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A Clinical and Radiographic Study Evaluated the Biologic Width of the Periodontium in Individuals with Healthy Periodontitis, Generalized Chronic Periodontitis and Generalized Aggressive Periodontitis

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***Abstract*:**The progression of periodontal destruction is generally considered to be chronic in nature and slowly progressing. This study was to correlate radiographic examination with the clinical periodontal condition in cases of biologic width in subjects with healthy periodontium,generalized chronic periodontitis and generalized aggressive periodontitisclinically and radiographically. Subjects between the age group of 20 and 45 years were screened. About10 patients each with healthy periodontium,subjects with generalized chronic periodontitis and generalized aggressive periodontitis were selected.The 21 sites each with biologic width invasion were found in patients with the three groups.The mean biological widthper group was compared with the control group. Radiographs and clinical periodontal parameters were analyzed. Exploratory analysis and Spearman's correlation were used to perform statistical analyses (SPSS $p<0.05$).Results showed a positive correlation between radiographic parameters of biologic width invasion and clinical conditions, with the mean clinical biological widthvalues in the healthy group being statistically greater than those in the groups 1 and 2.

Key words: *Biologic width, Periodontitis, Radiographic, Periodontium, bone level.*

Introduction

For the lifetime of teeth and the success of restorations, maintaining gingival health is essential. Sicher coined the term "biological width" (BW) in 1959, and is defined as the distance from the clinical attachment level to the crestal bone level. BW acts as a defense against pathogenic biofilm attacks for the supporting alveolar bone and adjacent subjacent periodontal ligament[1]. By disrupting tissue homeostasis, a breach of BW can have an effect on periodontal health [2].A study aimed to correlateradiographic examination with the clinical periodontal condition in cases of biologic width in subjects with healthy periodontium, generalized chronic periodontitis (GCP) and generalized aggressive periodontitis (GAP) clinically and radiographically.

Materials And Methods

The study involved 10 patients each with healthy periodontitis, generalized chronic periodontitis, and generalized aggressive periodontitis visiting the Department of Periodontics at Rama Dental College Hospital & Research Centre in Kanpur, India. The study was approved by the Institutional Ethical Committee.

The study included subjects aged 20-45 years, with three groups:

Group 1: Subjects having ≥20 teeth with ≥30% of measured sites with ≤3 mm clinical attachment level (CAL) and no bleeding on probing were considered healthy.

Group 2: Subjects having ≥20 teeth with ≥30% of measured sites with ≥5 mm pocket depth (PD) and ≥3 mm clinical attachment level (CAL) were considered GCP.

Group 3: Subjects having generalized attachment loss in at least three permanent teeth other than first molars and incisors were considered GAP.

The study focused on patients with restored posterior teeth with biologic width invasion in the mesial or distal surface. The 21 sites each with biologic width invasion was found in patients within the three groups were selected. Subjects were excluded if they had received antibiotic therapy, nonsurgical periodontal therapy, or surgical periodontal therapy. The study used interproximal x-rays for radiographic analysis, with an intra-class correlation coefficient of 0.98. The diagnostic method for biologic width invasion was based on a systematic review[3] with the cut-point for biologic width invasion being a distance ≤ 3 mm between the bone crest and the restoration marginFig. 1.Clinical parameters analyzed included plaque index, bleeding on probing, probing depth, height of gingival recession, clinical attachment level, width of gingival recession, keratinized tissue height, and keratinized tissue thickness.

Fig.1 Interproximal radiography of biologic width invasion by overextending margin restoration.

Clinical variables such plaque index, bleeding on probing, probing depth, height of gingival recession, clinical attachment level (CAL), width of gingival recession, height of keratinized tissue, and thickness of keratinized tissue were examined in the study.

In cases of intra-bony defects, the following radiographic parameters were evaluated:

1. Bone defect level (BDL) was the vertical distance from the CEJ to the base of the bone defect at which the periodontal ligament space appeared normal.

2. Bone crest level (BCL) was the vertical distance between the CEJ and the bone crest.

3. Intra-bony component (INTRA) was defined by subtracting BDL-BCL, i.e., the vertical distance from the bone crest to the base of the defect.

4. Horizontalcomponent (HC) was the horizontal distance from the bone crest to the root surface in a perpendicular line to the axis of the tooth with biologic width invasion.

For each index tooth, radiographs were collected using radiovisiography, and the clinical bone level (CBL) was the distance (from CEJ to the alveolar crest) on proximal surfaces. CAL was subtracted from clinical bone level (CBL) to determine clinical BW.

