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Comparative Evaluation of Exploring the Impact of Smoking and Bone Loss Pattern After Implant Placement: An Original Research Study

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KEYWORDS

CBCT, Implant-supported Prosthesis, Horizontal Bone Loss, Vertical Bone Loss

ABSTRACT:

Aim: This study evaluates the effect of smoking on bone loss patterns after implant placement.

Materials and Methods: This study involved 20 patients, including both smokers and non-smokers, who required implants for missing mandibular posterior teeth. Only 20 out of 30 approached consented, underscoring the significance of patient willingness. Participants aged 25 to 50 had one missing mandibular right posterior tooth and were otherwise healthy. The same operator used a standardized implant kit for all procedures. Each patient received a chlorhexidine rinse and local anaesthesia, with 10 implants placed for primary stability. Mucosal flaps were secured with non-absorbable sutures, and rinses continued post-operatively. The prosthetic phase started two weeks post-surgery, with a one-year follow-up using CBCT to evaluate bone loss patterns.

Statistical Analysis and Results: This study employed SPSS software, created in Chicago, USA, for comprehensive data analysis.Participants was divided into two groups: Group 1 consisted of 10 smokers, and Group 2 included 10 non-smokers. Both groups underwent cone beam computed tomography (CBCT) evaluations before receiving implant-supported prostheses for mandibular posterior teeth. In Group 1, 4 patients showed horizontal bone loss, 5 had vertical loss, and 1 exhibited both patterns, with a significant p-value of 0.02 for horizontal loss. In Group 2, 3 patients had horizontal loss, 4 had vertical loss, and 3 showed both, with a significant p-value of 0.03 for vertical loss.

Conclusion: The authors concluded that smoking's impact on bone loss patterns after dental implant placement is crucial for the success of implant-supported prostheses. The findings indicate that smokers experience significantly more vertical bone loss compared to nonsmokers, although their horizontal bone loss is slightly lower. Overall, smokers tend to have a moderate degree of vertical bone loss, impacting implant success and longevity.

Introduction

Replacing missing teeth with dental implants requires a precise assessment of the implant site to ensure successful placement and to avoid damaging nearby vital structures.[1,2] Cone Beam Computed Tomography (CBCT) is the preferred choice. It has significantly

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reduced implant failures by providing accurate information about vital structures and the height, width, bone density, and profile of the alveolus, all while delivering low radiation exposure. A CBCT machine uses a cone-shaped beam and a reciprocating solid-state flat panel detector that rotates around the patient, covering the defined anatomical volume (either the entire dental/maxillofacial area or a limited regional area of interest). This approach differs from conventional CT, which produces images slice by slice. Digital technology has significantly improved dental radiology, enhancing imaging processes like acquisition, post-processing, and review. This advancement has streamlined workflows and improved communication among dental professionals. Three-dimensional imaging techniques, such as cone beam computed tomography (CBCT), offer detailed 3D images for better visualization and treatment planning of complex anatomical structures. In addition, these radiographs allow the observation of bone loss patterns such as horizontal bone loss, vertical bone loss, and furcation defects in periodontitis cases.[2,3]It is very important to determine the bone loss patterns and bone morphology to make an appropriate treatment plan and achieve successful results.[4] Horizontal bone loss happens uniformly across all tooth surfaces, with the alveolar crest resorbing parallel to healthy levels. In contrast, vertical bone loss is localized and angled in the interdental regions. Smoking is a significant risk factor that not only initiates and exacerbates periodontal disease but also hinders successful treatment, increasing bone destruction in both patterns. Assessing alveolar bone levels in periodontal disease is essential for planning surgeries and determining treatment outcomes. Vertical bone loss can lead to complications like furcation defects, making accurate diagnosis essential.[5] Additionally, research indicates that smoking exacerbates periodontal disease, affecting treatment outcomes, highlighting the need for tailored strategies for affected patients.[6] This study aims to evaluate the impact of smoking and bone loss patterns following implant placement.

