Routine panoramic radiography of new adult patients in general dental practice: Relevance of diagnostic yield to treatment and identification of radiographic selection criteria

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Objectives. We sought to measure the diagnostic yield of relevance to treatment on routine panoramic radiographs taken of new adult (ie, 18 years and over) patients in general dental practice.
Study design. Routine panoramic radiographs (n = 1817) obtained from general dental practice were assessed and radiologic yield recorded using consensus viewing by 2 dental radiologists. A modified diagnostic yield of relevance to treatment for each radiograph was calculated by omission of findings that would have been identified on bilateral posterior bitewing radiographs and of radiologic findings of no relevance to treatment. Stepwise logistic regression analysis was used in attempt to identify clinical indicators of a high diagnostic yield of relevance to treatment.
Results. The diagnostic yield of relevance to treatment was zero for the majority (56%) of patients. This figure rose to 71% when the symptom-free patients were considered. Five clinical indicators for panoramic radiography were identified, as follows: clinical suspicion of teeth with periapical pathologic conditions, presence of partially erupted teeth, clinically evident caries lesions, swelling, and clinically suspected unerupted teeth.
Conclusion. Routine panoramic radiography of adult dental patients is not supported by the results of this study. The use of clinical indicators to select patients may help to improve diagnostic yield.
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The growth of panoramic radiography in general dental practice in the United Kingdom has been rapid over the last 2 decades, rising from 0.7 million films in 1981 to more than 2.04 million films in 1998 and 1999 (personal communication, Dental Data Services, Dental Practice Board of England and Wales). Paradoxically, the growth of intraoral radiography (confined to bitewing and periapical films only) is less than 14% when compared with panoramic films for the same period (personal communication, Dental Data Services, Dental Practice Board of England and Wales).

Recent British evidence-based guidelines[1] have recommended that bitewing radiography is essential for all dentate patients. A questionnaire study,[2] however, found that 42% of dentists with panoramic x-ray equipment carried out routine panoramic radiography of all new adult patients. Such routine practices have been condemned[1] as it is a fundamental requirement of radiation protection that all exposures to x-rays as part of diagnosis should be clinically justified.[3]

A review[4] of the literature relating to panoramic radiography identified numerous studies that have measured the diagnostic yield obtained from panoramic films. These studies have assessed the diagnostic yield, as all radiologic findings, regardless of whether such findings were of clinical significance or whether they would have been identified on posterior bitewing radiography. These previous studies have been surveys of hospital patients or of specific groups of individuals, which are at variance to the unique mix of adult patients attending dental clinics/offices for routine dental treatment.

The purposes of this study were as follows: (1) to identify the radiologic findings from routine panoramic radiographs taken of adult (18 years and older) patients in general dental practice, (2) to develop indices of radiologic diagnostic yield that exclude findings that would have been identified on posterior bitewing radiographs and those of no relevance to treatment and (3) to identify clinical indicators of high diagnostic yield.

MATERIAL AND METHODS

In 1997, a questionnaire-based study was performed that addressed various aspects of panoramic radiography in general dental practice. The study[2] reported 542 completed questionnaires from dentists (73.3% response rate), in which 42% of respondents identified

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Table I. Radiologic findings recorded on the panoramic radiographs [n = 1817] contributing to diagnostic yield (DY), modified diagnostic yield of relevance to treatment (MDYT) and modified diagnostic yield of relevance to treatment ($MDYT_a$) for 731 asymptomatic patients. Calculus and periodontal disease were recorded on a per patient basis

	DY (Expert assessment) Number (%)	*MDTY (Expert Assessment Number (%)*	*$MDTY_a$ (Expert Assessment Number (%)*
Presence of calculus deposits	961(52.9)		
Periodontal bone loss			
None	785 (43.2)		
Early	682 (37.5)		
Moderate	297 (16.3)		
Advanced	53 (3.0)		
Number of caries lesions			
None	560 (30.8)	1567 (86.2)	655 (89.5)
1	359 (19.7)	147 (8.1)	44 (6.0)
2	290 (16.0)	53 (2.9)	17 (2.3)
3	182 (10.0)	23 (1.3)	7 (1.0)
4	127 (7.0)	11 (0.6)	3 (0.4)
5 or more	299 (16.5)	15 (0.8)	5 (0.6)
Number of periapical lesions			
None	1087 (59.8)	1406 (77.4)	651 (89.1)
1	420 (23.1)	291 (16.0)	60 (8.2)
2	162 (8.9)	85 (4.7)	15 (2.1)
3	78 (4.3)	15 (0.8)	3 (0.4)
4 or more	70 (3.9)	19 (1.1)	2 (0.2)
Number of retained roots			
None	1503 (82.7)	1681 (92.6)	695 (95.1)
1	230 (12.7)	94 (5.2)	22 (3.0)
2	45 (2.5)	15 (0.8)	5 (0.7)
3 or more	39 (2.1)	26 (1.4)	9 (1.2)
Presence of unerupted teeth	647 (35.6)	156 (8.6)	48 (6.6)
Pathology of maxillary antra	255 (14.0)	5 (0.3)	0(0)
Other abnormalities	366 (20.1)	69 (3.8)	13 (1.8)
Pre-extraction information		189 (10.4)	48 (6.6)
Significant negative findings		2(0.1)	0(0)