Statistical Analysis

Frequencies, averages, and standard deviations were provided via exploratory analysis, which was carried out statistically using statistical package SPSS® version 22.0. The 95% confidence interval and 5% significance level were used. The correlation between clinical and radiographic findings was validated using the Shapiro-Wilk test and Spearman's rank correlation coefficient.

Results

Table 1.Prevalence of biologic width invasion by tooth surface among three Groups.

Groups	Parameter	Total	
		N	%
Group1	Surface		
	Mesial	10	49.7
	Distal	11	57.8
Group2	Surface		
	Mesial	10	47.4
	Distal	11	55.3
Group3	Surface		
	Mesial	10	39.6
	Distal	11	52.4

In the teeth that showed biologic width invasion, the mesial surface was involved in 49.7% (n=10) and the distal surface in 57.8% (n=11) of the group 1 was more as compared to test groups(Table 1).

Table 2. Average of the parameters related to the sites probed (n = 21)among three Groups.

Parameters related to the sites probed	Mean ± SD (mm)		
	Group 1	Group 2	Group 3
Probing depth	2.69±2.19	2.27±0.19	2.23 ± 0.18
Clinical attachment level	2.31±1.12	2.29±0.19	2.23 ± 0.18
Height of gingival recession	2.50 ± 0.21	1.51 ± 0.20	0.50 ± 0.18
Width of gingival recession	1.51 ± 0.59	1.48 ± 0.57	1.38 ± 0.52
Keratinized tissue height	5.15 ± 0.41	4.95 ± 0.34	4.85 ± 0.30
Keratinized tissue thickness	1.62 ± 0.21	1.51 ± 0.19	1.40 ± 0.16
Level of bone defect	2.93 ± 0.19	2.89 ± 0.17	2.81 ± 0.13
Bone crest level	2.01 ± 1.13	1.99 ± 0.19	1.98 ± 0.08
Intra-bony component	1.74 ± 0.19	0.89 ± 0.15	0.83 ± 0.10
Horizontal component	1.67 ± 0.32	1.09 ± 0.17	1.05 ± 0.15

Table 2showed the radiographic findings on 21 sites with biologic width invasion were found in patients with the three groups. Two teeth presented with mobility class I, corresponding to 9.5% of the teeth with biologic width invasion. No teeth with biologic width invasion presented with furcation defects.

Table 3. Spearman rank correlation coefficient (r_s) of clinical and radiographic findings among three Groups.

Clinical parameters	Radiographic parameters							
	Level of bone defect		Bone crest level		Intrabony component		Horizontal component	
	r_s	p	r_s	p	r_s	p	r_s	p
Tooth	0.278	0.101	-0.076	0.351	0.263	0.102	-0.231	0.132
Site	-0.167	0.219	0.100	0.343	-0.329	0.090	-0.364	0.087
Plaque index	0.149	0.253	-0.075	0.387	0.277	0.141	0.566	0.004*
Bleeding on probing	0.059	0.412	0.006	0.475	0.188	0.204	0.554	0.004*
Probing depth	0.271	0.129	0.099	0.349	0.101	0.339	0.296	0.103
Clinical attachment level	0.221	0.182	0.035	0.451	0.051	0.417	0.269	0.129
Height of gingival recession	0.198	0.195	0.397	0.039*	0.136	0.291	-0.282	0.119
Width of gingival recession	0.154	0.291	0.424	0.027*	0.039	0.455	-0.329	0.079
Keratinized tissue height	0.167	0.238	-0.099	0.349	0.356	0.078	0.186	0.224
Keratinized tissue thickness	0.152	0.267	-0.195	0.199	0.268	0.137	-0.097	0.347
Diagnosis	-0.085	0.359	0.069	0.387	0.106	0.329	0.249	0.160

*Statistically significant correlation

The correlations between the clinical and radiographic findings were shown in Table 3. There was a significant positive correlation between the plaque index and bleeding on probing with the horizontal component, as well as the height and width of the gingival recession with the bone crest level.

Discussion

The study demonstrates a relationship between plaque index and bleeding on probing, two clinical symptoms, and radiographic measures of biologic breadth invasion. By correctly inserting junctional epithelium and connective tissue fibers throughout biologic width, periodontal health is preserved[4]. Inflammatory processes, gingival recession, and raised bone crest level might result from operations such cavity fillings, definitive restorations, provisional restorations, and dental impressions. To evaluate the periodontal tissues around the surrounding teeth, measurements on the buccal surface are taken.

