

Diagnostic Outcomes of Digital Images in Pediatric Dentistry: an Intra-Examiner Agreement Assessment

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Abstract

Teledentistry could be defined as a branch of telemedicine, which consists of the use of digital information and communication technology (ICT) to transmit oral health information and support oral healthcare delivery using synchronous or asynchronous clinical information. It is an alternative method to provide access to oral health care for patients in rural, remote, and urban areas where face-to-face specialist dental consultation is not possible. Teledentistry has shown to be accurate and effective in diagnosing oral diseases and dental problems and improving access to oral health care by avoiding face-to-face clinical examination. Currently, there are no regulations to practice teledentistry in the State of Alabama; therefore, it seems to be necessary to provide scientific clinical evidence that support its practice. In addition, no study has assessed the implementation of teledentistry for oral diagnosis using an intra-oral video camera of a comprehensive oral examination in children

The purpose of this study was to assess the intra-examiner diagnoses obtained via traditional oral clinical examination versus an examination completed from video images of children.

Methods

- Fifty (50) patients 5 to 10 years of age, attending the Pediatric Dentistry Clinic at the University of Alabama at Birmingham (UAB) for initial or recall visits.
- The oral comprehensive examination was performed by five second-year pediatric dentistry residents.
- A full-mouth intraoral video was recorded for each patient using an intra-oral camera MouthWatch® by a trained dental hygienist.
- After a one-month wash-out period, the videos were assessed by the same examiner for evaluation.
- Intra-examiner consistency (percent) An examiner agreement was determined using the kappa coefficient (95% confidence interval [CI]).

Results

Table 1. Demographics of Pediatric Dental Subjects and Dental Caries Examination Findings

Variables	Description
50 Children mean age	5 to y10 years
Number of Teeth examined:	1116 teeth
Number of surfaces:	4990 Surfaces
Primary Teeth:	654 teeth
Permanent Teeth:	462 teeth
Number of surfaces with dental Caries from face-to face	426 surfaces
Number of surfaces with dental Caries from Telediagnosis	410 surfaces

Table 3. Dental Caries detection in primary and permanent teeth with two methods of examination

Dental Caries by Tooth Type	Consistency*	Kappa (95%CI) †
Primary anterior teeth	98.0%	0.84 (0.74-0.91)
Primary posterior teeth	97.0%	0.84 (0.74-0.91)
Overall Caries detection in primary teeth	94.0%	0.82 (0.71-0.90)
Permanent anterior teeth	100%	0.96 (0.93-1.00)
Permanent posterior teeth	99.3%	0.96 (0.91-1.00)
Overall Caries detection in permanent teeth	99.6.%	0.96 (0.93-0.98)

*Consistency is the percent agreement by tooth surface.
†Kappa and 95% Confidence Interval (CI) Using a five-item scale to assess agreement

Table 3. Hard tissue assessment evaluation teeth with two methods of examination

Hard tissues assessment	Consistency	Kappa (95%CI) †
Enamel defects	100%	1.00 (1.00-1.00)
Erosion	94%	0.82 (0.62-1.00)
Attrition	98%	0.92 (0.77-1.00)
Staining	98%	0.96 (0.88-1.00)
Overall hard tissues assessment	98%	0.93 (0.82-1.00)

†Kappa and 95% Confidence Interval (CI) Using a five-item scale to assess agreement, almost perfect agreement (range 0.82-1.00) was found in all comparisons.

Table 2. Overall intra-examiner agreement obtained from face-to-face examination versus teledentistry examination

Variables	Consistency*	Kappa (95%CI) †
Dental caries detection	98%	0.89 (0.82-0.94)
Assessment of hard tissues	98%	0.93 (0.82-1.00)
Assessment of oral hygiene	95%	0.82 (0.61-1.00)
Assessment of dental occlusion	83%	0.64 (0.40-0.88)
Overall agreement	93,5%	0.85 (0.73-0.95)

* Consistency is the percent agreement between traditional oral clinical examination versus digital oral examination one month later by the same examiner.
†Kappa and 95% Confidence Interval (CI) Using a five-item scale to assess agreement. ≤ 0 as indicating no agreement and 0.01–0.20 as none to slight, 0.21–0.40 as fair, 0.41– 0.60 as moderate, 0.61–0.80 as substantial, and 0.81–1.00 as almost perfect agreement

Table 4. Dental Occlusion assessment evaluation teeth with two methods of examination

Occlusion assessment	Consistency*	Kappa (95%CI) †
Molar occlusion	84%	0.73 (0.53-0.93)
Canine occlusion	87%	0.73 (0.51-0.96)
Midline Normal	78%	0.56 (0.33-0.79)
Overbite	84%	0.68 (0.46-0.90)
Overjet	84%	0.49 (0.17-0.82)
Overall occlusal assessment	83%	0.64 (0.40-0.88)

*Consistency is the percent agreement.
†Kappa and 95% Confidence Interval (CI) Using a five-item scale to assess agreement, a substantial agreement (0.68-0.73) was found for molar, canine, and overbite relationship. However, moderate agreement found for overjet and midline (0.49-0.56)

Table 3. Oral hygiene and soft tissue assessment evaluation teeth with two methods of examination

Assessment of soft tissue/oral hygiene*	Consistency**	Kappa (95%CI) †
Soft tissue	100%	1.00 (1.00-1.00)
Plaque	94%	0.65 (0.23-1.00)
Calculus	94%	0.83 (0.63-1.00)
Gingivitis	92%	0.80 (0.59-1.00)
Overall assessment of oral hygiene	95%	0.82 (0.61-1.00)

†Kappa and 95% Confidence Interval (CI) Using a five-item scale to assess agreement, a moderate to almost perfect agreement (range 0.65-1.00) was found in all comparisons.



Figure (A) Posterior upper right arch with interproximal dental caries on primary teeth. (B) gross decay on upper right first molar. (C) show lower right first molar with an occlusal sealant and a caries lesion on the distal occlusal cusp (D) permanent molar occlusion and plaque accumulation around the gingival margin.(E) Upper left first molar with enamel defect (F) shows attrition on upper anterior primary teeth. (G) show lingual erosion in upper anterior primary teeth. (H) Show lingual calculus accumulation on lower anterior permanent teeth. (I) Heavy plaque accumulation on right side molar area. (J) class I canine relationship and anterior crossbite in primary dentition. (K) left side class I molar occlusion relationship. (L) right side canine relationship, overbite, and overjet in permanent dentition. (M) Midline in primary dentition. (N) Enamel erosion in primary molars (O) shows distal-occlusal-lingual caries on lower right primary first molar with buccal abscess.

Conclusions

1. Overall results indicate almost perfect intra-examiner agreement between the diagnosis from clinical face-to-face examination and that conducted from intraoral video records
2. Oral video records are comparable to the traditional clinical examination for the diagnosis of dental problems among school children.
3. Telediagnosis based on video records is a useful method for obtaining clinical information.
4. No patient receiving Digital oral examination would fail to receive follow-up dental care as indicated by face-to-face oral examination.