themselves as practicing routine panoramic radiography of all new adult (≥18 years) patients. This is understood to be the routine use of a radiographic diagnostic technique regardless of the presence or absence of clinical signs and symptoms. A letter was sent to this cohort of practitioners inviting them to participate in a prospective study on panoramic radiography.

A total of 41 dentists were recruited. The study commenced in the autumn of 1998 and concluded in the late winter of 1999. The study details have been reported fully elsewhere.[5] However, in brief, each dentist was asked to complete a clinical proforma[5] for each of 50 consecutive new adult patients who underwent a panoramic radiographic examination. The collection of basic information from the patient before clinical examination included data on age, sex, symptoms, and reason for attendance. The dentists provided the researchers with a panoramic radiograph of each patient and gave details of their proposed treatment plan. The dentists were asked to derive their treatment plan from the clinical examination and panoramic radiograph only, without viewing any intraoral radiographs that might have been taken. All of these items were submitted to the investigators.

On receipt, each original radiograph was viewed simultaneously by 2 dental radiologists (V.E.R. and K.H.) and a consensus radiologic diagnostic yield was determined for each patient. Diagnostic yield was calculated as 2 separate indices. First, it was calculated as being the sum of the total number of lesions from each category outlined in column one of Table I (Index A). The unit of index A was, therefore, "lesions." Second, it was defined as being the sum of the scores for positive findings in the list (column one of Table I), where the presence of one or more lesion in any single category was given a score of 1 and the absence of a lesion in that category was given a score of 0 (Index B). The unit of index B was types of lesion. Thus, for example, 5 carious lesions in an individual contributed 5 to index A, but only 1 to index B.

The information obtained from the clinical proforma along with the radiologic yield was entered on a spreadsheet for analysis using standard statistical software.[6] For each patient, the 2 diagnostic yield indices

were then subsequently modified by exclusion of positive radiologic findings that would have been identified by bilateral posterior bitewing radiography and by eliminating findings of no significance to treatment.

For the exclusion of positive radiologic findings that would have been identified on posterior bitewing radiographs, it was assumed that for dentate patients any lesion in the posterior premolar/molar regions corresponding in area to a size 2 (3×4 cm) intraoral film would have been identified by bitewing radiography. All caries lesions in these regions were, therefore, excluded from analysis, as was periodontal bone loss and presence of calculus deposits. The precise area on the panoramic radiograph covered by right and left posterior bitewing radiographs was that defined by Whaites.[7] For edentulous patients, where bitewing radiography was not applicable, this modification was not performed. For partially dentate patients, the 2 investigators made individualized patient judgements about whether bitewing radiography would have been practicable on one, or both, sides of the mouth, and the radiologic yield was modified appropriately.

For the elimination of radiologic findings of no relevance to treatment, the 2 investigators examined each case in conjunction with the proposed treatment plan supplied by the dentist. Each diagnostic yield index was further modified by exclusion of all radiologic findings of no relevance to treatment (ie, purely documentary findings). A radiologic finding was considered to be documentary and of no relevance to treatment when the following occurred: (1) its discovery had not influenced (either positively or negatively) the treatment plan of the dentist and (2) when it did not, in the consensus of the investigators, require treatment or justify further clinical or radiologic review. Two new categories of radiologic finding were included in the assessment: pre-extraction information and significant negative finding. For the former, a score of 1 was added to diagnostic yield where panoramic radiography is widely accepted as being appropriate before certain types of dental extraction (ie, for any third molar or lone-standing upper molar tooth). If there were 2 third molars in a patient requiring treatment, a score of 2 would be added by using index A and a 1 would be added by using index B. A significant negative finding was recorded by addition of a score of 1 to the diagnostic yield indices in those instances in which it was judged that the radiograph had been taken prudently to exclude significant pathologic conditions such as the possibility of a bony fracture.

