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The Significance of Gap and Overextension Measurement of Crowns

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Introduction

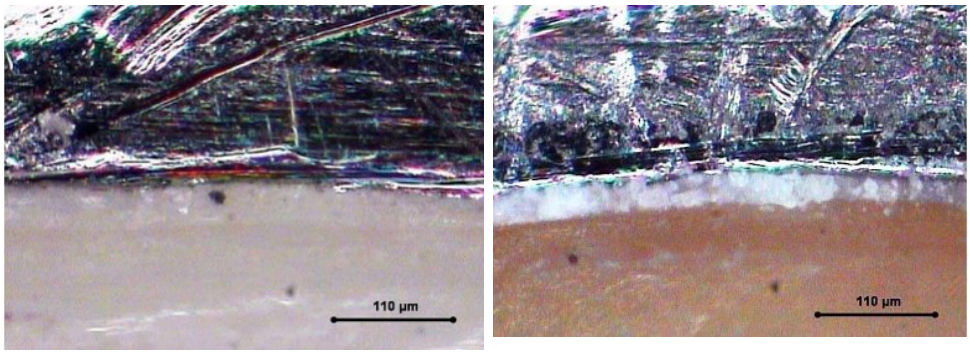
An important criterion for the clinical success of a crown is its fit. An deficient marginal fit can result in damage to the tooth and the periodontal tissues surrounding it [1]. The data on clinically deficient marginal fit of different kinds of crowns fluctuate between 34 % and 56 % according to different surveys [2]. Up to 95 % of these single crowns showed clinical pathological changes.The fit of a casting can be defined best in terms of the "misfit". Clinically important measurements are the marginal gap and the overextended margin [3]. The statements to a desirable size of the marginal gap ranging from 30 µm up to 200 µm [4]. On the other hand gap sizes of 300 µm up to 500 µm have been described in clinical practice [5]. Saliva increasingly influences the dissolution of the cement in marginal gaps. Therefore an existing gap should not be increased by the thickness of the luting agent. Findings of investigations of extended margins are rarely to find. However, overextensions of up to 482 µm were described [6]. The rate of casting crowns with noticeable marginal overextensions range between 26% and 50% [2,6]. The periodontal response to crowns appears to relate mainly to an inadequate overextension rather than to insufficient marginal gap [7]. Under the conditions of the dental lab the technician can control the exactness of the marginal fit by light microscopy. However, in the patient's mouth fit can only be evaluated without exact measurements. The estimation of the crown fit in the patient's mouth depends on the subjective assessment by the practitioner.

Objectives

This study describes the correlation between objective marginal fit and its subjective evaluation by dentists and dental technicians.

Material and Methods

30 human premolars and molars were prepared and randomly divided into 6 groups. For each of the groups complete crowns were made of different alloys and technologies (Tab1). The crowns were provisional cemented. 10 dentists and 10 technicians were asked to evaluate the fit of the crowns with a new dental explorer (EXS3A6, Hu-Friedy, Chicago IL., USA). The examiners were not informed about the kind of alloys and technologies used for the crowns. They responded to a two answer questionnaire with a "yes" or a "no" answer 1.'Can the marginal fit be accepted?' and 2.'In consideration of the marginal fit quality, would you cement the crown into a patient's mouth?'. The crowns were removed and permanently cemented with a zincoxide-phosphate cement (Harvard Cement, Richter & Hoffmann Harvard Dental Ltd., Berlin, Germany). The marginal gap (MG) and a possible overextended margin (OM) were examined under a special 560X-light-microscope using measuring software (VMZM40, TV-tubus 1.6-Objectives 2,0-Screenlevel 4,0x, Metrona Software, 4H JENA engineering, Jena, Germany). The marginal gaps and the margins were separately measured (Fig1). A statistically solid mean had to be determined by 50 single measuring on each crown [8]. The means of MGs and OMs were calculated for each group. The statistic analyses were performed by using the software SPSS (SPSS Inc., Chicago, USA). Significances were detected by ANOVA and post-hoc-test (Bonferroni, $p<0.05$). Correlations between objective measuring and subjective evaluation were evaluated using Pearson-Test. The influence of the measured values on the subjective evaluation was determined by regression analyses.



