. 2016;14.
13. Lawshe CH. A quantitative approach to content validity. Personnel psychology. 1975;28(4):563-75.
14. Ramirez Fernandez MP, Mazon P, Gehrke SA, Calvo-Guirado JL, De Aza PN. Comparison of Two Xenograft Materials Used in Sinus Lift Procedures: Material Characterization and In Vivo Behavior. Materials (Basel). 2017;10(6).
15. Park WB, Okany KP, Park W, Han JY, Lim HC, Kang P. Atypical and Late-Developed Sinus Graft Complications Following Maxillary Sinus Augmentation: Successful Management with Guided Bone Regeneration. Medicina (Kaunas). 2024;60(8).
16. Peng W, Kim IK, Cho HY, Pae SP, Jung BS, Cho HW, et al. Assessment of the autogenous bone graft for sinus elevation. J Korean Assoc Oral Maxillofac Surg. 2013;39(6):274-82.
17. Sbordone C, Toti P, Guidetti F, Califano L, Bufo P, Sbordone L. Volume changes of autogenous bone after sinus lifting and grafting procedures: a 6-year computerized tomographic follow-up. J Craniomaxillofac Surg. 2013;41(3):235-41.
18. Starch-Jensen T, Deluiz D, Vitenson J, Bruun NH, Tinoco EMB. Maxillary Sinus Floor Augmentation with Autogenous Bone Graft Compared with a Composite Grafting Material or Bone Substitute Alone: a Systematic Review and Meta-Analysis Assessing Volumetric Stability of the Grafting Material. J Oral Maxillofac Res. 2021;12(1):e1.
19. Kormas I, Pedercini A, Alassy H, Wolff LF. The Use of Biocompatible Membranes in Oral Surgery: The Past, Present & Future Directions. A Narrative Review. Membranes (Basel). 2022;12(9).
20. Zhao R, Yang R, Cooper PR, Khurshid Z, Shavandi A, Ratnayake J. Bone Grafts and Substitutes in Dentistry: A Review of Current Trends and Developments. Molecules. 2021;26(10).
21. Starch-Jensen T, Deluiz D, Duch K, Tinoco EMB. Maxillary Sinus Floor Augmentation With or Without Barrier Membrane Coverage of the Lateral Window: a Systematic Review and Meta-Analysis. J Oral Maxillofac Res. 2019;10(4):e1.
22. Urban IA, Lozada JL, Jovanovic SA, Nagursky H, Nagy K. Vertical ridge augmentation with titanium-reinforced, dense-PTFE membranes and a combination of particulated autogenous bone and anorganic bovine bone-derived mineral: a prospective case series in 19 patients. Int J Oral Maxillofac Implants. 2014;29(1):185-93.
23. Simion M, Fontana F, Rasperini G, Maiorana C. Vertical ridge augmentation by expanded-polytetrafluoroethylene membrane and a combination of intraoral autogenous bone graft and deproteinized anorganic bovine bone (Bio Oss). Clin Oral Implants Res. 2007;18(5):620-9.

24. Troeltzsch M, Troeltzsch M, Kauffmann P, Gruber R, Brockmeyer P, Moser N, et al. Clinical efficacy of grafting materials in alveolar ridge augmentation: A systematic review. J Craniomaxillofac Surg. 2016;44(10):1618-29.
25. Alpan AL, Cin GT. Perceptions and Surgical Approaches of Periodontists and Residency Students for Bone Augmentation Procedures. Necmettin Erbakan Üniversitesi Diş Hekimliği Dergisi.6(1):53-64.
26. de Azambuja Carvalho PH, Dos Santos Trento G, Moura LB, Cunha G, Gabrielli MAC, Pereira-Filho VA. Horizontal ridge augmentation using xenogenous bone graft-systematic review. Oral Maxillofac Surg. 2019;23(3):271-9.
27. Urban IA, Montero E, Amerio E, Palombo D, Monje A. Techniques on vertical ridge augmentation: Indications and effectiveness. Periodontol 2000. 2023;93(1):153-82.
28. Quisiguina Salem C, Ruiz Delgado E, Crespo Reinoso PA, Robalino JJ. Alveolar ridge preservation: A review of concepts and controversies. Natl J Maxillofac Surg. 2023;14(2):167-76.
29. Mateo-Sidron Anton MC, Perez-Gonzalez F, Meniz-Garcia C. Titanium mesh for guided bone regeneration: a systematic review. Br J Oral Maxillofac Surg. 2024;62(5):433-40.
30. Milinkovic I, Cordaro L. Are there specific indications for the different alveolar bone augmentation procedures for implant placement? A systematic review. Int J Oral Maxillofac Surg. 2014;43(5):606-25.
31. Urban IA, Lozada JL, Wessing B, Suárez-López del Amo F, Wang HL. Vertical Bone Grafting and Periosteal Vertical Mattress Suture for the Fixation of Resorbable Membranes and Stabilization of Particulate Grafts in Horizontal Guided Bone Regeneration to Achieve More Predictable Results: A Technical Report. Int J Periodontics Restorative Dent. 2016;36(2):153-9.