A proportion of the patients were symptom-free at initial attendance before clinical examination, and this subgroup was investigated separately because the diagnostic yield may be expected to be different for this group.

This progressive process of data modification produced measures of modified diagnostic yield of relevance to treatment for all patients for both of the indices A and B previously outlined for the diagnostic yield. Mean values (with SD and range) were determined for both indices for diagnostic yield and diagnostic yield of relevance to treatment. As the distributions of diagnostic yield were markedly skewed, the Mann-Whitney test was used to compare the medians of the groups with respect to the dichotomous clinical variables. Associations between both indices for diagnostic yield of relevance to treatment and the independent clinical variables were assessed by using Spearman correlation coefficients. Stepwise logistic regression models were fitted to diagnostic yield of relevance to treatment, with the clinical variables obtained from the clinical proforma available as potential independent variables for entry into each model. A probability of inclusion in the models was set at 0.05 and a probability for exclusion was set at 0.10. The 0.05 level of significance was used.

A random sample of 125 radiographs (7%) was retrieved and reassessed by the experts. The resulting data were related to those from the original assessment by using 2×2 tables correlating presence/absence for each of the radiologic findings in Table I. Interexaminer repeatability assessments (each examiner viewing the radiographs in isolation) were subsequently carried out by taking a random sample of 50 films and relating presence/absence for each of the radiologic findings in Table I. An assessment of the level of agreement between the repeated assessments was made by calculation of the κ statistic.[8]

RESULTS

The 41 dentists submitted 1817 radiographs that included sufficient data for this aspect of the study. Only 28 of the dentists returned a complete allocation of 50 radiographs and completed proformas. The remaining dentists submitted fewer than 50 before time and financial constraints necessitated the termination of the study.

As previously reported,[5] a large percentage (41%) of patients were asymptomatic at initial presentation to the general dental practitioner, 40% attending with symptoms of pain and the remaining 19% attended the dentist complaining of a wide range of other symptoms (ie, swelling, bad taste, trismus). The overwhelming majority (93%) of patients were recorded as requesting a complete course of dental care, with the remainder seeking only limited dental treatment. In 57% of patients, the panoramic film was the only radiograph taken.[5]

The radiologic findings recorded on 1817 radiographs are shown in Table I. The descriptive data and

the subsequent indices for diagnostic yield and diagnostic yield of relevance to treatment for all patients and the asymptomatic group are shown in Table II.

From the data for all patients, the majority of panoramic radiographs (56%) taken had no diagnostic yield after excluding positive radiologic findings that would have been identified by bilateral posterior bitewing radiography and by eliminating findings of no significance to treatment. This figure rose to 71% when the asymptomatic subgroup was analyzed alone.

There were highly significant ($P < 0.001$) differences in diagnostic yield of relevance to treatment, for both indices, when the 2 categories of each of the following dichotomous independent variables were compared, presence of symptoms, presence of partially erupted teeth, presence of clinically suspected unerupted teeth and presence of swelling(s) (shown for index A in Table III). There was a significantly higher diagnostic yield of relevance to treatment (both indices) for men ($P = 0.001$) and for those with gingivitis ($P = 0.001$). For the asymptomatic subgroup, there was a significantly higher diagnostic yield of relevance to treatment (both indices), for those with "presence of gingivitis" ($P = 0.001$) and for patients with swelling(s) ($P < 0.001$). Patients with partially erupted teeth had a significantly higher diagnostic yield of relevance to treatment for both indices. The diagnostic yield of relevance to treatment was also higher for men ($P < 0.05$) and for those patients with other evidence of periodontal disease only for index B ($P = 0.044$).

There were significant correlations between both diagnostic yield of relevance to treatment indices and all ordinal (and interval) independent variables except for the number of restorations present (Table IV). Although significant, the correlations were all fairly weak with the strongest ($r_s = 0.36$) being between diagnostic yield of relevance to treatment index B and the number of teeth with clinically suspected periapical lesions. For the asymptomatic subgroup, there were similar correlations apart from those relating to the age of the patient (both indices). The strongest correlation ($r_s = 0.31$) was between diagnostic yield of relevance to treatment for index A and the number of clinically evident carious teeth.

