What's new for the clinician?

Summaries of and excerpts from recently published papers

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1. Are Oral Hygienists just as good as Dentists in identifying dental caries in children?

Daniel SJ, Kumar S. Comparison of dental hygienists and dentists: clinical and teledentistry identification of dental caries in children. Int J Dent Hygiene 2016; DOI: 10.1111/idh.12232

Preamble

Oral hygienists are considered the drivers of preventive oral health programs among children and adults. Both the proposed new National Oral Health Policy and the Re-engineered Primary Health Care Plan for South Africa have focused on school based programs for the prevention of dental caries in children. The prevalence of tooth decay among 4-5 year olds and 6 year olds nationally is 50.6% and 60.3% respectively with some provinces such as the Western Cape reporting prevalence rates of up to 77% for 4-5 year olds and 82% for 6 year olds.[1] Consequently, huge prevention programs that are being planned/implemented in many provinces and Oral Hygienists will be expected to diagnose caries and record dmft scores among children.

Additionally, there are many rural areas without dental professionals and the endeavour to increase access to dentistry in these areas to meet the needs of the underserved, has resulted in new care models that include electronic health records (EHR), intraoral photographs and mobile radiographic equipment, all components of teledentistry. Utilization of dental hygienists, dental assistants, nurses, physicians and health educators has also been suggested to contribute towards meeting the oral health needs in many areas. Teledentistry or e-oral health uses encrypted patient electronic data that are stored and forwarded to another health provider for review, diagnosis and treatment options, or the patient data can be viewed in real time through videoconferencing for the same purposes. The use of teledentistry is an effective and efficient means for the identification of dental caries.[2]

With the integration of teledentistry into current and future healthcare delivery models now imminent, Daniel and Kumar (2016) reported on a study that sought to compare the identification of dental caries by oral hygienists and dentists by both clinical and teledentistry methods.[2]

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ACRONYMS

DFS:	Decayed/filled surface
EHR:	Electronic Health Records
PI:	Principal Investigator

MATERIALS AND METHODS

This study was undertaken in the Department of Dental Hygiene at the University of Tennessee Health Science. A sample of 82 children (4–7 years of age) was selected from one elementary school to participate in the study. Participants were included if they met the age criteria and informed consent had been granted. Conversely, participants were excluded from the study if they did not cooperate or were unavailable for either the clinical screening or intraoral photography sessions.

Of the 82 participants, 78 met inclusion criteria. One child refused to cooperate with the taking of photographs, and three children were absent from school on the day scheduled for screening.

Four examiners participated in the study: two clinical examiners (dental hygienist and dentist) and two teledentistry examiners (dental hygienist and dentist). Each recorded the following on the patient chart: missing primary teeth, existing permanent teeth, dental caries and existing restorations.

Teledentistry examiners received written and oral instructions for accessing intraoral images posted on a specified site within Blackboard® (a course management software) accessible only by the principal investigator (PI) and teledentistry examiners. The PI conducted a one hour face-to-face training session with the teledentistry examiners. Photographic images of dental caries in primary and transitional dentitions were used for training. Location of lesions, presence of colour change in enamel and examiner internal criteria for determining the presence of a carious lesion were discussed to arrive at an understanding of visual characteristics relevant to the identification of dental caries. Recording of existing restorations, missing teeth and dental caries on the geometric chart was reviewed. Both teledentistry examiners were provided a three-ring binder with instructions and with coded geometric charts for each participant.

All data (charts and photographs) were coded with the participant's number.

An Apple iPhone 4S® was used to capture photographs of the dentition on all children. Cheek retractors were held by the participant whilst photographs of the facial surfaces of anterior teeth were obtained, and paediatric intraoral mirrors were held by a dental hygienist when photographs of the maxillary and mandibular occlusal surfaces were taken. Photographs were placed in a coded album according to participant number.

The data recording dental caries and restorations for each participant were converted to Decayed/filled surface (DFS) scores by the PI, resulting in four DFS scores for each participant that could be used for examiner comparison and analyses. Decayed filled surface scores were also used to capture extent of disease.

RESULTS

The teeth of the 78 participants were identified by FDI number, resulting in data being collected for twenty categories of primary teeth and 21 categories of permanent teeth. . Of these 41 categories, , 25 presented with a DFS score of zero for all examiners. DFS scores ranged from 0 to 55 for participants in the study. With the large number of zero DFS scores, the data were negatively skewed requiring use of nonparametric statistics.

