



Visual-tactile Examination Compared With Conventional Radiography, Digital Radiography, and Diagnodent in the Diagnosis of Occlusal Occult Caries in Extracted Premolars

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Abstract

Purpose: This laboratory study compared visual-tactile examination with conventional radiographs, digital radiographs, and laser fluorescence in the detection of occlusal occult caries on extracted premolar teeth.

Methods: Extracted premolars without obvious caries or restorations were collected from school dental clinics. Occlusal surfaces of 320 extracted premolars were examined visually with an explorer, then examined using the KaVo Diagnodent unit and scored using specific criteria. The teeth were exposed using conventional and digital radiography, respectively. The radiographs were assessed for dentin radiolucencies beneath the occlusal surface.

Results: Of the 320 teeth used in this study, 302 were scored as sound by visual-tactile examination. Of these, 57 (19%) demonstrated dentin radiolucency on conventional bite-wings, and 245 (81%) were scored as radiographically sound. Thus, the sensitivity and specificity values of the visual-tactile examination compared with conventional radiography were 81% and 44%, respectively. In contrast, Diagnodent produced results of 82% sensitivity and 36% specificity when compared with conventional radiography. When compared to digital radiography, the sensitivity and specificity values of the visual-tactile examination were 90% and 44%, respectively. In contrast, when compared to digital radiography, Diagnodent showed a very low specificity of only 32%, although sensitivity was still high at 91%. Differences in specificity among the techniques were statistically significant ($P < .03$), whereas differences in sensitivity were not ($P > .01$).

Conclusions: Although the diagnosis of occult dentinal caries may be further enhanced by the Diagnodent, a combination of visual-tactile examination and either conventional or digital radiography should identify over 80% of lesions. (*Pediatr Dent.* 2003;25:341-349)

KEYWORDS: DIAGNODENT, DENTAL RADIOGRAPHY, DIGITAL DENTAL RADIOGRAPHY, OCCULT CARIES, VISUAL-TACTILE DENTAL EXAMINATION

Received September 18, 2002 Revision Accepted February 6, 2003

The majority of clinicians use visual examination together with the dental explorer to decide if an occlusal surface is in need of restoration or if preventive management is required. However, accurate diagnosis of the occlusal surface is difficult due to the anatomical nature of the fissures and the likelihood of caries being

initiated on the fissure walls and base,^{1,2} which make it difficult to detect with probing alone. For these reasons, occlusal caries may be missed clinically, yet the lesion may be diagnosed by radiographic means. The term "occult caries"³ or "hidden caries"⁴ is used to describe such lesions that are not clinically diagnosed using accepted visual-tactile

criteria such as cavitation, softening, opacity, and color change, but which are detected only on radiographs as radiolucent lesions in dentin. The prevalence of occult caries has been reported to range from around 3% to more than 50% in clinical studies.⁵⁻¹¹ The high prevalence of occult lesions suggests that traditional clinical methods using the mirror and explorer may be of questionable accuracy in the diagnosis of occlusal lesions. As these lesions have extended into dentin, restorations are usually recommended—although in cases where a lesion is limited, sealing of the cavity with an occlusal sealant may be considered if the progress can be monitored.

Studies using histological validation show that only a small proportion of occlusal carious lesions can be discovered by visual inspection and probing.^{12,13} Although it is known that conventional radiography is not sensitive in detecting early carious lesions which are limited to only enamel,¹⁴⁻¹⁶ conventional radiography in conjunction with visual-tactile examination has been shown to significantly improve the accuracy of occlusal caries diagnosis¹⁷ and is commonly employed in clinical practice.

With the introduction of digital radiography in the 1990s, more clinicians are replacing conventional radiography with digital, yet minimal data is available on diagnostic differences between conventional radiography and digital techniques in the diagnosis of occlusal caries.^{15,18-23}

A few other methods have been introduced to aid caries diagnosis on occlusal surfaces. Electrical resistance measurement devices have been reported to have relatively high sensitivity and specificity, but the results were less accurate with larger lesions.^{12,14,17} More recently, laser fluorescence was introduced as another technique for caries diagnosis with the putative advantage of being able to quantify early mineral loss from dental caries.^{24,25} Although early reports using the KaVo Diagnodent suggest that the diagnostic performance of this new method is more accurate and reproducible compared with conventional radiography and clinical inspection,^{26,27} further studies are required.