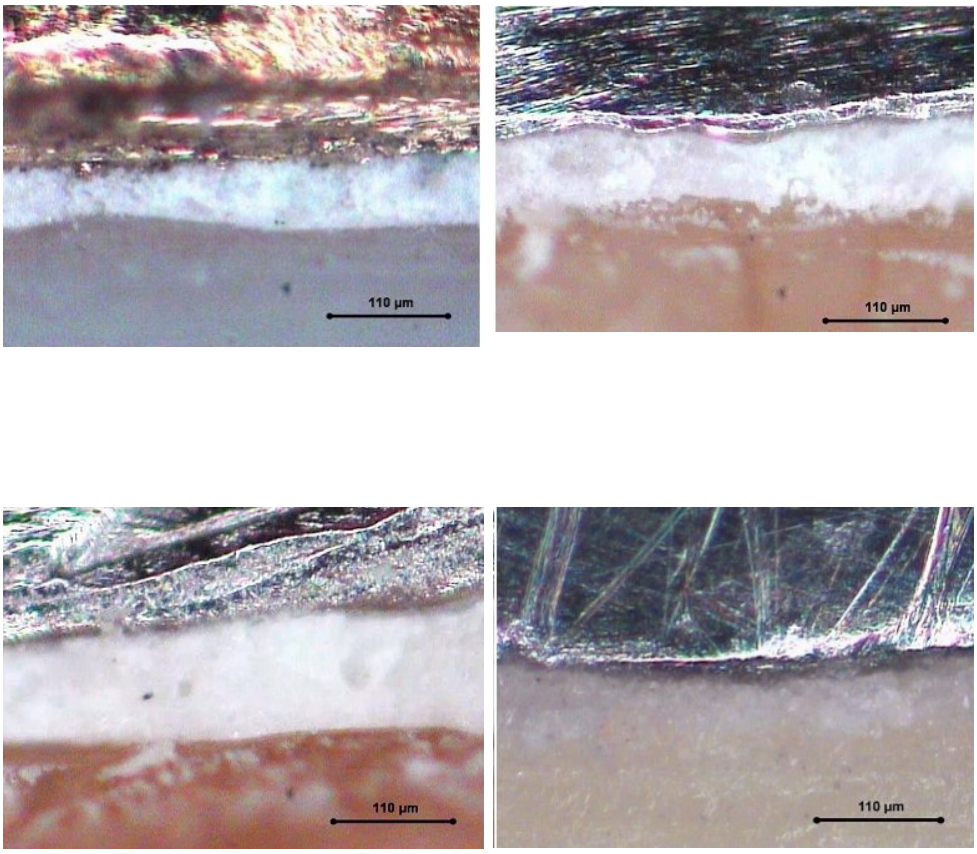


Fig. 1 Light microscopy of the marginal fit

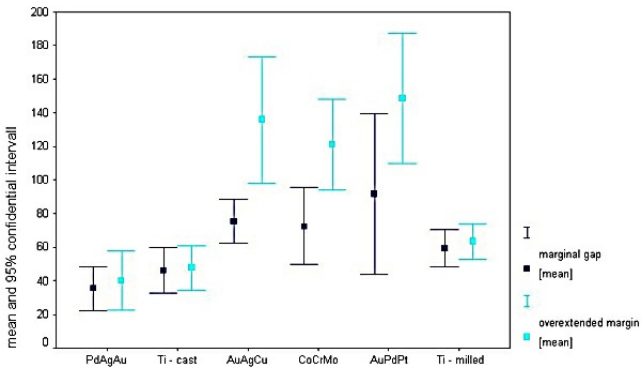


Fig 2 Arithmetical mean and confidential interval of the marginal gaps and overextended margins

Alloy	Technology	Tradename	Batch number	Manufacturer
PdAgAu	cast	Degupal G	10015442	DeguDent, Hanau, Germany
Ti	cast	Biotan	687221	Schütz, Rosbach, Germany
AuAgCu	cast	Degulor M	10012784	DeguDent, Hanau, Germany
CoCrMo	cast	Triloy	11610	Dentaurum, Ispringen, Germany
AuPdPt	cast	Degutan	10013942	DeguDent, Hanau, Germany
Ti	milled	DC-Titan	151770	DCS, Allschwill, Switzerland

