Advances in Dentistry & Oral Health
ISSN: 2472-6389

Juniper Publishers
key to the Researchers

Research Article
Volume 15 Issue 3 - May 2022
DOI: 10.19080/ADOH.2022.15.555915

Adv Dent & Oral Health

Differences of Annual Radiographic Periodontal Attachment levels among Periodontitis Disease Groups for Periodontal Treatment with and without using the TPP splint

Guey-Lin Hou[1,2]* and I Zu-Wang[3]

[1]*Department of Periodontology, Periodontal-Prosthetic Therapeutic Center, Chang Gung Memorial Hospital, Kaohsiung Medical Center, Taiwan*

[2]*Department of Periodontology, Graduate Institute of Dental Sciences, School of Dental Medicine, Kaohsiung Medical University, Taiwan*

[3]*Graduate Institute of Dental Science, Department of Periodontology, School of Dental Medicine, Kaohsiung Medical University, Taiwan*

Submission: May 17, 2022; **Published:** May 30, 2022

***Corresponding author:** Guey Lin Hou, Department of Periodontology, Periodontal-Prosthetic Therapeutic Center, Chang Gung Memorial Hospital, Kaohsiung Medical Center, Graduate Institute of Dental Sciences, School of Dental Medicine, Kaohsiung Medical University, Taiwan

Abstract

The aim of the present study was to assess the differences annual radiographic periodontal attachment levels (ARPAL) of treatment for periodontal treatment of teeth with and without using the TPP splint over 5 years or more. A total of 53 subjects, who had taken two sets of full-mouth periapical paralleling radiographs with separated periods of 5 years or more in the hospital were collected for the past 20 years. The radiographic periodontal attachment levels at mesial and distal aspects of teeth were assessed by measuring the distance between cemento-enamel junction (CEJ) and the bone crest using an electronic digimatic caliper (EDC) under a 3.5X magnified dental x-ray radiographs. Results revealed that there was a remarkable gain of ARPAL and significant ($p<0.001$) (+0.10±0.19 mm/yr.) in the treatment of teeth with TPP splint as compared to the bone loss (-0.05±0.13 mm/yr.) those teeth without TPP splint, respectively. We concluded that here was a significant attachment level gain in the teeth with TPP splint as compared to the teeth without TPP splint.

Keywords: Periodontal treatment; ARPAL; TPP splint

Abbreviations: IPAL: Intermittent Periodontal Attachment Loss; ARPAL: Annual Radiographic Periodontal Attachment Levels; CP: Chronic Periodontitis; EDC: Electronic Digimatic Caliper; CEJ: Cemento Enamel Junction; LAgP: Localized Aggressive Periodontitis; GAgP: Generalized Aggressive Periodontitis; PH: Periodontal Healthy; AgP: Aggressive Periodontitis

Introduction

There are large losses of the alveolar bone in the maxillary and mandibular molars and the premolar molars, whereas periapical x-rays of these teeth usually show typical trauma from occlusion images, hourglass effects due to widening of the periodontal ligament, and intra-osseous defects are particularly pronounced. Wouters et al. [1] measured the root length and the height of the alveolar bone and calculated the ratio of the two (Bone/Root; B/R). After analysis, it was found that: 1) The average of the ratio of alveolar bone height to root length (B/R) did not differ significantly between men and women; 2) The average of the ratio of alveolar bone height to root length (B/R) decreases with age, at a rate of 0.04 mm (0.26%/year) for each additional year.