Spearman's correlations were conducted to examine the relationship between DFS scores by type of examiner. Results revealed a high positive correlation of $\rho = 0.993$ between the two clinical examiners, $P < 0.01$, and a correlation of between $\rho = 0.749–0.808$ between all other groups of examiners ($P < 0.01$).

The Freidman's test found a significant difference in DFS scores among the four examiners (clinical dentist, clinical dental hygienist, teledentistry dentist and teledentistry dental hygienist), χ^2 (3) = 83.43, $P < 0.001$ but when the DFS scores were compared only between the clinical dentist and the clinical dental hygienist, there was no statistical difference. There was a statistically significant difference between the DFS scores of the teledentistry dentist and the other three examiners. Specifically, a significant difference was found between the teledentistry dentist and the teledentistry dental hygienist ($Z = 5.20$, $P < 0.01$), clinical dentist ($Z = 5.59$, $P < 0.01$) and the clinical dental hygienist ($Z = 5.74$, $P < 0.01$). Most importantly, there was no significant difference between the DFS scores of the clinical dentist and the teledentistry dental hygienist ($P > 0.10$).

CONCLUSIONS

The authors concluded that the clinical dental hygienist and the clinical dentist showed a significant positive correlation in diagnosing caries in children in the clinical setting. The teledentistry dental hygienist and the clinical dentist DFS scores were not significantly different ($P > 0.10$).

IMPLICATIONS FOR PRACTICE

This study found that dental hygienists and dentists performed essentially equally well in the clinical identification of dental caries in children. However, clinicians must note that this might not apply to all settings and training and calibration is essential for fair comparisons to be made.

Reference

1. van Wyk PJ, Louw AJ, du Plessis JB. Caries status and treatment needs in South Africa: report of the 1999-2002 National Children's Oral Health Survey. SADJ. 2004;59: 238, 240-2.
2. Daniel SJ, Kumar S. Comparison of dental hygienists and dentists: clinical and teledentistry identification of dental caries in children. Int J Dent Hygiene 2016; DOI: 10.1111/idh.12232

2. The effects of preheated dental fissure-sealing materials on marginal and internal integrity.

Borges BC, de Assunção IV, de Aquino CA, de Melo Monteiro GQ, Gomes AS. Marginal and internal analysis of preheated dental fissure-sealing materials using optical coherence tomography. Int Dent J. 2016; 66: 23-8.

ACRONYMS

DE: demineralising
OCT: Optical coherence tomography
RE: remineralising

The efficacy of pit and fissure sealing to prevent dental occlusal caries lesions is now well established. Recently, clinical trials have shown similar efficacy when resin-based materials are used as a secondary preventive approach in the management of non-cavitated occlusal carious lesions in dentin.[1] These findings extend the use of pit and fissure sealants in clinical dentistry. However, retention is an integral requirement for the success of a resin-based sealant. Incomplete retention of resin-based sealant materials has been associated with the risk of subsequent caries or caries progression.[1] Thus, attempts should be made to improve the material strength of sealing materials and their marginal adaptation to occlusal enamel.

The use of a flowable composite for fissure sealing has been suggested in order to provide higher retention rates and better physical properties than a traditional fissure sealant.[1] Pre-heating composite materials before photoactivation is assumed to improve the physical properties of the material. Preheated flowable composites have also been shown to provide superior hardness and resistance to softening under pH cycling than materials photoactivated at room temperature.[1] This finding may indicate that preheated flowable composites will provide superior retention rates on occlusal fissures.

Conventional methods for detecting interfacial gaps, such as dye penetration, bacterial leakage and electrochemical leakage tests, are all invasive. Furthermore, destructive techniques, such as microscopy on sectioned samples, are commonly used to characterise the microstructure and damage of polymer matrix composites on a small scale.[1] Examining these features non-destructively would be very desirable, as the structure would remain intact because no sectioning is required. Optical coherence tomography (OCT) has been found to be a powerful, non-destructive tool for examining polymer matrix composites in terms of microstructure determination and mechanical property prediction, void and defect detection, and damage evaluation, with a high resolution and penetration depth of up to a few millimetres.[1]

Borges and colleagues (2016)[1] from Brazil undertook an *in vitro* study that sought to evaluate the influence of pre-photoactivation temperatures [room temperature (25°C) and 68 °C] on the marginal and internal integrity (occurrence of voids) of a flowable composite and a traditional fissure sealant in occlusal fissures using OCT. The null hypotheses tested were as follows: (i) preheated materials (68 °C) would not favour improved marginal and internal integrity; and (ii) the flowable composite would not show better marginal and internal integrity than the fissure sealant.