The aim of the present study was to determine the relative sensitivities and specificities of visual-tactile examination compared with laser fluorescence (Diagnodent), conventional radiography, and digital radiography in the diagnosis of occult occlusal lesions in extracted premolar teeth.

Methods

Selection of premolars

A total of 320 pooled extracted premolars were donated by the patients from school dental clinics, and the study was exempt from IRB. The teeth were extracted for predominantly orthodontic reasons, and the ages of the donors were approximately 12 to 15 years. The teeth had been screened with respect to the presence of gross carious lesions, restorations, or enamel hypoplasia/hypomineralization de-

fects so that only those with macroscopically intact surfaces were included in the study. The selected teeth had been soaked in formalin immediately after extraction, rinsed in tap water, and stored dry. The occlusal surfaces of the teeth were cleaned with a rotating bristle brush with pumice, rinsed in tap water, and dried with an air syringe. All clinical, radiographic, and Diagnodent scores were taken by a single examiner (MC).

Visual-tactile assessment

The teeth were first examined by visual inspection under standard dental lighting. The teeth were dried using an air syringe, and the color of enamel surrounding the fissures was noted with regard to whether demineralization (opacity) was present. The occlusal fissures were explored using a new sickle explorer. A fissure was defined as “sticky” if resistance was felt by the explorer tip on gentle probing. The results of visual-tactile examination of the occlusal surface were assigned the following scores:

1. C0=fissures not sticky and no demineralization (opacity);
2. C1=sticky fissures and no demineralization;
3. C2=demineralization (opacity) and no sticky fissure;
4. C3=demineralization (opacity) and sticky fissures;
5. C4=frank cavitation larger than explorer tip.

Radiographic techniques and assessment

Conventional film radiographs of the premolars were exposed. The teeth were placed on standard mounts, and periapical radiographs were exposed using a paralleling technique on the Siemens radiography unit (70 kV 70 mA; Siemens Aktiengesellschaft, Wittelsbacherplatz, D-8, Munich 2, Germany). Size 22×35 mm Super Poly-Soft Kodak Ultraspeed film (Eastman Kodak Company, Rochester, NY) was used with an exposure time of 0.32 seconds and processed manually according to the manufacturer's guidelines.

The radiographs were assessed by the author using a standard radiographic illuminated viewing box and peripheral light block out. The teeth were scored according to the depth of radiolucency present in dentin according to the following criteria:

1. R0=no intracoronal radiolucency;
2. R1=radiolucency present within crown (<1/3 dentin width);
3. R2=radiolucency present within the crown (1/3-2/3 dentin width);
4. R3=radiolucency present within the crown (>2/3 dentin width).

Digital radiographic technique and assessment

The digital film radiographs were exposed using the Sirona Heliodont DS unit (Sirona Dental Systems GmbH, Fabrikstrasse 31, D-64625 Bensheim, Germany). Paralleling technique was used with teeth placed horizontal on a

Table 1. Correlated Results of Visual-tactile Assessment (C)* Compared With Conventional Radiography (R), Digital Radiography (D), and Diagnodent (L)

	C0 (no sticky fissures, no demineralization) N (%)	C1 (sticky fissures, no demineralization) N (%)	C2 (demineralization, no sticky fissures) N (%)	C3 (demineralisation sticky fissures) N (%)	Total N
R0 (no intracoronal radiolucency)	221 (69)	24 (8)	11 (3)	0	256
R1 (radiolucency present <1/3 dentin width within crown)	48 (15)	6 (2)	6 (2)	0	59
R2 (radiolucency present within crown=1/3-2/3 dentin width)	3 (1)	0	2 (1)	0	5
R3 (radiolucency present within crown >2/3 dentin width)	0	0	0	0	0
DR0 (no intracoronal radiolucency)	246 (77)	27 (8)	10 (3)	0	283
DR1 (radiolucency present within crown <1/3 dentin width)	25 (8)	3 (1)	7 (2)	0	35
DR2 (radiolucency present within crown=1/3-2/3 dentin width)	1 (1)	0	1 (1)	0	2
DR3 (radiolucency present within crown >2/3 dentin width)	0	0	0	0	0
L0 (numerical value <5 indicating no caries)	0	0	0	0	0
L1 (numerical value=5-25 indicating enamel caries)	248 (76)	22 (7)	8 (3)	0	278
L2 (numerical value=26-35 indicating dentin caries)	11 (3)	5 (2)	7 (2)	0	23
L3 (numerical value >35 indicating advanced dentin caries)	13 (4)	3 (1)	3 (1)	0	19