Norwegian investigator Dr. Albandar & Abbas [2] measured the change of X-ray alveolar bone over a two-year period for 180 adult periodontitis patients by enlarging the two radiographic x-ray images 10 times before and after, and then depicting the shape with 10 times the magnification of transparent checkered paper, measuring the distance from CEJ to the alveolar crest, and the average annual amount of X-ray alveolar bone loss was -0.11mm/yr. In addition, Papapanou et al. [3] also observed 283 adult patients with periodontitis for 10 years by measuring the previous and subsequent radiographic x-ray images, and the results were from -0.07mm to - 0.28 mm/yr. The results of this study in patients with chronic periodontitis (CP) are from -0.08

to -0.25mm/yr., with an average of -0.09±0.05mm/yr., similar to the results observed by the former two investigators. In addition, Brown et al. [4] observed 91 American adolescents aged 13 to 20 with EOP for 6 years, using periodontal probes to probe the height of periodontal attachment. In addition, he also showed that the fastest rate of periodontal attachment loss was in the full-mouth young periodontitis (GJP) group (0.18mm/yr.), followed by localized young periodontitis (LJP) group (0.08 mm/yr.), and the intermittent periodontal attachment loss (IPAL) group (0.02mm/yr.).

Materials and Methods

Table 1: Distribution and percentage (%) of the sample pool by age groups (at the time of 1st time X-ray taking).

Age(years)	Total samples n (%)					
	Male		Female		Total	
	n	(%)	n	(%)	n	(%)
20-34	10	18.9 (%)	10	18.9 (%)	20	37.7 (%)
35-49	12	22.6 (%)	12	22.6 (%)	24	45.3 (%)
50-64	6	11.3 (%)	2	3.8 (%)	8	15.1 (%)
≥65	1	1.9 (%)	0	0 (%)	1	1.9 (%)
Total	29	54.7 (%)	24	45.3 (%)	53	100 (%)

AGE mean ± SD: 37.70±11.58 y/o.

From 1981 to 2001, the Department of Periodontology of Kaohsiung Medical University had received two routine full mouth periapical radiographs examinations with an interval of more than five years, and their full-mouth root tip of periapical radiographs were screened to meet the standard parallel or wing-biting method. A total of 53 patients were collected samples. The age of the patients ranged from 20 to 66 years (mean age 37.7±11.58 years), and their age distribution (20-34 years, 35-49 years, 50-64 years, and over 65 years and males compared to male and female are showed in Table 1.

This article uses the method of electronic digimatic caliper (EDC) to measure the change of radiographic x-ray periodontal attachment. This is similar to the research of radiographic x-ray periodontal attachment loss of various types of periodontal diseases counted by dental periapical radiographic image analysis of magnify method in the past, first of the end of study. we use ARPAL, and its mean and standard deviation (M±SD) of annual level changes to make a comparison among these study groups. Comparison of annual radiographic periodontal attachment level (ARPAL) in different periodontal groups as follows: chronic periodontitis (CP), localized aggressive periodontitis (LAgP), generalized aggressive periodontitis (GAgP); periodontal healthy (PH) (Table 2). In order to understand the different change rates of ARPAL, in the former studies have adopted the regular tracking method. We collected radiographic dental x-ray data from the patients recall visit at early, follow up, and the end stages. In addition, we also calculate the ARPAL of different groups of periodontitis by comparing the bone height difference between the alveolar bone levels of ARPAL at the baseline, and the end of study.

Table 2: Distribution and percentage (%) of the study population by disease types.

Disease Types	Total samples n (%)						
	Male		Female		Total		Age
	n	(%)	n	(%)	n	(%)	Mean (SD)
CP	10	18.9 (%)	4	7.6 (%)	14	26.4 (%)	50.50 (8.72)
LAgP	6	11.3 (%)	3	5.7 (%)	9	17.0 (%)	29.33 (6.82)
GAgP	9	17.0 (%)	11	20.8 (%)	20	37.7 (%)	39.40 (5.72)
PH	4	7.6 (%)	6	11.3 (%)	10	18.9 (%)	23.90 (3.45)
Total	29	54.2 (%)	24	45.3 (%)	53	100 (%)	37.70 (11.58)

CP: chronic periodontitis; LAgP: localized aggressive periodontitis: GAgP: generalized aggressive periodontitis; PH: periodontal healthy.