The diagnostic yield of relevance to treatment was dichotomized at the no abnormality/some abnormalities level and a logistic regression model was applied. As the proportion with no abnormality was the same for both index methods (A and B), the difference between the 2 methods of index calculation was irrelevant to this part of the analysis. Complete data was only available for 1817 cases from the whole sample and for 700 in the asymptomatic subgroup. The final model for all patients (Table V) included eight independent variables, five of which also appeared in the model (Table VI) for the subgroup of asymptomatic patients. These were as follows: (1) teeth with suspected periapical pathology, (2) presence of partially erupted teeth, (3) presence of gingivitis, (4) clinically evident caries lesions and (5) type of dentition. The highest odds ratio appeared in the final model for all patients, where patients with teeth with clinically suspected periapical pathology had 2.82 the odds of having a diagnostic yield compared with patients without such teeth.

Table II. Mean values of diagnostic yield (DY) and modified diagnostic yield of relevance to treatment (MDYT) in the study (number of radiographs = 1817)

	Mean	*Standard deviation*	*Range*
DY_A	5.29	3.79	0-28
$MDYT_A$	1.16	2.08	0-17
DY_B	3.06	1.45	0.8
$MDYT_B$	0.67	0.9	0-5

Subscripts A and B refer to the 2 methods of calculating diagnostic yield.

Although the logistic regression model for diagnostic yield of relevance to treatment for the asymptomatic subgroup (Table VI) fit well by using the Hosmer and Lemeshow Goodness-of-Fit Test[6] ($\chi^2 = 3.39$; 8 *df*; $P = 0.91$), the sensitivity and specificity at the 0.5 cut point was 25% and 96%, respectively. Other cut points were examined and overall the sensitivity and specificity were found to be poor, emphasizing that the model was of no value as a predictor. The Hosmer and Lemeshow Goodness-of-Fit Test[6] was repeated for the logistic regression model for diagnostic yield of relevance to treatment for all patients (Table V). The fit was inferior to that of the asymptomatic subgroup ($\chi^2 = 13.05$; 8 *df*; $P = 0.11$) and the sensitivity and the specificity at the 0.5 cut point was 53% and 84%, respectively. Once again other cut points were examined and overall the sensitivity and specificity was poor.

The repeatability of expert radiologic assessments has previously been published.[5] However, in brief, agreement[9] was excellent for both intraobserver and interobserver assessments for all types of pathologies considered except for presence of calculus and numbers of caries lesions where agreement was only fair to good (for intraobserver assessment) and for all other abnormalities (interobserver assessment).

DISCUSSION

This study is the first to address the issue of diagnostic yield and selection criteria for panoramic radiography in a general dental practice population. All the radiographs included in this study were taken routinely, regardless of the presence or absence of any clinical

Table III. Comparison between mean values of diagnostic yield of relevance to treatment using index A. N = number

	*N**	*Mean*	*Standard deviation*	*N**		*Mean*	*Standard deviation*	*P-value*
Men	934	1.23	2.08	Women	877	1.08	2.09	0.001
Symptoms								
Present	1074	1.47	2.32	Absent	741	0.70	1.58	<0.001
Partially erupted teeth								
Present	367	1.80	2.59	Absent	148	1.00	1.90	<0.001
Clinically suspected unerupted tooth/teeth								
Present	447	1.61	2.46	Absent	1369	1.01	1.92	<0.001
Gingivitis								
Present	1419	1.19	2.06	Absent	395	1.04	2.16	0.001
Swellings								
Present	224	2.50	3.25	Absent	1589	0.97	1.79	<0.001

N = number
*indicates that some data was missing from patient records.

Table IV. Spearman's correlation coefficients (r_s) for the relationship between modified diagnostic yield of significance to treatment (MDYT) and the ordinal (and interval) independent variables

	$MDYT_1$	*$MDYT_2$*
$MDYT_1$	1	0.98**
$MDYT_2$	0.98**	1.00
Age of patient	–0.08**	–0.07**
Time since last visit to a dentist	0.13**	0.13**
Number of restorations present	–0.02	–0.02
Number of clinically evident carious teeth	0.23**	0.22**
Oral hygiene (1= good, 2= fair, 3= poor)	0.14**	0.13**
Number of teeth with clinically suspected periapical lesions	0.35**	0.36**
Dentition (1 = dentate, 2 = partially dentate, 3 = edentulous)	0.06**	0.06*

*$P < .05$
**$P < .001$

justification for radiography. This practice is tacitly sanctioned by the third party National Health Service (NHS) payment authority in England and Wales. When such a routine procedure is used, it is essential to establish that the benefits to the patients outweigh the radiation risks. Furthermore, regardless of whether the payment for the radiograph is made by the NHS or the patient, it is only reasonable to be informed about the cost effectiveness of the practice. When many radiologic findings can be purely documentary in nature, it was considered important to measure the impact of the radiographic findings when pathology that would have been identified on posterior bitewing radiographs and findings of no significance to treatment had been removed from the diagnostic yield.

