Efficacy of Asynchronous Teledental Caries Detection in Pediatric Patients

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Background

Traditional dental examination involves an in-person visual clinical examination with the use of radiographs for accurate diagnosis and treatment planning. Teledentistry has proven to be a valid and comparable means for oral evaluation and treatment decisions, increasing oral health access.

The purpose of this retrospective chart review was to evaluate the diagnostic accuracy of caries detection by tooth surface and location captured using asynchronous teledentistry compared to traditional clinical examination

Methods

- After institutional exemption (IRB: i22-00057), electronic dental records of 23 patients aged 4-8 who received new or recall in-person dental examinations reviewed by two similarly trained pediatric dental residents.
- Clinical exam (CE) included caries diagnosis by surface using visual examination and appropriate radiographs. An intraoral camera (Mouthwatch) was then used to capture a pre-selected set of 10-14 images depending on the presenting dentition
- A minimum of 60 days later, an asynchronous teledentistry exam was completed independently by each resident examiner (TDA, TDB). Examiners used de-identified radiographs and intraoral pictures from each patient to identify caries extent by tooth surface.
- Statistical analysis was performed to evaluate the overall percent agreement in caries diagnosis and to determine significance by tooth surface and location

Figure1. Sample intraoral camera images utilized for teledentistry examination

Results

Table 1. Descriptive Statistics		
Clinical agreement of tooth surfaces amongst 23 subjects (n=2528)	**%agreement**	**(n=)**
Overall agreement CE and TDA	77.5%	1961
Overall agreement CE and TDB	67.9	1718
Overall agreement CE, TDA, and TDB	73.0%	1855
Clinical agreement CE, TDA, and TDB by extent of caries per surface	**%agreement**	**(n=)**
Clinically Sound surfaces (n=2175)	67.5%	1470
Surfaces with Lesions limited to Enamel (n=65)	23.0%	15
Surfaces with Lesions limited to Dentin (n=140)	19.2%	27
Surfaces with Lesions limited to Pulp (n=30)	46.6%	14

Table 2. Percent agreement between exam type by tooth location and surface			
Maxillary dentition caries detection vs Mandibular dentition caries detection			
	%agreement Maxillary	%agreement Mandibular	p-value
CE, TDA	79.0%	79.7%	--
CE, TDB	67.6%	71.4%	--
CE, TDA, TDB	**61.9%**	**66.00%**	**0.035**
Anterior dentition caries detection vs Posterior dentition caries detection			
	%agreement Anterior	%agreement Posterior	p-value
CE, TDA	79.8%	79.8%	--
CE, TDB	74.5%	63.6%	<.001
CE, TDA, TDB	**71.2%**	**55.50%**	**<.001**
Interproximal (IP) caries detection vs Other surfaces			
	%agreement IP	%agreement Other	p-value
CE, TDA	87.0%	74.2%	<.001
CE, TDB	86.0%	58.5%	<.001
CE, TDA, TDB	**81.8%**	**52.0%**	**<.001**
Occlusal caries detection vs Other surfaces			
	%agreement Occlusal	%agreement Other	p-value
CE, TDA	79.70%	79.3%	--
CE, TDB	82.30%	66.3%	<.001
CE, TDA, TDB	**75.1%**	**61.2%**	**<.001**
Facial/Buccal (FB) caries detection vs Other Surfaces			
	%agreement FB	%agreement Other	p-value
CE, TDA	82.3%	78.60%	--
CE, TDB	68.4%	69.8	--
CE, TDA, TDB	**60.1%**	**64.9%%**	**0.044**
Lingual/Palatal (LP) caries detection vs Other surfaces			
	%agreement LP	%agreement Other	p-value
CE, TDA	60.70%	84.0%	p<.001
CE, TDB	24.8%	80.7%	p<.001
CE, TDA, TDB	**21.0%**	**74.7%**	**p<.001**

Results (cont.)

The overall percent agreement between TDA, TBA, and CE was found to be 73.0%. Overall percent agreement between TDA and TBA was 75.1%

Overall percent agreement of clinically sound surfaces was 67.5% and 19.2% for surfaces with lesions found to be limited to dentin on clinical exam..

Significant differences in percent agreement between TDA, TDA, and CE were found by surface location:

- 71.2% with anterior segment surfaces compared to 55.6% with posterior segment surfaces
- 81.8% agreement with interproximal surfaces compared to 52.0% with all other surfaces
- 21.0% with lingual/palatal surfaces compared to 74.7% with all other surfaces

No significant differences in percent agreement were found when comparing permanent and primary dentition

Discussion

Limitations of this study include a small sample size, quality of intraoral photographs, and practitioner differences in diagnosis.

Findings suggest that tooth surface location and depth of lesion may impact level of agreement. Ensuring an adequate number of intraoral clinical pictures with direct views from all surfaces is essential for diagnosis.

Past research has demonstrated equivalence of teledentistry with in-person exams. Asynchronous teledentistry shows strong promise as a useful and acceptable alternative when traditional in person clinical examination is not accessible.

Future research should include investigating agreement in planned treatment as well as suggested best practices for image quantity and quality.