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MTBS of Dentin Adhesives on Primary Dentin Subjected to Irradiation

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Introduction

Radiation therapy plays an important role in the management of malignant tumors in the head and neck region (1). However, this modality of treatment frequently results in serious and sometimes unavoidable changes to the orofacial structures (2,3). Radiation can cause early side effects that are noted during or shortly after treatment such as inflammation of the oral mucosa, loss of taste and salivary gland hypofunction (xerostomia, changed salivary composition) as well as late side effects which develop months or years after the end of radiotherapy affecting salivary glands, teeth, bone, muscles and skin. The influence of radiation on the dental hard tissue is still unknown and controversially discussed in the literature.

Objectives

The aim of this study was to evaluate the effect of different irradiation doses on microtensile bond strength (mTBS) of four different dentin adhesives / compomer combinations on perfused primary dentin in vitro.

Material and Methods

The study was carried out on 144 freshly extracted primary molars. All teeth were specially prepared allowing the simulation of dentin perfusion and standardized conditions. According to four different dentin adhesives and three irradiation doses (0 Gy, 6 Gy and 60 Gy), the specimens were randomly assigned to twelve experimental groups of twelve each: Syntac (S0, S6, S60), Prime&Bond (P0, P6, P60), Futurabond (F0, F6, F60), Optibond (O0, O6, O60). Each specimen was irradiated fractionally with 2 Gy/day (6 mV, x-ray) using a linear accelerator (Mevatron-MXE-2, Siemens, Germany), respectively, depending on the experimental irradiation dose group. All materials were applied as recommended by the manufacturer. Microtensile bond strength was measured 15 minutes after application of the dentin adhesive using an universal testing machine (Figure 1). Statistical analysis was performed using SPSS 15.0. The data of mTBS were analysed by one-way anova and Tukey's multiple comparisons. For each out-come, statistical significance was set at $P < 0.05$.

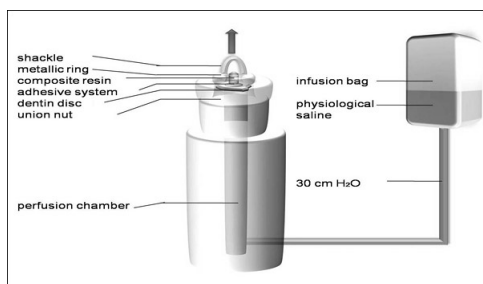


Fig. 1: Special apparatus designed to test mTBS

Results

Statistical analysis showed a significant influence of irradiation on microtensile bond strength ($p < 0.001$, ANOVA) (Figure 2). The highest mTBS were evaluated in the non-irradiated groups (S0, P0, F0, O0), the lowest mTBS were observed in specimens irradiated with 60 Gy (S60, P60, F60, O60). Comparison of the dentin adhesives in non-irradiated groups showed significant higher values in specimens treated with Optibond compared to group S0 ($p < 0.05$, Tukey's test). Between groups S0, P0 and F0 no significant difference could be detected ($p > 0.05$, Tukey's test). The influence of irradiation was significant in the 60 Gy groups except for Syntac (Tukey's test, $p < 0.05$). Irradiation doses of 6 Gy did not show any significant influence compared to non-irradiated groups (0 Gy).

- Syntac Prime&Bond Futurabond DC Optibond All in One

	S0	S6	S60	S0	S6	S60	S0	S6	S60	S0	S6	S60
Mean	17.60	16.59	13.49	21.14	18.71	13.88	21.82	17.93	12.51	25.25	20.64	18.21
±	4.00	5.48	4.35	3.90	4.39	3.15	7.14	7.08	5.20	6.97	3.65	4.73

Tab. 1: Mean value and standard deviations (in MPa) within the different groups

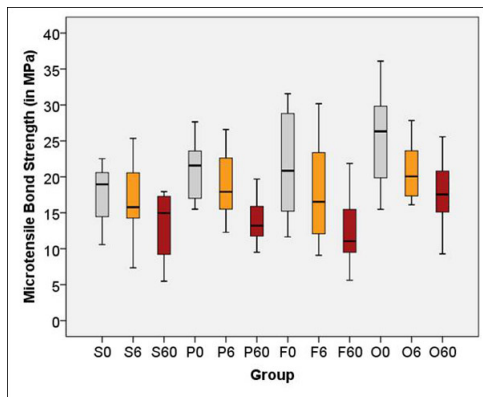


Fig. 2: Boxplot

Conclusions

Within the limitations of an in vitro investigation it can be concluded that irradiation of primary teeth in doses of 60 Gy might affect microtensile bond strength of dentin adhesive/comonomer combinations.