Age: Mean (SD)/Year; CP:50.50±8.72/yr.; LAgP:29.33±6.82/yr.

GAgP:39.40±5.72/yr.; PH23.90±3.45/yr.

How to cite this article: Guey Lin Hou, I Zu Wang. Differences of Annual Radiographic Periodontal Attachment levels among Periodontitis Disease Groups for Periodontal Treatment with and without using the TPP splint. Adv Dent & Oral Health. 2022; 15(3): 555915. DOI: 10.19080/ADOH.2022.15.555915

Results

Table 2 indicated that the collected 53 patients according to the classification criteria of the international workshop for a classification of periodontal diseases and conditions at the end of 1999. Classification criteria for reclassification of periodontal disease and periodontal variation, including patient age, alveolar bone loss, type of bone loss, number of teeth involved, location of teeth involved, etc., were diagnosed as aggressive periodontitis (AgP), Patients with chronic periodontitis (CP), and periodontal healthy patients (HP). * (AgP is subdivided into LAgP and GAgP two classification) [5]. In order to understand the different change rates of ARPAL, in the former studies have adopted the regular tracking method, which must collect X-ray data from the patient's early and later stages and calculate the ARPAL by comparing the height difference between the alveolar bone of the two to obtain information about the disease. Dr. Hou introduced a new method in 2000, [6] and ARPAL is defined as radiographic periodontal attachment loss per year after the root of the tooth is completely formed and involved in the occlusal function. It is calculated as cumulative radiographic periodontal attachment loss (CRPAL) divided by the time after the root of the tooth is fully formed (age of root completion; Unit: years), i.e. the time of actual participation in the occlusal function. Thus, the mean of annual periodontal attachment levels in the periapical radiographs is millimeter/ per year. According to former studies [7] statistics show that the age of tooth eruption ranges from 6 to around 13 years (excluding the third molar).

Figure 1a & 1b: Therapeutic provisional prosthesis (TPP) splint was applicated on the left mandibular teeth from #44 to # 47 (buccal view). 1b: The lingual view of TTP splint.

Table 3 demonstrated that continuous annual mean loss rate of the tooth with radiographic periodontal attachment during the former two radiographic x-ray taking at teeth with and without TPP splint (Figures 1a-1d). Affected teeth with ARPAL are continued during both of the periodontal attachment rate of the total teeth (50) with the fixed TPP splint is +0.10±0.19mm/yr., the annual mean rate of alveolar bone loss without any TPP splint (44) is -0.05±0.13mm/yr., there exists a statistically significant different ($p<0.0001$). The present study was subdivided by periodontal disease types, the ARPAL of teeth with splinting in the CP group revealed bone gain of +0.08±0.16 mm/yr., and the ARPAL decrease change of bone loss was -0.06±0.13mm/yr. at teeth without TPP splint, the difference of bone level changes between the two is 0.14 mm/yr. There was a statistically significant difference between the two ($p<0.05$). Result demonstrated that there was effective for the treatment of ARPAL rate of affected teeth with TPP splint in the GAgP group revealed a greater bone gain of +0.20±0.22mm/yr., as compared to the LAgP group got only a slight +0.01±0.12mm/yr. bone gain of ARPAL, respectively (Table 3). The AgP group with TPP splint was +0.11±0.20mm/yr., which including both of the GAgP group and the LAgP group are +0.20±0.22mm/yr. and +0.01± 0.0.11mm/yr., respectively. The ARPAL of teeth without TPP splint in the AgP group was -0.05± 0.13mm/yr., where these are consisted both of the GAgP group and the LAgP group are -0.01±0.12mm/yr. and -0.09±0.13mm/yr., respectively. There revealed a statistically significant difference in each of the both groups (GAgP group, $p<0.01$; LAgP group, $p<0.05$) (Table 3) as compared to the teeth with TPP splint. The mean of ARPAL in the PH group was the lowest (0.07±0.06 mm/yr.).