$P < .001$ for all comparisons except for clinical and conventional radiography ($P = .01$).

standard mount. The film radiographs were recorded as 2×3 cm images. The scoring criteria are as follows:

1. DR0=no intracoronal radiolucency;
2. DR1=radiolucency present within crown (<1/3 dentin width);
3. DR2=radiolucency present within the crown (1/3-2/3 dentin width);
4. DR3=radiolucency present within the crown (>2/3 dentin width).

Diagnodent technique and assessment

Each occlusal surface was examined using the tip of the laser device of the KaVo Diagnodent laser fluorescence device (KaVo Dental GmbH & Co KG, Bismarckring 39, D-88400, Biberach/Riss, Germany) and rotated around a vertical axis until the highest reading was found. Dupli-

cate readings were taken and the mean reading was recorded. The scoring criteria are as follows:

1. L0=numerical value (<5) indicating no caries;
2. L1=numerical value (5-25) indicating enamel caries;
3. L2=numerical value (26-35) indicating dentin caries;
4. L3=numerical value (>35) indicating advanced dentin caries.

When performing assessment of one technique, the operator was blinded to the results of the other techniques.

Reproducibility of intraexaminer scores

Reproducibility of the visual, conventional, and digital radiographic scoring system by the examiner was assessed with an unweighted kappa statistic.²⁸ This was performed for 9 teeth, each of which was scored 3 times on 3 separate occasions.

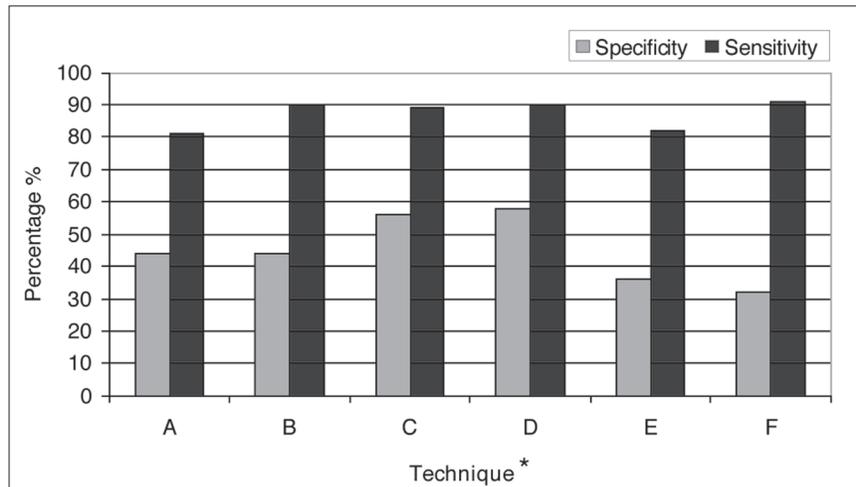


Figure 1.

*The differences in specificity among the different techniques were statistically significant ($P < .03$), whereas the differences in sensitivity were not significant ($P > .1$).

A=clinical examination and conventional radiography.

B=clinical examination and digital radiography.

C=clinical examination and Diagnodent.

D=conventional radiography and digital radiography.

E=Diagnodent and conventional radiography.

F=Diagnodent and digital radiography.

The kappa statistic showed high scores of 0.83 for visual-tactile, 0.82 for conventional radiography, and 0.91 for digital radiography, suggesting high intraexaminer consistency ($P < .001$). The Diagnodent technique did not require intraexaminer variability determination because the numeral readings provide consistent, objective scores.

Statistical analysis

The data were analyzed using the SAS for Windows version 8.2 computer program. The Spearman rank correlation was used to compare different techniques. Mantel-Haenszel chi-square tests were used to determine significance of sensitivity and specificity values.