Materials and Methods

This study was conducted on a total of 20 patients, comprising both smokers and non-smokers, who required implant placement due to the absence of mandibular posterior teeth. Initially, 30 patients were approached to participate in the study, but only 20 consented to undergo the procedure, thus highlighting the importance of patient willingness in clinical research. The participants, aged between 25 and 50 years, included individuals of both genders. Each patient was carefully screened and provided written consent before proceeding with the implant placement. The inclusion criteria were specifically designed to target individuals with a single missing mandibular right posterior tooth who were open to receiving an implant-supported prosthesis. Those excluded from the study had uncontrolled systemic health issues or were unable to open their mouths sufficiently, which would prevent effective surgical intervention. To maintain a high level of standardization and consistency in the surgical process, the same experienced operator performed all procedures. All implants were placed using a standardized implant kit, meticulously chosen to enhance both the speed and efficiency of the surgery. Prior to the surgical procedure, each patient underwent a pre-operative rinse with chlorhexidine, an antimicrobial agent aimed at reducing the risk of infection. Local anesthesia was administered to ensure patient comfort during the procedure. In total, 10 implants were strategically placed in both the smoker and non-smoker groups each, with primary stability confirmed at the end of each procedure. Following implant placement, the mucosal flaps were skillfully repositioned and secured with non-absorbable sutures to promote optimal healing. Post-operatively, patients were advised to continue rinsing with chlorhexidine to further bolster infection control during the healing process. The prosthetic phase was initiated two weeks after the completion of the surgical phase. A comprehensive follow-up was conducted one year later to evaluate the patterns of bone loss, utilizing Cone Beam Computed Tomography (CBCT) to ensure precise and accurate assessment of the implant sites. This thorough approach underscored the study's commitment to understanding the long-term effects of implant placement in varying patient demographics.

Statistical Analysis and Results

All studies employed SPSS software, created in Chicago, USA, for comprehensive data analysis. These studies showcased a range of variables concerning patients and their corresponding treatments, presenting the data in several formats, including means

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accompanied by standard deviations and proportions represented as numerical values. To determine statistical significance, the study analyzed the differences in proportions across various groups using the chi-square test, allowing for a rigorous categorical data comparison.

Results

This study encompassed a cohort of 20 patients, whose ages ranged from 25 to 50 years, representing a incorporation of both genders. As detailed in Table 1, the statistical analysis reveals the age and gender distribution of these participants, with a total of 7 males and 13 females included in the study. The demographic landscape of these patients is visually represented in Graph 1, which highlights key demographic details. The participants were strategically divided into two distinct groups for the study's purposes. Group 1, comprising 10 patients, consisted of individuals who were habitual smokers. These participants underwent a thorough evaluation using cone beam computed tomography (CBCT) before receiving implant-supported prostheses aimed at replacing their mandibular posterior teeth. In contrast, Group 2 also included 10 patients who were non-smokers. Similar to Group 1, these non-smoking participants received implant-supported prostheses following a comprehensive CBCT assessment for the same dental interventions. Table 2 delineates the findings from the statistical analysis conducted on Group 1 (smokers, n=10), focusing on the patterns of bone loss identified through CBCT imaging. The results revealed that 4 patients exhibited a horizontal pattern of bone loss, while 5 demonstrated a vertical pattern. Additionally, 1 patient showed a combination of both horizontal and vertical patterns. Notably, the p-value indicating the significance of the horizontal bone loss pattern was calculated at p=0.02.Turning to Group 2 (non-smokers, n=10), Table 3 presents similar findings based on the same evaluative criteria. Here, it was noted that 3 patients displayed a horizontal bone loss pattern, 4 had a vertical bone loss pattern, and 3 exhibited a combination of both patterns. In this group, the p-value for the vertical bone loss pattern was determined to be significant, with a value of p=0.03.Lastly, Table 4 showed a comprehensive estimation encompassing all studied groups, utilizing one-way analysis of variance (ANOVA) to analyze the overall data effectively. This thorough assessment allows for a more expansive understanding of the differences and trends in bone loss patterns across both smoking and non-smoking patients.