Tab 1 Alloys and technologies used for fabrication of the investigated restorations

Pearson correlation test

		marginal fit is acceptable (dentists)	marginal fit is acceptable (technicians)	restoration is acceptable for cementation (dentists)	restoration is acceptable for cementation (technicians)
marginal fit is acceptable (dentists)	Pearson correlation	1	,751**	,900**	,819**

	Significance		,000	,000	,000
	N	30	30	30	30
marginal fit is acceptable (technicians)	Pearson correlation	,751**	1	,767**	,949**
	Significance	,000		0,000	0,000
	N	30	30	30	30
restoration is acceptable for cementation (dentists)	Pearson correlation	,900**	,767**	1	,844**
	Significance	,000	,000		,000
	N	30	30	30	30
restoration is acceptable for cementation (technicians)	Pearson correlation	,819**	,949**	,844**	1
	Significance	,000	,000	,000	
	N	30	30	30	30

** Pearson correlation p<0.01 significant.

Tab 2 Correlation among dentists and technicians regarding subjective evaluations

	non standardized coefficients		standardized coefficients		
	B	standard error	Beta	T	significance
1 (constant)	80,314	9,418		8,527	,000
marginal gap mean	,177	,229	,193	,772	,447
overextended margin (mean)	-,379	,123	-,770	-3,081	,005
2 (constant)	84,489	7,653		11,040	,000
overextended margin (mean)	-,303	,073	-,616	-4,134	,000

Tab 3 Influence of the measured values on the subjective evaluation among the dentists if the marginal fit is acceptable

	non standardized coefficients		standardized coefficients		
	B	standard error	Beta	T	significance
1 (constant)	86,053	11,126		7,734	,000
marginal gap mean	,106	,271	,093	,391	,699
overextended margin mean	-,454	,145	-,742	-3,119	,004
2 (constant)	88,551	8,968		9,874	,000
overextended margin mean	-,408	,086	-,668	-4,747	,000

Tab 4 Influence of the measured values on the subjective evaluation among the technicians if the marginal fit is acceptable

	non standardized coefficients		standardized coefficients		
	B	standard error	Beta	T	significance
1 (constant)	100,167	6,818		14,692	,000
marginal gap mean	-,006	,166	-,008	-,033	,974
overextended margin mean	-,260	,089	-,680	-2,920	,007
2 (constant)	100,037	5,480		18,255	,000
overextended margin mean	-,263	,053	-,687	-4,998	,000

Tab 5 Influence of the measured values on the subjective evaluation among the dentists if the restoration is acceptable for cementation

		non standardized coefficients		standardized coefficients		
Modell		B	standard error	Beta	T	significance
1	(constant)	97,820	9,720		10,063	,000
	marginal gap mean	,168	,237	,160	,711	,483
	overextended margin mean	-,472	,127	-,835	-3,717	,001
2	(constant)	101,790	7,886		12,908	,000

overextended margin mean	-,400	,076	-,707	-5,291	,000

Tab 6 Influence of the measured values on the subjective evaluation among the technicians if the restoration is acceptable for cementation

Results

Crowns made from different alloys and technologies showed partly significantly ($p<0.05$) different MGs (35 µm-92 µm) and significantly ($p<0.05$) different OMs (40 µm-149 µm) (Fig2). There were significant correlations ($p<0.05$) between subjective findings and objective data. Correlations ($p<0.01$) were also found between the subjective findings of dentists and technicians (Tab2). Regression analyses showed that the marginal gap had no significant influence on the decision among dentists and technicians regarding the marginal fit, but the influence of the overextended margin was highly significant ($p=0.005$, Tab3 and $p=0.004$, Tab4). In the evaluation of the perceived clinical acceptability for clinical cementation a significant influence of the marginal gap did not exist, while the overextended margin had a high significant influence on the acceptability among the dentists ($p=0.007$, Tab5), and especially among the technicians ($p=0.001$, Tab6).