Results

A total of 320 premolars were examined. Of these, 218 (68%) were maxillary premolars and 102 teeth (32%) were mandibular premolars.

All the premolars in the sample had no obvious caries, occlusal malformations, or any restorations. The individual results of the clinical assessments of the 320 teeth were correlated against the results of conventional and digital radiographic assessment and Diagnodent.

Visual-tactile examination and conventional radiography

Out of the 320 teeth, 302 (94%) were scored as sound (C0-C1) using visual-tactile examination. Of these, 272 (90%) were scored as C0 (ie, having no opacity and fissures not sticky), and 30 (10%) were scored as C1 (ie, having sticky fissures and without demineralization). Of the remaining 18 teeth scored as having caries, all were scored to have demineralization with no sticky fissures.

When examined with conventional radiographs, 256 (80%) teeth did not exhibit a radiolucency within the tooth crown, 59 (18%) teeth had radiolucency less than one third the dentin width of the crown and only 5 (2%) showed dentin radiolucency extending to within one third to two thirds the dentin width.

As shown in Table 1, the results of clinical assessment were correlated against the results of the radiographic assessment. Of the 302 teeth scored as clinically sound (C0-C1), 57 (19%) demonstrated dentin radiolucency on conventional bitewings (R1-R3) and 245 (81%) scored as radiographically sound (R0). The sensitivity of the clinical exam with conventional radiography was thus determined to be 0.81 (Figure 1).

Of the 18 teeth clinically scored as having caries (C2-C4), 8 (44%) were found to have radiolucencies within the crown as seen on bitewing radiography (R1-R3). Therefore, the specificity of the technique was determined to be 0.44. (Figure 1). The Spearman rank correlation was $S_p = 0.10$ (95% CI: -0.024, 0.224; $P < .01$; Table 3).

Visual-tactile examination and digital radiography

As shown in Table 1, the results of the visual-tactile examination were correlated against the results of the digital radiography. The data show that of the 302 teeth that were scored as clinically sound (C0-C1), 273 teeth were also scored as radiographically sound (DR0), thus giving a sensitivity value of 90%. When the 18 teeth scored as having clinical caries (C2-C3) were considered, 8 showed radiolucencies and were scored as (DR1-DR3). Thus, the specificity of the visual-tactile examination compared against digital radiography was 44% (Figure 1).

The Spearman rank correlation was $S_p = 0.166$ (95% CI: 0.025, 0.308; $P < .01$; Table 3).

Visual-tactile examination and Diagnodent

As shown in Table 1, results with the Diagnodent indicated that, of the 302 teeth that scored as clinically sound (C0-C1), 270 (89%) teeth had a reading of no caries or early enamel caries on the Diagnodent (L0-L1), yielding a sensitivity of 89% (Figure 1). When the teeth with clinical caries (C2-C3) were considered, 10 of the 18 (56%) teeth gave Diagnodent scores of L2 to L3, showing that the specificity of Diagnodent in diagnosing the carious lesions was only 56% (Figure 1).

Table 3 shows that the Spearman rank correlation was $S_p = 0.307$ (95% CI: 0.164, 0.449; $P < .001$).

Conventional radiography compared with digital radiography

Of the 283 teeth scored by conventional radiography as being sound (R0), 256 (90%) teeth were also scored as sound on the digital radiographs (Table 1). Thus, the sensitivity of conventional radiography compared to digital radiography was 90% (Figure 1). On the other hand, in the teeth scored as having caries on conventional radiographs (R1-R3), only 37 out of 64 were also scored as having caries on digital radiographs (DR1-DR3). Therefore, the specificity of conventional radiography compared with digital radiography was only 58%.

The Spearman rank correlation for this technique was $S_p=0.643$ (95% CI: 0.538, 0.749; $P<.01$; Table 3).

Diagnodent and conventional radiography

Of the 278 teeth scored on the Diagnodent as either sound or having early enamel caries (L0- L1), 229 (82%) teeth were radiographically sound (R0; Table 2). The sensitivity of the Diagnodent technique was found to be 82%. Of the 42 teeth scored as having dentinal caries with the

Diagnodent (L2-L3), 15 were found to have radiolucencies within the crown as seen on conventional radiographs (R1-R3). Therefore, the specificity of the technique was determined to be 36%.