Table 3: The difference of mean ARPAL (mm/yr.) on teeth with and without splinting by different periodontal disease types.

Disease type	Teeth w/ splint		Teeth w/o splint		Significance
	N	mean±SD	N	mean±SD	
CP	12	+0.08 (0.16)	12	-0.06 (0.13)	p<0.05*
GAgP	20	+0.20 (0.22)	16	-0.01 (0.11)	P<0.01**
LAgP	18	+0.01 (0.12)	16	-0.09 (0.13)	p<0.05*
PH			10	-0.07 (0.06)	
Total	50	+0.10 (0.19)	44	-0.05 (0.13)	P<0.0001****

w/: with; w/o: without; N: number of sites; +: means bone gain; NS: not significant ($p>0.05$) Significant: *$p<0.05$, **$p<0.01$, ***$p<0.001$, ****$p<0.0001$.

How to cite this article: Guey Lin Hou, I Zu Wang. Differences of Annual Radiographic Periodontal Attachment levels among Periodontitis Disease Groups for Periodontal Treatment with and without using the TPP splint. Adv Dent & Oral Health. 2022; 15(3): 555915. DOI: 10.19080/ADOH.2022.15.555915

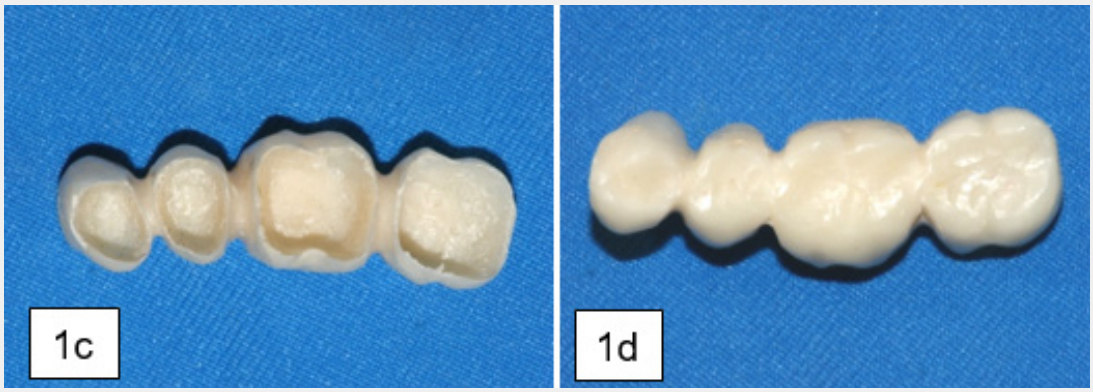

Figure 1c & 1d: The inner view of therapeutic provisional prosthesis (TPP) splint from #44 to # 47.
1d: The occlusal view of the TPP splint.

Discussion

Radiographic alveolar bone loss

The accuracy of X-ray measurements involves the chosen shoting method, the angle of X-ray illumination, the measurement method, and the amount of alveolar bone destruction. The bite-wing method (long cone, 16 inches or more target film distance) is generally considered more accurate than other methods [8,9] found that when the irradiation angle deviation was 10°, the effect on the bone score in the anterior tooth area was small, but the difference was more than 20% on the back tooth area. In addition, Henrikson and Lavstedt study [10] showed that X-beam angle deviations in the range of 10 -15° did not cause a change in the bone score. Hausmann et al. [11] study showed that when the irradiation angle deviation reached 20 °, it would cause radiographic crest changes (especially the molar area), resulting in a 18% difference in bone height to root length, or a direct measurement of CEJ-crest distance difference of up to 2.35 mm. Pepelassi et al. [12] found that direct measurement is more accurate for smaller amounts of alveolar bone destruction. But when Albander & Abbas [2] assessed the changes in alveolar bone height over a two-year period, it found that the indirect Schei method was better at detecting. Therefore, the appropriate measurement method should be selected depending on the purpose of the study, and the direct measurement method is suitable for calculating and evaluating the amount of alveolar bone destruction; the law of indirect proportions is suitable for assessing future prognosis [12].