In a study of this nature, it was essential to ensure that all patients involved should depict an accurate and representative sample of all those adult patients undergoing panoramic radiography in general dental practice in England and Wales. Any interpractitioner variation in choosing which patients would receive a panoramic examination had already been eliminated by recruiting only those practitioners who had identified themselves as practicing routine panoramic radiography of all new adult patients.[2] Subsequent analysis of the profile of the study patients compared with those patients within a sample attending general practices throughout England and Wales[5] found no significant differences. It would have been valuable to be more assured that there was no bias between the recruited dentists and those not recruited to the study. However, this would only have been possible by compulsory involvement of dentists who had expressed no interest in the study, an option not available to us.

Table I illustrates the radiologic findings that were of relevance to treatment with obvious reductions in all categories. The most dramatic reductions were in those relating to unerupted teeth and those with pathology within the maxillary antra. For all patients, the 36% with unerupted teeth contrasts markedly with the 9% for whom the finding had some clinical impact. For the asymptomatic subgroup, the reduction was more pronounced, reducing to 7% for whom the finding had some clinical impact from an original figure of 37%. Clinicians have been shown to overestimate the potential of unerupted teeth to develop pathosis[10] and it may be even these revised figures exaggerate the clinical necessity for removal. Furthermore, the publication of evidence-based clinical guidelines[11] on the treatment of unerupted teeth, after completion of this study, might have reduced the diagnostic yield of relevance to treatment even further. A similar trend was noted for pathology within the antrum, with practitioners recording only a small number of patients (0.3%) in which the condition had a clinical impact despite the

Table V. Regression coefficients (β), standard errors (SE(β)), odds ratios, and 95% confidence intervals from stepwise logistic regression model for the modified diagnostic yield of relevance to treatment dichotomized as none or some (n = 1752)

Independent variable	β	*SE(β)*	P-*value*	*Odds Ratio*	*95% confidence intervals*
Teeth with suspected periapical pathology	1.04	1.10	<0.001	2.82	(2.30,3.44)
Presence of partially erupted teeth	0.64	0.14	<0.001	1.89	(1.43, 2.49)
Clinically evident caries lesions	0.50	0.08	<0.001	1.64	(1.39, 1.94)
Swelling	1.01	0.18	<0.001	2.74	(1.91, 3.92)
Clinically suspected unerupted teeth	0.46	0.13	<0.001	1.58	(1.22, 2.05)
Presence of crowns	0.30	0.11	0.01	1.34	(1.07, 1.69)
Presence of gingivitis	0.31	0.13	0.02	1.36	(1.05,1.78)
Dentition	0.31	0.12	0.047	1.37	(1.09, 1.1.71)

Table VI. Regression coefficients (β), standard errors (SE(β), odds ratios, and 95% confidence intervals from stepwise logistic regression model for modified diagnostic yield of relevance to treatment dichotomized as none or some for asymptomatic attenders only (n = 700)

Independent variable	β	*SE(β)*	P-*value*	*Odds Ratio*	*95% confidence intervals*
Teeth with suspected periapical pathology	0.86	0.24	0.01	2.35	(1,47, 3.76)
Presence of partially erupted teeth	0.69	0.23	0.002	2.00	(1.28, 3.12)
Presence of gingivitis	0.76	0.23	0.001	2.13	(.35, 3.37)
Clinically evident caries lesions	0.97	0.15	<0.001	2.65	(1.97, 3.57)
Dentition	0.50	0.20	0.01	1.65	(1.11, 2.43)

abnormality being present in 14% of the study patients. The literature on panoramic radiography confirms that the identification of inconsequential "pathology" is a common finding. Barrett et al[12] found 200 instances of pathosis in 167 patients but in only 12 individuals was any treatment indicated. Osbourne and Hemmings[13] reported similar findings in a group of patients attending a periodontal clinic.