The Spearman rank correlation for this technique was $S_p=0.444$ (95% CI: 0.334, 0.553; $P<.001$; Table 3).

Diagnodent and digital radiography

Of the 278 teeth scored as sound or having caries limited to enamel on the Diagnodent (L0-L1), 253 (91%) were also found to be sound on digital radiographs (DR0). The sensitivity of the Diagnodent technique compared to digital radiography in diagnosing dentinal caries was 91%. In the 37 teeth scored as having caries on the digital radiographs (DR1-DR3), only 12 were scored as having dentin caries using the Diagnodent technique. Thus, the specificity of the Diagnodent technique against digital radiography was 32%.

The Spearman rank correlation for this technique was $S_p=0.180$ (95% CI: 0.040, 0.320; $P<.001$; Table 3).

Table 2. Correlated Results of Diagnodent (L)* Compared With Visual-tactile Assessment (C), Conventional Radiography (R), and Digital Radiography (D)

	L0 (numerical value <5 indicating no caries) N (%)	L1 (numerical value 5-25 indicating enamel caries) N (%)	L2 (numerical value 26-35 indicating dentin caries) N (%)	L3 (numerical value >35 indicating advanced dentin caries) N (%)	Total N
R0 (no intracoronal radiolucency)	0	229 (72)	14 (4)	13 (4)	256
R1 (radiolucency present <1/3 dentin width within crown)	0	48 (15)	6 (2)	5 (2)	59
R2 (radiolucency present within crown=1/3-2/3 dentin width)	0	1 (0.3)	3 (1)	1 (0.3)	5
R3 (radiolucency present within crown >2/3 dentin width)	0	0	0	0	0
DR0 (no intracoronal radiolucency)	0	253 (79)	14 (5)	16 (5)	283
DR1 (radiolucency present within crown <1/3 dentin width)	0	24 (8)	8 (2)	3 (1)	35
DR2 (radiolucency present within crown=1/3-2/3 dentin width)	0	1 (1)	1 (1)	0	2
DR3 (radiolucency present within crown >2/3 dentin width)	0	0	0	0	0
C0 (no sticky fissures, no demineralization)	0	248 (76)	11 (3)	13 (4)	272
C1 (sticky fissures, no demineralization)	0	22 (7)	5 (2)	3 (1)	30
C2 (demineralization, no sticky fissures)	0	8 (3)	7 (2)	3 (1)	18
C3 (demineralisation, and sticky fissures)	0	0	0	0	0

* $P<.001$ for all comparisons.

Table 3. Diagnostic Techniques and Spearman Rank Correlation Results

Diagnostic techniques	Spearman rank correlation coefficient S_p (95% CI)
Clinical examination and conventional radiography	$S_p=0.10$ (-0.024, 0.224)
Clinical examination and digital radiography	$S_p=0.1663$ (0.025, 0.308)
Clinical examination and Diagnodent	$S_p=0.307$ (0.164, 0.449)
Conventional radiography and digital radiography	$S_p=0.6433$ (0.538, 0.749)
Diagnodent and conventional radiography	$S_p=0.444$ (0.334, 0.553)
Diagnodent and digital radiography	$S_p=0.18$ (0.040, 0.320)

Comparison of the various techniques for sensitivity and specificity

Comparison of the techniques showed that the differences in specificity among the techniques were statistically significant ($P<.03$), whereas differences in sensitivity were not significant.

Discussion

As occlusal caries now represents a large majority of the caries found in children,²⁹⁻³¹ it is of increasing clinical importance that occult lesions are detected to prevent its further progression of dental decay in the tooth. Traditionally, occlusal lesions have been diagnosed visually with the aid of a mirror and explorer. However, clinical and laboratory results using radiographs have detected a high frequency of undetected occlusal dentinal caries when only visual inspection of the surface is used.^{21,32}

Ekstrand et al³³ showed the damaging effects on demineralized enamel caused by the use of an explorer whilst examining fissures. This has shown to increase the rate of formation and growth of the lesion.³⁴ Furthermore, unreliable and poor sensitivity scores were achieved in studies which used explorers for caries diagnosis.¹³ In fact, Lussi¹² reported lower sensitivity results from dentists who used explorers compared to those who did not in an in vitro study, which examined the diagnostic accuracy and reproducibility of explorers of occlusal caries.