Table 1: Age & gender based statistical description of contributing patients

Age Group (Yrs)	Male	Female	Total	P value
25-30	1	3	4	0.01*
31-35	2	6	8	0.20
36-40	1	2	3	0.60
41-45	2	1	3	0.90
46-50	1	1	2	0.50
Total	7	13	20	*Significant
				*p<0.05 significant

Graph 1: Patients demographic distribution and associated details

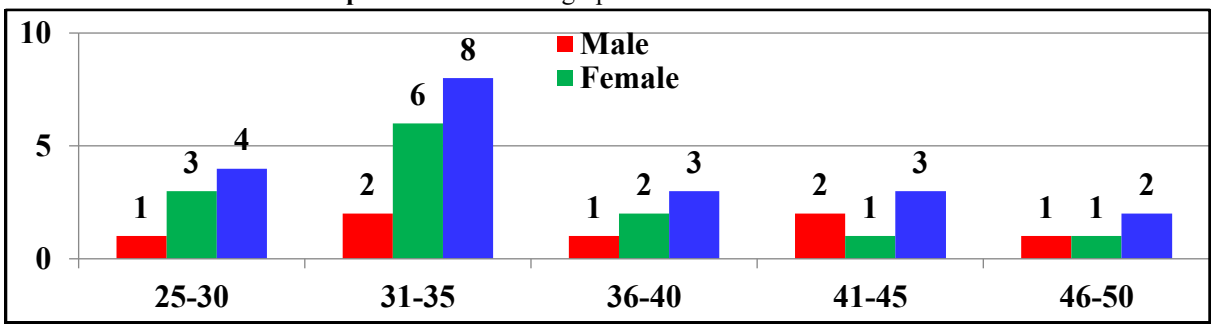

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Table 2: Evaluation of statistical assessment with level of significance using "Pearson Chi-Square" test, Group 1 smokers (n=10)based on type of bone loss pattern evaluated by cone beamed computer tomography (CBCT)

Types of bone loss pattern	n	Stat. Mean	Std. Dev.	Std. Error	95% CI	Pearson Chi-Square Value	df	p value
Horizontal	4	1.13	0.494	0.155	1.56	2.381	1.0	0.02*
Vertical	5	1.15	0.895	0.268	1.97	3.682	1.0	0.80
Combination	1	1.09	0.289	0.049	1.48	1.078	1.0	0.56
*p<0.05 significant								

Table 3: Evaluation of statistical assessment with level of significance using "Pearson Chi-Square" test (Group 2 non-smokers (n=10) based on type of bone loss pattern evaluated by cone beamed computer tomography (CBCT)

Types of bone loss pattern	n	Stat. Mean	Std. Dev.	Std. Error	95% CI	Pearson Chi-Square Value	df	p value
Horizontal	3	1.12	1.593	1.152	2.60	2.180	1.0	0.26
Vertical	4	1.13	2.789	2.166	3.96	3.235	1.0	0.03*
Combination	3	1.12	0.193	0.176	1.85	0.280	1.0	0.45
*p<0.05 significant								

Table 4: Estimation amongst all studied groups using one-way ANOVA

Variables	Degree of Freedom	Sum of Squares ∑	Mean Sum of Squares m∑	F	Level of Sig. (p)
Between Groups	3	1.320	1.437	1.3	0.001*
Within Groups	14	2.204	0.723	_	
Cumulative	103.13	07.544	*p<0.05 significant		

Discussion

Nemtoi et al reviewed that the advent of digital technology in the field of medical imaging has profoundly transformed dental radiology, leading to significant enhancements in various imaging processes, such as acquisition, post-processing, and review.[7] Gaeta-Araujo H et at reviewed that this technological leap has not only streamlined the workflow but has also improved the quality of image archiving and communication among dental professionals.[8] Bushberg JT et al in his study included that in contrast, the introduction of three-dimensional imaging techniques, such as multisided computed tomography (CT) and cone beam computed tomography (CBCT), has revolutionized the visualization of complex anatomical structures. CBCT, in particular, employs a rotating x-ray tube and detector to create highly detailed 3D images, allowing for precise analysis and treatment planning.[9] Lee CT et al reviewed that Radiographic evaluations play a pivotal role in diagnosing patterns of bone loss in patients, a critical factor in assessing periodontal health. reviewed that the bone loss can manifest in various ways, which include horizontal bone loss, indicating a uniform reduction in bone across all surfaces, while vertical bone loss typically occurs obliquely within the interdental regions.[10] Ertaş K et al reviewed in their study that vertical loss can lead to significant complications, such as furcation defects affecting multi-rooted teeth, making accurate diagnosis essential for effective treatment.[11]Moreover, it is crucial to consider the impact of lifestyle factors, particularly smoking, on periodontal disease. Bagaitkar et al stated that smoking significantly increases the risk, extent, and severity of periodontal issues; it alters the fatty acid profile of