According to the study, rough surface patches on posterior teeth that have biologic width invasion may be the cause of their high plaque index, which can cause severe gingival inflammation, periodontal degeneration, and gingival recession[3,5]. The diagnosis was made using the interproximal approach since it is less prone to distortion [6].Understanding gingival tissue architecture and physiology is critical for establishing adequate mastication, aesthetics, and a healthy interface, and clinical examination of dental restorations is crucial for identifying biologic width invasion[7,8]. The present results show that gingival inflammation and bone crestresorption were common findings in cases of posterior teeth with biologic width invasion among three groups.

Biologic width invasion in periodontal disease is closely associated with local periodontal disease and should be classified as acquired deformitiesand conditions [9].On statistical analysis, the mean BW in group 1 (Healthy) was greater than group 2 (GCP) and group 3 (GAP) ($P < 0.05$). BW is essential for preservation of periodontal health. Adequate biological width protects the tooth from inflammatory changes and progression from health to disease. Hence, in the current study, the mean BW was greater in heath as compared to GCP and GAP.

Results were in accordance with studies who found a mean clinical biological width of 2.36 mm in healthy subjects versus the mean clinical biological width of 1.92 mm in chronic periodontitis subjects. Furthermore, the histological BW was found to be 2.04 mm [10].In group 2 (GCP) and group 3 (GAP), there was a statistical inverse correlation between the clinical parameters (PD, CAL), wherein increased PD and CAL were noted in groups 2 and 3 with reduced BW values as compared to healthy control group. Violated BW can result in uncontrolled bone resorption and periodontal disease. New longitudinal studies are needed to investigate more relevant periodontal correlations and use regression analysis to determine the behavior and causality between variables [11].

Conclusion

New longitudinal studies are needed to investigate periodontal correlations and regression analysis. A positive correlation was found between biologic width invasion and clinical conditions, with healthy periodontium having a greater mean clinical BW than GCP and GAP. Further research is needed to understand the role of biologic width in prognosis and restorative dentistry.

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References

[1] Gaddale, R.,Mudda, J., Karthikeyan, I., Desai, S., Shinde, HH.,&Tapashetti R, et al. (2015). Determination of clinical biologic width in chronic generalized periodontitis and healthy periodontium: A clinico-radiographical study. J Indian SocPeriodontol, 19,194-8.

[2] Bosshardt D.D., & Lang, N,P. (2005). The junctional epithelium: from health to disease. J Dental Res, 84, 9-20.

[3] Schmidt, J.C., Sahrmann, P., Weiger, R., Schmidlin, P.R., & Walter, C. (2013). Biologic width dimensions - a systematic review. J Clinical Periodontol, 40, 493- 504.

[4] Gargiulo, A.W., Wentz, F.M., &Orban, B (1961). Dimensions and relations of the dentogingival junction in humans. J Periodontol, 32:261-7.

[5] Kosyfaki, P., Pinilla, P.D., Martín, M, &Strub, J.R. (2010). Relationship between crowns and the periodontium: a literature update. Quintessence International, 41, 109-26.

[6] Pimentel, J.O., Filho, A.M.M., Mota, O.M.L., Pereira, S.L.S., Lima, D.L.F., & Carlos, M.X. (2006). Comparative study between radiographic and surgical evaluation in the diagnosis of invasion of periodontal biological space. Revista de Periodontia,1,11-5.

[7] Sanavi, F., Weisgold, A.S., & Rose, L.F. (1998). Biologic width and its relation to periodontal biotypes. J Esthetic Dent,3,157-63.

[8] Sadan, A. & Adar, P. (1998). Esthetic proportions versus biologic width considerations: A clinical dilemma. J Esthetic Dent, 4,175-81.

[9] Armitage, G.C. (1999). Development of a classification system for periodontal diseases and conditions. Ann Periodontol, 4,1-6.

[10] Rajesh, K.S., Ganji, S.D., Hegde, S., Kumar, M.S. (2016). Biologic width dimensions in diseased and healthy periodontium a clinico-radiographic study. Indian J Dent Adv,8,3-9.

[11] Nugala, B., Kumar, B.S., Sahitya, S., Krishna, P.M. (2012). Biologic width and its importance in periodontal and restorative dentistry. J Conservative Dent, 15, 12-7