Alveolar bone height changes in periodontal health

Boyle et al. [13] took this claim a step further, when he divided 123 healthy periodontal individuals into several age groups, using the modified calipers to measure the alveolar bone height loss. The conclusion is that for each increase in age of alveolar bone height, there will be a loss of 0.017mm, and if the loss is significantly greater than this normal condition, it is considered to have a pathological change. Eliasson et al. [14] conducted a study of 76 periodontal health patients aged 18 to 22 years, using a digital vernier caliper to measure the height of the alveolar bone. It was found that the average tooth length was 24.9 mm; The average root length differs by 3.9% from the average alveolar bone height, which translates to a distance of 0.97mm between CEJ and interdental septum in terms of average tooth length, which is in line with Herulf [15] study and is similar to the normal distance of CEJ-alveolar crest proposed by Schei [9] of 1mm. In addition, Eliasson et al. [14] conducted a ten-year X-ray observation of 94 Swedish musicians who found that the decline in periodontal bone height was about 0.83% (an average of 0.08% per year) over 10 years, and there was a tendency to increase with age, but it was not statistically significant. This is much lower than the statistical loss of 0.5 per cent (0.1mm) per year of the ten-year study of the Swedish general population by Lavstedt et al. [16]. It is close to the twelve-year alveolar bone loss of 0.2 to 0.4 mm in the report of Wennström et al. [17] for groups receiving regular preventive treatment.

Alveolar bone height changes in cases affected periodontitis

Becker et al. [18] study of 30 untreated periodontal disease patients with a period of 18 to 115 months showed that all patients revealed alveolar bone loss between examinations. They found that the main type of destruction was mainly horizontal and had more angular bony defects. These teeth were located at the molar root furcation then followed by a large X-ray transmission area. There are large losses of the alveolar bone, whereas x-rays of these teeth usually show typical SOT images, due to widening of the periodontal ligament, and intra-osseous defects are particularly pronounced.

In a two-year study of 180 factory employees in Norway, Albandar [13] found that men lost more alveolar bone than women; Moreover, where the original alveolar bone height is lost more, the subsequent loss rate is faster. However, the mean of annual alveolar bone loss for the entire population was 0.11

How to cite this article: Guey Lin Hou, I Zu Wang. Differences of Annual Radiographic Periodontal Attachment levels among Periodontitis Disease Groups for Periodontal Treatment with and without using the TPP splint. Adv Dent & Oral Health. 2022; 15(3): 555915. DOI: 10.19080/ADOH.2022.15.555915

mm. Wouters et al. [19] conducted crosssectional epidemiological studies on 723 Swedish adults and after 5 times magnification of the full-mouth apical X-ray with a computer digital system, the analysis software EPIX. Machtei et al. [20] used electronic periodontal exploration to classify the probing depth (PD) of each tooth position into shallow (0 to 3.9 mm), medium (4 to 6.9mm), and deep (7mm) for 51 untreated periodontal disease patients. During the one-year observation period, it was found that the average attachment loss of the original PD was 1.03 mm, which was significantly greater than the 0.34mm in the middle and 0.1mm shallow ($p< 0.001$); the average loss for all patients was 0.2mm. The conclusion showed that when PD (7 mm), the speed and depth of clinical periodontal attachment loss will be greater in the future. Thus, deeper pockets, especially at PD (7mm), are at higher risk of further loss of attachment in the future.