Conclusions

Conclusions Crowns from different alloys and technologies showed differences in marginal fit. All tested crowns showed clinically acceptable marginal gaps, as well as marginal overextensions. The findings regarding the marginal gap and the overextended margin correlated significantly with the subjective evaluation of the marginal fit as well as with the perceived clinical acceptability among the dentists and technicians. Comparison of the evaluations of the dentists and the technicians showed a significant correlation. The overextended margin had a significant influence, whereas the marginal gap had no influence on the decision among dentists and technicians regarding the marginal fit and the perceived clinical acceptability of the tested crowns.

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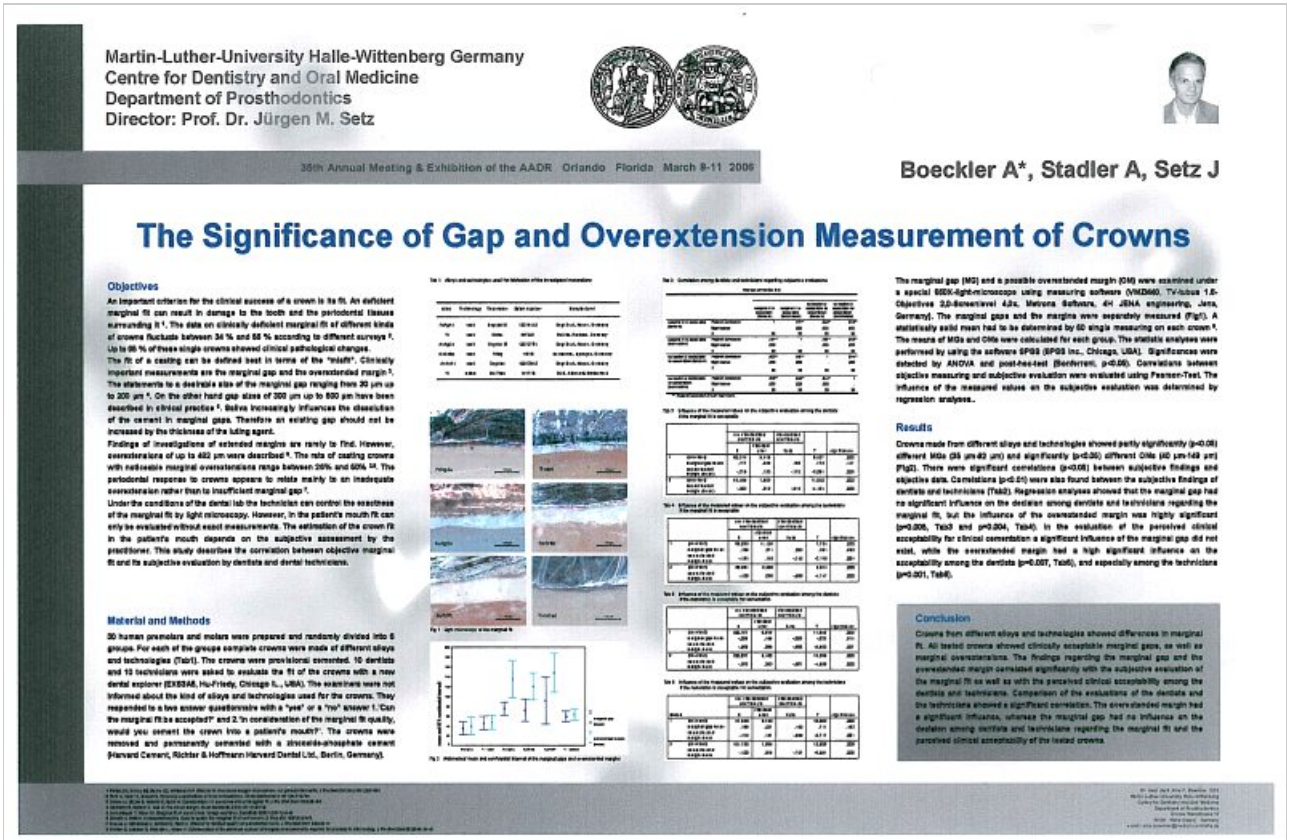

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Findings of investigations of extended margins are rarely to find. However, overcontours of up to 462 µm were described [6]. The rate of casting crowns with noticeable marginal overextensions range between 26% and 60% [7]. The periodontal response to crowns appears to relate mainly to an inadequate overextension rather than to insufficient marginal gap [7].
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Conclusion

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