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saliva, which in turn diminishes the effectiveness of treatment outcomes. Consequently, smokers often experience less favourable results when managing periodontal disease through various interventions, including grafting and implant procedures, compared to non-smokers.[12,13] Schiegnitz E.et al reviewed that it is important to understand the factors that affect dental implants to create effective treatment plans for patients with smoking-related issues. Recently, dental implants have been used for both complete and partial tooth replacement. Studies show that non-smokers have a success rate of 95.2% to 98.8% with dental implants.[14-17] Chrcanovic B.R. et al included in their study that several problems can lead to implant failure, including peri-implantitis, movement of the implant, bone loss, dark areas around the implant on X-rays, ongoing pain, infections, nerve issues, tingling sensations, and problems with the jaw nerve. The link between where the implant is positioned, the thickness of the surrounding tissue, and bone loss is complicated.[18-21] Sher J. et al reviewed in their study that when dental implants are positioned below the crest of the bone, combined with the presence of thinner soft tissues, there is an increased risk of bone loss over time. This correlation suggests a complex interplay between implant placement and tissue characteristics that warrants further investigation. Additionally, the timing of bone loss following implant placement plays a significant role; studies have shown that the rate of bone loss tends to be more pronounced at the three-month mark compared to six months post-surgery. Understanding these dynamics is essential for improving implant success and longevity.[22-26]

Conclusion

Within the limitations of this study, the outcome of the results has clarified the impact of smoking on bone loss patterns following the placement of dental implants. Understanding these bone loss patterns is crucial for the success of implant-supported prostheses used in replacing missing teeth. The findings revealed a significant disparity between smokers and non-smokers; specifically, smokers experienced a greater percentage of vertical bone loss compared to their non-smoking counterparts. While the smokers exhibited a notably increased amount of vertical bone loss, the horizontal bone loss they experienced was slightly lower than that observed in non-smokers. Overall, this indicates that smokers tend to suffer from a moderately significant degree of vertical bone loss, which could have important implications for implant success and longevity.

References

1. Venkatesh E, Elluru SV. Cone beam computed tomography: basics and applications in dentistry. J Istanb Univ Fac Dent 2017;51(3 Suppl 1):S102-S121
2. De Faria Vasconcelos K, Evangelista KM, Rodrigues CD, Estrela C, de Sousa TO, Silva MA. Detection of periodontal bone loss using cone beam CT and intraoral radiography. Dentomaxillofac Radiol. 2012;41:64–9.
3. Haas LF, Zimmermann GS, De Luca Canto G, Flores-Mir C, Corrêa M. Precision of cone beam CT to assess periodontal bone defects: a systematic review and meta-analysis. Dentomaxillofac Radiol. 2018;47:20170084.
4. Shrier I., Boivin J.F., Steele R.J., Platt R.W., Furlan A., Kakuma R., Brophy J., Rossignol M. Should meta-analyses of interventions include observational studies in addition to randomized controlled trials? A critical examination of underlying principles. Am. J. Epidemiol. 2007;166:1203–1209.
5. Gomes-Filho IS, Sarmento VA, de Castro MS, da Costa NP, da Cruz SS, Trindade SC, et al. Radiographic features of periodontal bone defects: evaluation of digitized images. Dentomaxillofac Radiol. 2007;36:256–62.
6. Jayakumar A, Rohini S, Naveen A, Haritha A, Reddy K. Horizontal alveolar bone loss: a periodontal orphan. J Indian Soc Periodontol. 2010;14:181–5.
7. Nemtoi A, Czink C, Haba D, Gahleitner A. Cone beam CT: a current overview of devices. Dentomaxillofac Radiol 2013;42(8):20120443.
8. Meijer HJA, Slagter KW, Gareb B, Hentenaar DFM, Vissink A, Raghoebar GM. Immediate single-tooth implant placement in bony defect sites: A 10-year randomized controlled trial. J Periodontol. 2025 Feb;96(2):151-163.
9. Gaˆeta-Araujo H, Alzoubi T, Vasconcelos KdF, Orhan K, Pauwels R, Casselman JW, et al. Cone beam computed tomography in dentomaxillofacial

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radiology: a two-decade overview. Dentomaxillofac Radiol 2020;49(8):20200145.