References

1. Wouters FR, Salonen LWE, Frithiof L, Hellden LB (1993) Significance of some variables on interproximal alveolar bone height based on cross-sectional epidemiologic data. J Clin Periodontol 20(3): 199-206.
2. Albandar JM, Abbas DK (1986) Radiographic quantification of alveolar bone level changes. Comparison of 3 currently used methods. J Clin Periodontol 13(9) : 810-813.
3. Papapanou PN, Wennstrom JL, Grondahl K (1989) A 10-year retrospective study of periodontal disease progression. J Clin Peri odontol 16(7): 403-411.
4. Brown LJ, Albanda JM, Rrunelle JA, Loe H (1996) Early onset periodontitis: Progression of attachment loss during 6 years. J Periodontol 679(10): 968-975.
5. (1999) Annals of Periodontology. International Workshop for a Classification of Periodontal Disease and conditions.
6. Hou GL, Lin CH, Hung CC, Yang YS, Shieh TY, et al. (2000) The consistency and reliability of periodontal bone level measurements using digital scanning radiographic image analysis - A pilot study. Kaohsiung J Med Sci 16(11): 566-573.
7. Ten Cate AR (1987) Oral histology - development, structure, and function. 2nd Edition p. 284.
8. Sugarman MM, Sugarman EF (1977) Precocious periodontitis: A clinical entity and treatment responsibility. J Periodontol 48(7): 397-409.
9. Schei O, Wauhauug J, Lovdal A, Arno A (1959) Alveolar bone loss as related to oral hygiene and age. J Periodontol 30(1): 7-16.
10. Henrikson AO, Lavstedt S (1975) Precision and accuracy in intraoral roentgenological determination of proximal marginal bone loss. Acta Odontol Scand, Suppl 67: 26-49.
11. Hausmann E, Allen K, Christersson L, Genco RJ (1989) Effect of x-ray bean vertical angulation on radiographic alveolar crest level measurement. J Periodont Res 24(1): 368-369.
12. Pepelassi EA, Diamanti Kipioti A (1997) Selection of the most accurate method of conventional radiography for the assessment of periodontal osseous destruction. J Clin Periodontol 24(8): 557-567.
13. Boyle WD, Via WF, McFall WT (1973) Radiographic analysis of alveolar crest height and age. J Periodontol 44(4): 236-243.
14. Eliasson S, Bergstrom J (1997) Minimum periodontal bone loss in dentally-aware adults. A 10-year prospective study. J Clin Peri- odontol 24(1): 34-38.
15. Herulf G (1968) On the marginal alveolar ridge in adults. Sven Tandlak Tidskr 61(12): 675-703.
16. Lavstedt S, Bolin A, Henrikson CO (1986) Proximal alveolar bone loss in a longitudinal radiographic investigation. II. A 10-year follow-up study of an epidemiologic material. Acta Odontol Scand 44(4): 199-205.
17. Wennström JL, Serino G, Lindhe J, Eneroth L, Tollskog G (1993) Periodontal conditions of adult regular dental care attendents. A 12-year longitudinal study. J Clin Periodontol 209(10): 714-722.
18. Becker W, Berg ML, Becker BE (1979) Untreated periodontal disease. A longitudinal study. J Periodontol 50(5): 234-244.
19. Wouters FR, Salonen LWE, Frithiof L, Hellden LB (1993) Significance of some variables on interproximal alveolar bone height based on cross-sectional epidemiologic data. J Clin Periodontol 20(3): 199-206.
20. Machtei EE, Norderyol J, Koch G, Duford R, Grossi S, et al. (1993) The rate of periodontal attachment loss in subjects with established periodontitis. J Periodontol 64(8): 713-718.

DOI: 10.19080/ADOH.2022.15.555915

How to cite this article: Guey Lin Hou, I Zu Wang. Differences of Annual Radiographic Periodontal Attachment levels among Periodontitis Disease Groups for Periodontal Treatment with and without using the TPP splint. Adv Dent & Oral Health. 2022; 15(3): 555915. DOI: 10.19080/ADOH.2022.15.555915