Literature

1. Argiris A et al.: Head and neck cancer. Lancet 2008; 9625(371):1695-709.
2. Vissink A et al.: Oral sequelae of head and neck radiotherapy. Crit Rev Oral Biol Med 2003;3(14):199-212.
3. Otmani N: Oral and maxillofacial side effects of radiation therapy on children. J Can Dent Assoc 2007;3(73):257-61.

Abbreviations

Gy = Gray
mTBS = microtensile bond strength
MPa = Megapascal

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Introduction

Radiation therapy plays an important role in the management of malignant tumors in the head and neck region.¹ However, this modality of treatment frequently results in serious and sometimes unavoidable changes to the orofacial structures.^{2,3} Radiation can cause early side effects that are noted during or shortly after treatment such as inflammation of the oral mucosa, loss of taste and salivary gland hypofunction (xerostomia, changed salivary composition) as well as late side effects which develop months or years after the end of radiotherapy affecting salivary glands, teeth, bone, muscles and skin. The influence of radiation on the dental hard tissue is still unknown and controversially discussed in the literature.³

Aim of the Study

The aim of this study was to evaluate the effect of different irradiation doses on microtensile bond strength (mTBS) of four different dentin adhesives / compomer combinations on perfused primary dentin in vitro.

Material and Methods

The study was carried out on 144 freshly extracted primary molars. All teeth were specially prepared allowing the simulation of dentin perfusion and standardized conditions. According to four different dentin adhesives and three irradiation doses (0 Gy, 6 Gy and 60 Gy), the specimens were randomly assigned to twelve experimental groups of twelve each: Syntac (S0, S6, S60), Prime&Bond (P0, P6, P60), Futurabond (F0, F6, F60), Optibond (O0, O6, O60). Each specimen was irradiated fractionally with 2 Gy/day (6 mV, x-ray) using a linear accelerator (Mevatron-MXE-2, Siemens, Germany), respectively, depending on the experimental irradiation dose group. All materials were applied as recommended by the manufacturer. Microtensile bond strength was measured 15 minutes after application of the dentin adhesive using an universal testing machine (Figure 1).

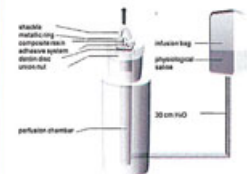


Figure 1: Special apparatus designed to test mTBS.

Statistical analysis was performed using SPSS 15.0. The data of mTBS were analysed by one-way anova and Tukey's multiple comparisons. For each outcome, statistical significance was set at $P < 0.05$.

Results

For the test series following tensile bond strengths were evaluated (mean values and standard deviations in MPa) (Table 1):

	Syntac			Prime&Bond			Futurabond DC			Optibond All in One		
	S0	S6	S60	P0	P6	P60	F0	F6	F60	O0	O6	O60
Mean	17.60	16.50	13.40	21.14	18.71	13.88	21.82	17.93	12.51	25.25	20.64	18.21
±s	4.00	3.48	4.35	3.90	4.39	3.15	7.14	7.08	5.20	6.97	3.65	4.73

Table 1: Mean value and standard deviations (in MPa) within the different groups.

Statistical analysis showed a significant influence of irradiation on microtensile bond strength ($p < 0.001$, ANOVA) (Figure 2). The highest mTBS were evaluated in the non-irradiated groups (S0, P0, F0, O0), the lowest mTBS were observed in specimens irradiated with 60 Gy (S60, P60, F60, O60). Comparison of the dentin adhesives in non-irradiated groups showed significant higher values in specimens treated with Optibond compared to group S0 ($p < 0.05$, Tukey's test). Between groups S0, P0 and F0 no significant difference could be detected ($p > 0.05$, Tukey's test). The influence of irradiation was significant in the 60 Gy groups except for Syntac (Tukey's test, $p < 0.05$). Irradiation doses of 6 Gy did not show any significant influence compared to non-irradiated groups (0 Gy).

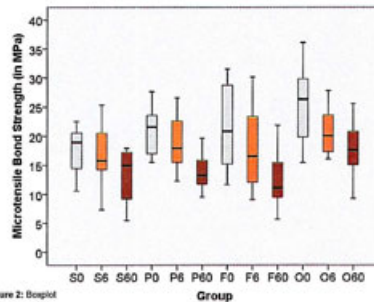


Figure 2: Boxplot

Conclusions

Within the limitations of an in vitro investigation it can be concluded that irradiation of primary teeth in doses of 60 Gy might affect microtensile bond strength of dentin adhesive/compomer combinations.

References

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- Vasink A et al.: Oral sequelae of head and neck radiotherapy. *Crit Rev Oral Biol Med* 2003;3(14):199-212.
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