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Intrasurgical and computer-assisted radiographic measurement of interproximal bone loss: A comparison of 2 methods

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Objective

Comparison of computer-assisted linear measurements of interproximal intrabony defects on radiographs using two different methods with the gold standard of intrasurgical measurements.

Material and Methods

Patients

- 22 patients (11 female) 34 -64 years of age.
- untreated advanced periodontal disease.
- each exhibiting at least one interproximal intrabony defect.

Radiographic examinations

- standardized bitewing radiographs of teeth with intrabony defects using modified film holders (VIP 2 Film Positioning, UpRad Corp., Fort Lauderdale, FL, USA) (Fig. 1, 2). Two orthodontic wires were placed on the mandibular side of the filmholder at a specified position (Fig. 1). Shadows of these wires were cast onto the radiographs (Fig. 3). From the distances between the images of these wires on a radiograph, the vertical and horizontal angulation difference between the central beam and the orthoradial projection could be calculated.
- intraoral dental films (Ultraspeed, Eastman Kodak Co., Rochester, NY, USA) size 2.
- x-ray source (Heliodent 70, 70 kV, 7 mA, Siemens, Bensheim, Germany).
- development unit (Periomat, Dürr Dental GmbH, Bietigheim-Bissingen, Germany).

Fig. 1: Modified filmholders: c: central beam; o: orthoradial; a = arctan d/20.

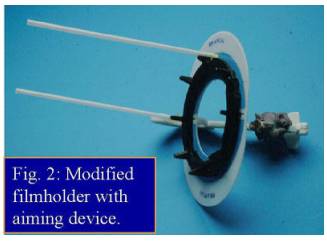
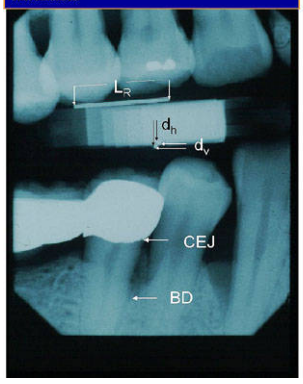


Fig. 2: Modified filmholder with aiming device.

Fig. 3: Radiograph of intrabony defect mesial a right second premolar: if the CEJ was destroyed by restorations the restoration margin was chosen as landmark.



Clinical examinations

At 6 sites per tooth:

- Gingival Index (GI) and Plaque Index (PII).
- PD and PAL-V to the nearest 0.5 mm (PCPUNC 15).

After reflection of a full thickness flap:

- distance cemento-enamel junction (CEJ) to the most apical extension of the bony defect (BD).
- the height of the 3-wall as well as the 2- and 3-wall component of each interproximal lesion.
- all clinical measurements were performed by one examiner (PE) to the nearest 0.5 mm (PCPUNC 15).

Radiographic evaluation
Measurements using a loupe of 10 fold magnification and a 0.1 mm grid (Scale loupe 10, Peak, Tohkai Sangyo, Tokyo, Japan):

- distances between the projections of the - orthodontic wires that had been fixed to the filmholders vertically (dv) and horizontally (dh) on every radiograph (Fig. 3).
- the length LR of the cast shadow of the wire placed on the maxillary side of the filmholder and calculation of the radiographic enlargement of each radiograph (Fig. 3).

side-by-side	LMSRT
• capturing of each radiograph with a CCD camera:	
Cohu Solid State Camera, Cohu Inc., San Diego, CA	WV-BD 400 Panasonic, Secaucus, NJ
• enlargement: 8x	4/10x
• all radiographs were analysed by 2 examiners blinded to the clinical and intrasurgical measurements:	
EH	TSK.
• adjustment of all radiographic measurements according to the enlargement of each individual radiograph.	

Definition of landmarks
BD was defined as most coronal point where the periodontal ligament space showed a continuous width. If no periodontal ligament space could be identified the point where the projection of the AC crossed the root surface was taken as landmark. If both structures could be identified at one defect, the point defined by the periodontal ligament was used as BD. If several bony contours could be identified the most apical that crossed the root was defined as the BD.

Statistical analysis

- Kolmogorov-Smirnov/Lilliefors-Test for normal distribution.
- comparison of intrasurgical/radiographic measurements by paired t test.
- stepwise multiple linear regression analysis:
  - dependent variable: Diff. intrasurgical/radiographic measurements
  - explanatory variables: patient, angulation differences, analysing method, intrasurgical parameters.

Results

Results — 33 radiographs of 34 intrabony defects

Tab.1: clinical parameters

	GI	PII	PD/mm	PAL-V/mm	angulation/° vertical	horizont.
mean±SD	1.9±0.3	0.3±0.7	8.3±1.8	9.0±1.6	2.5±1.5	0.8±0.7
interval	1.0-2.0	0.0-3.0	5.5-12.0	6.5-13.0	0.0-5.5	0.0-2.6

Tab. 2: intrasurgical / radiographic parameters/mm

	intrasurgical mean±SD	interval		radiographic parameters/mm mean±SD	interval
CEJ-BD	9.2±2.1	5.0-14.0	LMSRT	8.4±1.9 $p < 0.05$	5.0-12.7
			side-by-side	7.7±2.1 $p < 0.005$	4.0-13.4
hight					
2/3wall	4.4±1.6	0 - 8.5	difference	LMSRT-side-by-side	
3wall	2.4±1.5	0 - 4.5		0.7±2.3 n.s. ($p = 0.084$)	

Tab. 3: stepwise multiple linear regression analysis:
dep. variable: ΔCEJ-BD intrasurgical - radiographic/mm;
n = 68; R^2 = 0.515; $R^2_{adjusted}$ = 0.458; s.e.(estimate) = 1.532

	b	s.e.(*b*)	β	*p*
constant	-3.357	0.898		0.000
patient 12	-2.288	0.802	0.970	0.006
patient 13	-1.900	0.812	0.945	0.023
2wall component	0.375	0.294	0.694	0.008
CEJ-BD intrasurgical	0.472	0.098	0.856	0.000

analysis of variance

source	SSQ	DF	MSQ	*F*-ratio	*p*
regression	149.520	7	21.360	9.095	0.000
residual	140.913	60	2.349		

Discussion and Conclusions

- both computer-assisted analyses of linear distances on radiographs underestimated the amount of interproximal bone loss as assessed by intrasurgical measurements.

- it appears that there are no major differences between different computer-assisted analyses in underestimating interproximal alveolar bone loss.

Abbreviations

GI: Gingival Index
PII: Plaque Index
PD: probing depth
PAL-V: vertical probing attachment level
CEJ: cemento enamel junction
AC: alveolar crest
BD: bony defect
SD: standard deviation
SSQ: sum of squares
MSQ: mean of squares
DF: degrees of freedom

This Poster was submitted on 30.01.01 by Dr. Peter Eickholz.

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