The usefulness of conventional radiography in the detection of proximal lesions has been validated.³⁵ However, its use for diagnosing early enamel caries has been considered of limited value¹⁴ due to the superimposition of sound enamel of the surrounding cusps.³⁶ However, this method is recommended as an adjunct to clinical observation and occlusal caries diagnosis, particularly of caries which has reached the dentin.^{32,37}

Quantitative light induced fluorescence (QLF) may provide an alternative technique with advantages of providing quantitative and repeatable diagnostic information.

Results of clinical investigations with laser fluorescence using operative intervention as validation have shown significantly higher sensitivity values of 92% to 96% as compared to clinical inspection sensitivity values of 31% to 62% and a bitewing radiography sensitivity value of 63%.²⁷ An in vivo study using a cutoff limit at the enamel level has revealed conservative results of sensitivity (49%) and specificity (67%).³⁸ In addition to these results, in vivo studies have shown that repeatability and reproducibility of the QLF method are very good.³⁹

In the present study, the authors extended previous investigations in correlating clinical examination with conventional radiography and Diagnodent to determine their relative sensitivities and specificities in the diagnosis of occult occlusal lesions in premolar teeth. Using the clinical criteria of visual inspection and gentle probing, the authors found the sensitivity of this technique for sound teeth to be 0.81 (81% of the teeth scored as clinically sound were also found to be radiographically sound). Nineteen percent of teeth scored as visually sound had radiographic radiolucencies in dentin, indicating either a failure to clinically diagnose dentin carious lesions or the presence of occult lesions present in these teeth. The authors' present results support the reported prevalence of hidden caries, which range from 3% to 50%.^{7,9-11,40,41}

In an attempt to limit the number of false positive findings usually associated with probing, the presence of "stickiness on probing" was used together with the presence or absence of opacity/demineralization. Nevertheless, a sensitivity value of 81% suggests that 19% of the teeth scored through the visual-tactile examination as having occlusal caries did not have radiographic evidence of caries, thus demonstrating a moderate percentage of false positives. On the other hand, when the teeth with early caries (demineralization and/or sticky fissures) were considered, the specificity of conventional or digital radiography was only around 44%, thus demonstrating a large percentage of false negatives. These results are similar to those achieved by other authors⁴²⁻⁴⁴ in the evaluation of visual-tactile examination against conventional radiographs.

When compared with conventional radiography, the sensitivity and specificity values achieved by the Diagnodent were 82% ($P<.001$) and 36% ($P<.001$), respectively. Although the sensitivity values were comparable to those of other reports, the specificity value was significantly lower compared to those studies which included teeth with cavities in dentin.^{24,26} These differences in results may be related to better control of variables achieved in the authors' in vitro study compared to clinical studies. First, extracted teeth are more likely to be plaque-free than those in the clinical setting because they have been pumiced thoroughly. Furthermore, those teeth with staining, calculus, and enamel hypocalcification defects were excluded from the study so that the potential for erroneous readings resulting from these defects was minimized.

Given these ideal experimental conditions under which the teeth were scored, it is not surprising that there were no teeth scored in the Diagnodent technique as being "caries free" (ie, showing a numerical value of <5), and the majority of teeth (87%) were scored with the arbitrary criteria of "enamel caries" (ie, showing a numerical score of 5-25). As "enamel caries" lesions are not routinely restored, it is therefore clinically acceptable to employ a cutoff value of >25 to determine whether there is a lesion in dentin which is usually recommended for restoration.

Although histopathological evaluation may be used as a standard to compare results of the different techniques, in this study it is not feasible to perform detailed histological evaluation on over 300 teeth. Moreover, the present investigation was designed to compare techniques which are employed in clinical practice—namely visual-tactile examination, radiography, and Diagnodent. Results of the Spearman rank correlation suggest that there was only a modest association of the results between clinical examination vs conventional and digital radiography. However, the visual-tactile examination and Diagnodent were more highly correlated with each other than when compared with each of these techniques individually with conventional and digital radiography. The highest correlation was found between conventional and digital radiography.

