



The survival of direct composite restorations in the management of severe tooth wear including attrition and erosion: A prospective 8-year study



A. Milosevic^{a,*}, G. Burnside^b

^a Department of Restorative Dentistry, Liverpool University Dental Hospital, Pembroke Place, Liverpool, Merseyside L3 5PS, UK

^b The University of Liverpool, Dental Research Wing, Daulby Street, Liverpool, L69 3GN, UK

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ABSTRACT

Objectives: Survival of directly placed composite to restore worn teeth has been reported in studies with small sample sizes, short observation periods and different materials. This study aimed to estimate survival for a hybrid composite placed by one clinician up to 8-years follow-up.

Methods: All patients were referred and recruited for a prospective observational cohort study. One composite was used: Spectrum[®] (DentsplyDeTrey). Most restorations were placed on the maxillary anterior teeth using a Dahl approach.

Results: A total of 1010 direct composites were placed in 164 patients. Mean follow-up time was 33.8 months (s.d. 27.7). 71 of 1010 restorations failed during follow-up. The estimated failure rate in the first year was 5.4% (95% CI 3.7–7.0%). Time to failure was significantly greater in older subjects ($p = 0.005$) and when a lack of posterior support was present ($p = 0.003$). Bruxism and an increase in the occlusal vertical dimension were not associated with failure. The proportion of failures was greater in patients with a Class 3 or edge-to-edge incisal relationship than in Class 1 and Class 2 cases but this was not statistically significant. More failures occurred in the lower arch (9.6%) compared to the upper arch (6%) with the largest number of composites having been placed on the maxillary incisors ($n = 519$).

Conclusion: The worn dentition presents a restorative challenge but composite is an appropriate restorative material.

Clinical significance: This study shows that posterior occlusal support is necessary to optimise survival.

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1. Introduction

Tooth wear has become a significant dental problem. The recent UK Adult Dental Health Survey (ADHS) reported that 77% of 6469 examined adults had wear, with 15% showing moderate wear and 2% having severe tooth wear [1]. Moderate wear increased from 11% in 1998 to 15% in 2009. Tooth wear was age related such that more than 80% of the over 50-year olds in the UK ADHS exhibited some tooth wear and the authors concluded that the increasing proportion of young adults with moderate wear was likely to be clinically important [1]. Tooth wear encompasses acid erosion, abrasion and attrition. The clinical presentation depends on the predominant aetiological factor and patient factors such as occlusal relationships, habits and restorative status. The restorative rehabilitation of the worn dentition and particularly survival

of restorations has received some limited research but generally the studies have small sample sizes and short observation periods. Although survival estimates have been made few studies determined the factors associated with failure.

Early reports described bonding onto 52 worn anterior surfaces with either Durafill or Herculite XRV in 8 patients each and 75 indirect Artglass veneers in 12 cases with an increase in OVD and assessment up to 30 months [2,3]. Over 50% of the direct Durafill composites failed within 30 months compared to less than 10% of the Herculite XRV restorations [2] whereas 13% of the palatal indirect Artglass restorations failed after 24 months [3].

A comparison of direct composite with indirect full gold crowns and ceramo-metallic crowns found no significant difference in survival over 10-years [4]. The low sample size of 25 patients and the comparison of direct with indirect restorations is questionable, particularly when the majority of direct composites were placed on anterior teeth and all the full gold crowns on posterior teeth.

The median survival time of composite Dahl restorations placed on worn anterior teeth over 10 years was reported to be 5.8 years

* Corresponding author. Fax: +44 151 706 5797.

E-mail address: alexander.milosevic@rlbuht.nhs.uk (A. Milosevic).

[5]. Again a small number of 283 restorations in 26 subjects was assessed with a mixture of indirect and direct composites having been placed by different clinicians. Direct composite bulk build-ups for worn mandibular anterior teeth resulted in 94% survival at 2.5 years and 85% survival over 7 years although the number of patients and restorations were low at the start of the study at 18 and 168 respectively reducing to 15 and 107 composites after 7 years [6,7]. Clinical performance of direct composite at increased vertical dimension rather than survival was reported to be good with 7% failure over 4 years in 18 patients and “acceptable to excellent performance” in only 6 patients over a mean 5.5 year observation period using the modified USPHS criteria [8,9]. In posterior teeth, however, the use of direct and indirect microfilled resin composite was deemed to be contra-indicated as 50% of 32 restorations failed after 3-years [10]. Although the results are limited, composite seems to be a viable treatment modality for worn teeth. The advantages being reversibility, cost effectiveness, relative ease of placement and most importantly an additive approach using the ability to bond composite to tooth. Furthermore, direct composite placement should be possible in the primary care setting rather than require specialist hospital based treatment. Short worn teeth are not amenable to conventional indirect crowning because of a lack of retention and resistance form unless elective crown lengthening surgery is carried out.