10. Bushberg JT, Seibert JA, Leidholdt Jr E. The Essential Physics of Medical Imaging. 4th ed. Lippincott Williams & Wilkins (LWW); 2020.
11. Lee CT, Kabir T, Nelson J, Sheng S, Meng HW, Van Dyke TE, et al. Use of the deep learning approach to measure alveolar bone level. J Clin Periodontol. 2022;49:260–9.
12. Ertaş K, Pence I, Cesmeli MS, Ay ZY. Determination of the stage and grade of periodontitis according to the current classification of periodontal and peri-implant diseases and conditions (2018) using machine learning algorithms. J Periodontal Implant Sci. 2023;53(1):38–53.
13. Bagaitkar J, Demuth DR, Daep CA, Renaud DE, Pierce DL, Scott DA. Gingivalis fimbrial proteins which induce TLR2 hyposensitivity. PLoS One. 2010; 5(5): e9323.
14. Schiegnitz E, Al-Nawas B. Narrow-diameter implants: A systematic review and meta-analysis. Clin. Oral Implant. Res. 2018;29((Suppl. 16)):21–40.
15. Abdel-Halim M., Issa D., Chrcanovic B.R. The Impact of Dental Implant Length on Failure Rates: A Systematic Review and Meta-Analysis. Materials. 2021;14:3972.
16. Chrcanovic B.R., Kisch J., Albrektsson T., Wennerberg s. Bruxism and dental implant failures: A multilevel mixed effects parametric survival analysis approach. J. Oral Rehabil. 2016;43:813–823.
17. Chrcanovic B.R., Kisch J., Albrektsson T., Wennerberg A. Bruxism and dental implant treatment complications: A retrospective comparative study of 98 bruxer patients and a matched group. Clin. Oral Implant. Res. 2017;28:e1–e9.
18. Chrcanovic B.R., Albrektsson T., Wennerberg A. Diabetes and oral implant failure: A systematic review. J. Dent. Res. 2014;93:859–867.
19. Jiang X., Zhu Y., Liu Z., Tian Z., Zhu S. Association between diabetes and dental implant complications: A systematic review and meta-analysis. Acta Odontol. Scand. 2021;79:9–18.
20. Chrcanovic B.R., Albrektsson T., Wennerberg A. Periodontally compromised vs. periodontally healthy patients and dental implants: A systematic review and meta-analysis. J. Dent. 2014;42:1509–1527.
21. Chrcanovic B.R., Albrektsson T., Wennerberg A. Bisphosphonates and dental implants: A meta-analysis. Quintessence Int. 2016;47:329–342.
22. Sher J., Kirkham-Ali K., Luo J.D., Miller C., Sharma D. Dental Implant Placement in Patients With a History of Medications Related to Osteonecrosis of the Jaws: A Systematic Review. J. Oral Implantol. 2021; 47:249–268
23. Chrcanovic B.R., Albrektsson T., Wennerberg A. Dental Implants in Patients Receiving Chemotherapy: A Meta-Analysis. Implant. Dent. 2016;25:261–271
24. Chrcanovic B.R., Kisch J., Albrektsson T., Wennerberg A. Is the intake of selective serotonin reuptake inhibitors associated with an increased risk of dental implant failure? Int. J. Oral Maxillofac. Surg. 2017;46:782–788.
25. Sher J., Kirkham-Ali K., Luo J.D., Miller C., Sharma D. Dental Implant Placement in PatientsWith a History of Medications Related to Osteonecrosis of the Jaws: A Systematic Review. J. Oral Implantol. 2021;47:249–268
26. Chen J., Cai M., Yang J., Aldhohrah T., Wang Y. Immediate versus early or conventional loading dental implants with fixed prostheses: A systematic review and meta-analysis of randomized controlled clinical trials. J. Prosthet. Dent. 2019;122:516–536.