QLF provides quantitative information, is easy to use, is repeatable,³⁹ and is a noninvasive method for monitoring the progression of a suspected carious lesion. Typical QLF results show a strong correlation with the degree of enamel demineralization⁴⁵ but no correlation with the degree of dentinal decay.⁴⁶ Furthermore, correlation with the degree of enamel demineralization is limited to depth.⁴⁷⁻⁴⁹ Studies have shown that different values of fluorescence from light-induced studies can change with the dehydration of the sample tooth.⁵⁰ As the teeth in the authors' study were stored dry, the results may differ from those obtained clinically. On the other hand, the consistent degree of hydration obtained from laboratory investigations provides better standardization of the technique.

The Diagnodent system uses a laser fluorescence method that detects caries by measuring changes in fluorescence intensities rather than by analyzing spectral differences used by the QLF technique. Fundamental differences in the design between QLF and Diagnodent should raise caution in extrapolating research of QLF to the Diagnodent device.

Furthermore, although the Diagnodent provides an appealing high-tech approach in the dental chair, the authors' present results show that it not significantly better compared to the well-trained eye and sharp explorer. On the other hand, it will be a useful adjunct in the diagnosis of occult dentin caries, particularly when employed with conventional or digital radiography. It is expected that the accuracy of diagnosis of occult dentin lesions will increase when all the results of all 3 techniques are combined.

Conclusions

1. Diagnodent gave similar sensitivity values but lower specificity compared to visual-tactile examination in diagnosing occult dentinal caries.
2. There were no significant differences between conventional or digital radiography in diagnosis of occult dentin caries.
3. Although the diagnosis of occult dentinal caries may be further enhanced by the Diagnodent, a combination of visual-tactile examination and either conventional or digital radiography should suffice in most cases.

Acknowledgements

This study was funded by the Australian Dental Research Fund.

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ABSTRACT OF THE SCIENTIFIC LITERATURE



POSTTREATMENT CHANGES IN TEMPOROMANDIBULAR JOINT

The existing dental literature suggests a relationship between orthodontics and the production or exacerbation of temporomandibular joint disorders (TMD). This follow-up longitudinal study was conducted to determine changes in the condyle/fossa relationship after treatment with different types of orthodontic mechanics. These changes were correlated with either improvement or development of signs and symptoms of TMD. One hundred six white Class I or Class II division 1 orthodontic patients were selected for analysis. The average age was 13.6 years and average length of treatment was 2.3 years (Class I) and 2.8 years (Class II). All patients had pre- and posttreatment lateral cephalometric radiographs, tomograms of the left and right temporomandibular joints, study models, information about TMD, treatment plans, type of mechanics, and initial hand-wrist films. The results for the Class I group showed left-side size reductions of the posterior space with no change in the right side. Similar observations were made for the Class II patients. Of the 10 Class I patients with pretreatment signs/symptoms of TMD, 7 reported no posttreatment sign/symptoms (70% reduction). Of the 10 Class II patients with TMD, 9 reported no posttreatment symptoms (90% reduction). Due to the small patient numbers, there was no statistical significance. The authors conclude that with orthodontic treatment: (1) the condyle becomes more concentrically positioned; (2) the anterior, posterior, and superior joint spaces decreased; (3) the vertical height of the articular fossa increased; (4) the angle of the articular slope did not change significantly; and (5) there was no statistically significant difference in signs/symptoms of TMD before or after treatment.

Comments: It seems this has been the eternal controversy: Does orthodontic treatment lead to TMD? Although this study was not case controlled (patients not receiving orthodontic treatment that had TMD) or selected for patients treated orthodontically that had TMD, it does offer some answers to this question. In this study, the authors concluded that orthodontic treatment did not cause or exacerbate TMD (and, in most cases, alleviated symptoms). Nevertheless, it would have been a stronger study if patients had been followed for extended periods following treatment to see if the same initial results were maintained. KV

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Carlton KL, Nanda RS. Prospective study of posttreatment changes in the temporomandibular joint. *Am J Orthod Dentofacial Orthop.* 2002;122:486-490.

12 references