Another technique that has been applied to restore severely eroded anterior teeth is the sandwich approach whereby separate labial and palatal veneers are bonded onto the remaining tooth structure. Only 12 patients were enrolled and after a mean 4-year observation period none of the 134 veneers failed [11].

This study aimed to estimate the survival of direct resin composites placed for the restoration of the worn dentition using a

relatively simple technique. Factors associated with failure were also determined up to 8-years follow-up.

2. Methods

All the patients recruited into this study were referred to the first author with a tooth wear problem. The sample consisted of a consecutive case series that was not randomised and did not require changing patient care from accepted standards. The study was approved by the Research, Development and Innovation department of the hospital trust. The criteria for inclusion were ability to attend the hospital for annual long-term follow-up and agreement to comply with advice regarding reduction or elimination of all dietary acids. Patients were generally fit and healthy although some patients had gastro-oesophageal reflux (GORD) and were taking appropriate medication whilst a few suffered with an eating disorder. None of the patients were excluded. All the patients were classified with severe tooth wear according to the criteria of Smith and Knight with at least two anterior surfaces having more than 30% dentine exposed, scoring 3 on the Tooth Wear Index, and resulting in patient complaints of poor appearance [12]. Patient variables recorded at baseline were age and gender, the aetiology of the wear and occlusal relationships. Attrition was diagnosed by presence of mating wear facets in excursions and erosion from patient questioning on dietary acid intake and gastric disturbances. Despite advanced wear many cases had dento-alveolar compensation resulting in a normal Free-way Space as measured clinically with a Willis bite gauge. Treatment planning involved mounted study casts on a Denar Mark II semi-adjustable articulator in centric occlusion and a determination of whether or not an increase in occlusal vertical

Table 1
Univariable comparisons of both patient factors and tooth type and arch with failure of direct composite restorations.

Patient level factors	No failures (n = 125)	Any failures (n = 39)	Hazard ratio (95% CI), and p-value (Cox regression)
Mean age (s.d.)	49.8 (13.7)	56.1 (11.9)	1.04 (1.01, 1.06) p=0.005
Male	101 (73.2%)	37 (26.8%)	0.28 (0.07, 1.16) p = 0.079
Female	24 (92.3%)	2 (7.7%)	
Bruxism	104 (76.5%)	32 (23.5%)	1.26 (0.56, 2.87) p = 0.580
No bruxism	21 (75.0%)	7 (25.0%)	
Increase in OVD	107 (79.3%)	28 (20.7%)	1.66 (0.83, 3.34) p = 0.156
No increase in OVD	18 (62.1%)	11 (37.9%)	
Attrition (reference category)	48 (72.7%)	18 (27.3%)	0.69 (0.35, 1.40) 0.51 (0.19, 1.38) p = 0.335
Erosion	52 (78.8%)	14 (21.2%)	
Multiple	21 (80.8%)	5 (19.2%)	
Unknown type	4	2	
Class 1 (reference category)	49 (77.8%)	14 (22.2%)	0.50 (0.07, 3.83) 1.42 (0.73, 2.76) Not estimated p = 0.602
Class 2	7 (87.5%)	1 (12.5%)	
Class 3/edge-to-edge	61 (72.6%)	23 (27.4%)	
Class 2 div 2/deep OB on Class 1	7 (100%)	0	
Missing	1	1	
Lack of posterior support (LOPS)	37 (66.1%)	19 (33.9%)	2.61 (1.39, 4.89) p = 0.003
No LOPS	88 (81.5%)	20 (18.5%)	
Tooth level factors	No failure	Failure	Hazard ratio (95% CI) and p-value (Cox regression frailty model)
Upper	660 (94.0%)	42 (6.0%)	0.078
Lower	273 (90.4%)	29 (9.6%)	
Upper incisor	487 (93.4%)	32 (6.2%)	0.314
Upper canine	133 (93.4%)	9 (6.3%)	
Upper posterior	40 (97.8%)	1 (2.4%)	
Lower incisor	151 (88.8%)	19 (11.2%)	
Lower canine	65 (90.3%)	7 (9.7%)	
Lower posterior	57 (95.0%)	3 (5.0%)	

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