These factors obviously contributed to the very low values of mean diagnostic yield of relevance to treatment (Table II) and the finding that 56% of patients had a diagnostic yield of relevance to treatment of 0. For the asymptomatic subgroup the equivalent figure increased to 71%. Such findings are of major importance in judging the validity of using panoramic radiology as a routine procedure in general dental practice. These results show that most patients have no diagnostic benefit whatsoever and that, on average, barely more than one lesion (Index A) will be identified. Similarly, for the asymptomatic subgroup, the corresponding figure fell to less than one abnormality per radiograph.

A challenge in this study was to identify a unifying index of radiologic yield that could incorporate many disparate abnormalities. We developed two such indices, the first (A) was a simple additive index of all lesions. The problem with this is that common but relatively innocuous lesions (ie, caries) can outweigh unusual, but clinically more important, findings (ie, cysts). The second index (B) limited the impact of caries lesions. It might be possible to develop a further index by incorporating some modifying weighting relating to severity of pathosis. The 2 indices chosen represent a simple method of measurement for the diagnostic value of a radiologic technique that may identify a range of abnormalities.

The relationship of clinical variables with diagnostic yield was assessed by Spearman's correlation coefficients between diagnostic yield of relevance to treatment and the ordinal (or interval) variables. The strongest correlations were between diagnostic yield of relevance to treatment and number of clinically evident carious teeth (r_s = 0.23 for index A; r_s = 0.22 for index B) and number of clinically suspected periapical lesions (r_s= 0.35 for index A; r_s = 0.36 for index B) as shown in Table IV. There were similar findings for the asymptomatic subgroup with the number of clinically evident carious teeth (r_s = 0.31 for index A; r_s = 0.30 for index B) and number of clinically suspected periapical lesions (r_s = 0.25 for both indices) showing the strongest correlations. While clinical evidence of caries would be established directly, suspicion of periapical pathology could only be reached indirectly by identifying suggestive signs such as large restorations or grossly carious teeth.

By examination of the logistical regression analysis for all patients (Table V) and by including only those clinical variables for which the significance value was

<0.001, the analyses identified the following clinical factors as being the best predictors of a diagnostic yield of significance to treatment: clinical suspicion of teeth with periapical pathology, presence of partially erupted teeth, clinically evident caries lesions, swelling and clinically suspected unerupted teeth. All the odds ratios were modest and, as previously stated, overall sensitivity and specificity of the model was found to be poor. It would be wrong to consider them as absolute selection criteria that would guarantee a high diagnostic yield but as clues that would improve the odds of a positive diagnostic yield if panoramic radiographs are taken. Not surprisingly for such a small group, the final model for the asymptomatic patient subgroup (Table VI) had only one clinical variable for which the significance value was <0.001: clinically evident caries lesions.

The development of diagnostic yield of relevance to treatment used dentists' assessments of treatment need, and it may be viewed as a weakness in the methodology due to the variable diagnostic abilities of different observers and their attitudes to treatment. As previously discussed, recently published guidelines on the treatment of third molars[11] may have significantly altered practitioners' attitude to their management, and the subsequent outcome of the logistic regression.

It is also important to compare these study results with other research, although previous studies have used various population groups and have employed different methodology.[14-16] The finding of this study, that the number of clinically evident caries lesions are a positive predictor of yield, relates well with the studies of White et al,[14] Douglass et al,[16] and Weems et al,[15] although the latter study was confined purely to full mouth intraoral radiography. White et al[14] reported that the selection criteria most predictive of a high diagnostic yield was when the radiograph was taken for a nonscreening purpose, a guideline with which this study agrees.

Akerblom et al[17] reported the use of bitewing radiography in the detection of periradicular lesions by identifying those teeth with endodontic treatment or deep caries that would benefit from a periapical radiograph. Furthermore, combination of this with periapical radiographs of teeth with clinical signs and symptoms enabled detection of 90% of periradicular lesions. Other research[18] has substantiated these findings. Two studies[19,20] have shown that the application of selection criteria for intraoral radiography can effectively identify all patients that would benefit from a radiographic examination.

This study, along with others,[12,20,21] illustrates the extent to which the apparent yield from routine panoramic radiography can, after taking into account treatment significance, be reduced to a few abnormalities and limited pathosis which are often of questionable clinical significance.

CONCLUSIONS

This study has shown that when panoramic radiography was indiscriminately used, the resultant yield was negligible or extremely low for the majority of patients.

For the minority of patients for whom panoramic radiography is appropriate, the following clinical criteria may be used as indicators of radiologic yield: clinical suspicion of teeth with periapical pathology, presence of partially erupted teeth, clinically evident caries lesions, swelling, and clinically suspected unerupted teeth.

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