Received: 27 February 2019 | Revised: 11 March 2020 | Accepted: 10 April 2020

DOI: 10.1002/osi2.1063

ORIGINAL ARTICLE

Oral Science International
Official Journal of the Japanese Stomatological Society
WILEY

Comparison of depth of cure in opaque sealant cured with high irradiance light-emitting diodes at various light tip distances

Corey J. Cloud[1] | Daranee Tantbirojn[2] | Martha H. Wells[1] | Antheunis Versluis[3]

[1]Department of Pediatric Dentistry and Community Oral Health, College of Dentistry, University of Tennessee Health Science Center, Memphis, TN, USA

[2]Department of General Dentistry, College of Dentistry, University of Tennessee Health Science Center, Memphis, TN, USA

[3]Department of Bioscience Research, College of Dentistry, University of Tennessee Health Science Center, Memphis, TN, USA

Correspondence
Antheunis Versluis, Department of Bioscience Research, College of Dentistry, University of Tennessee Health Science Center, 875 Union Avenue, Memphis, TN 38163, USA.
Email: antheun@uthsc.edu

Abstract

Purpose: The purpose of this study was to investigate depth of cure of an opaque sealant when light cured from increasing tip distances with high irradiance light-emitting diode (LED) curing units.

Methods: Ultraseal XT Plus opaque sealant was cured in a 2 × 2 × 5 mm covered slot mold using LEDs in high irradiance (VALO, SmartLite) or regular mode (Demi Ultra). Curing durations were 9, 15, and 20 seconds for the VALO, SmartLite, and Demi Ultra, respectively. The light tip was placed at three distances from the sealant surface (0, 3, and 5 mm; N = 10/group). Depth of cure was determined at the sealant surface and at 0.5 mm increments using Vicker's hardness (VHN). Results were statistically analyzed using two-way ANOVA and multiple comparisons (α = 0.05).

Results: Depth of cure was significantly affected by the LEDs and light tip distance. At 0.5 mm below the surface, most combinations resulted in hardness higher than 80% of the surface value, except for SmartLite at 3 and 5 mm tip distances and VALO at 5 mm tip distance. Regardless of the tip distance, VALO and Demi Ultra achieved similar VHN values through 1.5 mm depth.

Conclusions: It is not likely that sealant is adequately cured with LEDs, even for those in high power mode, when the light tip is moved away from the surface due to lower radiant exposure.

KEYWORDS

depth of cure, hardness, light curing, light tip, sealant

1 | INTRODUCTION

In the past decade, a paradigm shift has occurred in dentistry, placing a stronger emphasis on prevention rather than surgical treatment of dental caries. Despite the growing efforts to decrease childhood and adolescent caries, dental caries is still the most common childhood chronic disease, surpassing asthma and hay fever.[1] Prevention techniques involve early exams, dietary counseling, fluoride treatment, and pit and fissure sealants. Sealants have proven to be effective in reducing the number of pit and fissure caries on at-risk surfaces.[2] Based on evidence-based data, an expert group from the 2014 AAPD Pediatric Dentistry Restorative Symposium concluded that sealant effectiveness improves with good technique and that clinicians should therefore stay informed of changes in materials and technologies.[3] Among other inherent challenges of placing a well-retained sealant, inadequate curing of the material in the deepest portions of the fissure is a potential reason for sealant failure.[4] This inadequate curing can be due to material factors, curing light factors, clinical techniques, or patient factors.[5,6]

Pediatric dentists are equipped with advanced materials and technology in their armamentarium. Light-emitting diode (LED) curing lights have mostly replaced quartz-tungsten-halogen curing lights, which have been used successfully over the years. The advances in LED technology have facilitated the option to increase the light irradiance (or