MATERIALS AND METHODS

Forty totally erupted human third molar teeth, free of macroscopic caries, abrasions and staining on the occlusal surface (assessed by visual examination), and extracted for surgical reasons from 18- to 40-year-old patients, were used. The teeth were assigned to four experimental groups (n = 10 per group), according to the sealing material [a flowable composite, Permaflo (Ultradent), and a fissure sealant, Fluroshield (Dentsply)] and the pre-photoactivation temperature (room temperature, 25°C; and preheated, 68°C).

For sealing, the occlusal surface was cleaned using pumice slurry, etched with 37% phosphoric acid for 15 seconds, washed with an air/water spray for 30 seconds and dried with an air stream, according to the manufacturer's recommendations. Sealing materials at room temperature were applied with a dental probe to help the material flow over the pits and fissures. The material was then light cured for 20 seconds using the Coltolux LED (Coltène/Whaledent) light-curing device at an intensity of 1263 mW/cm^2. The tip was positioned over the teeth in the centre of the occlusal surface so that light could propagate throughout the surface of the material. Preheated materials were warmed using a 700-W microwave device. 0.5mL of each material was measured, dispensed into a glass cup and heated for 60 seconds to reach a temperature of 68°C. After heating, the materials were immediately applied over the fissure, following the same steps described for the materials at room temperature.

After sealing, the teeth underwent thermocycling. Alternate baths at 5 ± 3°C and 55 ± 3°C were applied for 500 cycles, each for 30 seconds. An area of occlusal enamel (4mm in the mesiodistal direction × 4mm in the buccolingual direction) was selected in the centre of the main occlusal fissure involving the sealant and margins. The tooth was isolated with two coats of acid-resistant nail varnish, except for the occlusal-delimited area. The samples were then subjected to a 14-day pH-cycling model, simulating a high cariogenic challenge. Each cycle consisted of a 6-h immersion in a demineralising (DE) solution, followed by an 18-h immersion in remineralising (RE) solution. Each tooth was immersed in 40mL of DE solution, representing 2.5mL of solution/mm^2 of exposed enamel area. The teeth were washed in deionised water for 30 seconds, dried with absorbent paper and individually immersed in 20mL of RE solution, representing 1.25mL of solution/mm^2 of exposed enamel area. Both solutions contained thymol crystals to avoid microbial growth. The solutions (DE and RE) were changed after 7 days.

A commercially available OCT system was used for microstructure determination and mechanical property prediction, void and defect detection in each tooth and images were obtained.

The images were analysed with regard to the presence/absence of gaps in the margins and internal voids in the sealing material by a calibrated operator. The number of images with no gap or internal voids, interfacial gaps and/or internal voids was also measured and the mean values for each experimental group were obtained. Data were submitted to two-way analysis of variance and the Tukey test ($P < 0.05$).

RESULTS

There were statistically significant differences in the number of images with marginal gaps between materials and between temperatures ($P < 0.01$). Preheated materials had a lower number of marginal gaps than those at room temperature. The flowable composite had fewer marginal gaps than the fissure sealant, regardless of the temperature of the material.

There were statistically significant differences in the number of images with internal voids, between the materials and between the temperatures ($P < 0.01$). Preheated materials had a lower number of internal voids than those at room temperature. The flowable composite presented fewer internal voids than the fissure sealant, regardless of the temperature of the material.

CONCLUSIONS

The authors concluded that preheating of fissure-sealing materials had a positive effect on the marginal and internal integrity of occlusal fissures. The flowable composite tested performed better than the traditional fissure sealant tested.

IMPLICATIONS FOR PRACTICE

Clinicians should note that this is an *in-vitro* study but the improved performance of the materials (especially flowable composites) at pre-heated temperatures suggest that clinicians should consider this mode of use in their practices to obtain better results.

Reference

1. Borges BC, de Assunção IV, de Aquino CA, de Melo Monteiro GQ, Gomes AS. Marginal and internal analysis of preheated dental fissure-sealing materials using optical coherence tomography. Int Dent J. 2016; 66: 23-8.