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Department of Dental and Maxillofacial Radiology, 2nd Department of Medical Radiology
Chair and Department of Conservative Dentistry, Medical University of Lublin

DAGMARA KRAWCZYK, MAGDALENA MIAZEK,
T. KATARŻYNA RÓŻYŁO, INGRID RÓŻYŁO-KALINOWSKA,
ANNA ŚCIBAK-BOROCH

Assessment of needs of endodontic treatment in teeth with fixed prostheses

Crown-root inlays are one of the types of fixed prostheses, i.e. appliances mounted permanently on a tooth by means of different prosthetic cements. Such prosthetic constructions are applied when there appears significant or total destruction of crowns of patient's teeth that do not supply adequate retention for a future crown (3, 8). Such inlays consist of a crown part being a support for a future crown and a root part placed in dental root. There are several types of such prostheses: active or passive, available on the market or individually prepared (5). Most often crown-root inlays are made of metal but they can be also composed of glass fibers, carbon fibers or special ceramics (1, 9). Such inlays are used when esthetics is compromised and full ceramic crowns are planned. All types of inlays are radioopaque. The requirement of qualification of a tooth for placement of a crown-root inlay should be a correctly filled root canal without periapical pathologies as well as preserved supporting surface on a tooth (6, 7, 13, 14). It means that crown destruction should not exceed below alveolar bone level (11).

In order to properly prepare a given tooth for a crown-root inlay there should be the pulp extirpated and root canals packed with a filling material but not a paste (8), (11). Filling the canal solely with a paste (e.g. endomethasone) is currently considered a mistake. The root canal should be tightly filled with a non-resorbable material, neutral for periapical tissues. Such features characterize guttapercha and the preferred mode of filling of a root canal is lateral condensation in cold temperatures (13). The root canal should be filled to anatomical or physiological apex depending on the type of treatment.

The aim of the paper is evaluation of the state of periapical tissues and needs for endodontic treatment in teeth with crown-root inlays.

MATERIAL AND METHODS

The material consisted of radiograms of 201 patients, males and females, aged 15 to 76 (mean 55.4 years), in whom crown-root inlays were present. There were evaluated 325 maxillary and mandibular teeth in total. In the patients there were taken intraoral radiograms and panoramic radiograms. Intraoral radiograms were periapical views taken using bissected angle technique in the Digora Soredex digital radiography system, while digital radiograms were processed in the DBSWIN system.

Radiograms were evaluated on a calibrated monitor. During the analysis of intraoral radiograms there were used postprocessing options of the Digora system such as positive, negative, zoom,

tomosynthesis (color marking of areas of the same optical density), pseudo three-dimensional view. Panoramic X-rays were evaluated using positive, negative, zoom as well as filters available in the applied software.

On the radiograms there was evaluated the state of periapical tissues as well as the presence of filling material in the root canal. The quality of endodontic treatment was evaluated as correct when the root canal was filled 0–2 mm from radiological tooth apex. Root canal filling was incorrect when the root canal was filled less than 2 mm from radiological apex or when the filling material was present beyond the apex in alveolar tissue (6).

The obtained results were processed using Microsoft Excel software.

RESULTS

Among 325 evaluated teeth with fixed prostheses there were 96 teeth (29.5%) which were abutments for inlays.

Crown-root inlays were most often prepared for maxillary central incisors – 31 right teeth and 26 left teeth (Fig. 1). The prevalence of crown-root inlays in the studied group was higher in maxillary teeth – 279 (85.8%) than in mandibular teeth – 46 (4.2%). As far as maxillary teeth are concerned, the crown-root inlays were most often found in incisors and canines in over one-half of all the teeth (142–51%), while in 39.5% (n=110) cases they were found in premolars and in 9.5% (n=27) in molars. The proportions were different in mandibular teeth as 7 frontal teeth comprised only 15.2% of all teeth with inlays, while premolars (43.5%; n=20) and molars (41.3%; n=19) were more prevalent (Fig. 2).

Fig. 1. On a periapical radiogram it is evident that in the lateral maxillary incisor the root canal is underfilled

Fig. 2. Periapical radiograms shows several iatrogenic faults. In the tooth 12 the root canal is untreated endodontically. In the tooth 11 the root canal is underfilled while in the tooth 21 the root canal is overfilled

Although crown-root inlays should be structured on teeth, which had been endodontically treated, as many as 41 posts of this type (12.7%) were placed on untreated teeth (the majority – 92.5% – in 38 maxillary teeth, while only 3 in the mandible). Moreover, 182 (56%) inlays were fixed on endodontically treated teeth in which root canal was improperly filled: 154 (84.5%) in maxilla, 28 (15.5%) in the mandible. In the upper teeth the majority were frontal teeth and premolars (68 – 44%,

69 – 45% respectively), while only 11% were molars (n=17). The proportions were different in the mandible where molars and premolars stood out (Fig. 3).

Fig. 3. There is a visible widening of periodontal space at the underfilled root canal of the maxillary first premolar on a periapical view

In the examined group only one-third of the inlays were placed on teeth with properly filled root canals.

In the studied group of teeth with crown-root inlays periapical inflammations were observed in 82 cases (25.2%) (Fig. 4). As many as 84% were lesions affecting periapical tissues of maxillary teeth (n=69) and only 16% (n=13) – mandibular teeth. In four cases the inflammatory lesions were present on a lateral surface of a root due to perforation of root wall (1.2%).

Fig. 4. On a panoramic radiogram there is evident the filling material beyond root apex in lateral maxillary incisor, while in the maxillary canine the root canal is underfilled

DISCUSSION

In evaluation of the studied material there was applied an up-to-date method of imaging – digital radiography. Digital radiography is very useful for analysis of both hard tissues of teeth as well as pathological processes affecting soft tissues. Among its many advantages low patient exposure to ionizing radiation, possibilities of image postprocessing as well as picture archiving possibilities are considered the greatest benefits (4, 15). Digital images can be precisely analysed using options

such as negative image, positive image, tomosynthesis, pseudo three-dimensional presentation as well as density measurements. In many cases it means more accurate diagnosis based not solely on subjective evaluation of a radiographic image, which depends on many external factors (4).

In the own study there were used panoramic radiograms, considered by many authors inappropriate for examination of periapical tissues (14). However, on the basis of own observations the authors judged the panoramic X-rays sufficient for the purpose of the presented study. Moreover, in the literature there are no reports on application of panoramic radiograms for similar purposes, therefore, the impact of digital image enhancement on diagnostic efficiency has not been ascertained before. Diagnostics of periapical lesions was not complete due to lack of information on duration of the period between placement of a fixed prosthesis and taking the radiogram as well as because previously taken radiograms were not available (2, 6, 14).

In the examined group 12% of the teeth with crown-root inlays were untreated endodontically. In the material of other authors (7, 14), the percentage was lower or comparable (9.5% and 10%). Grieve (6) found that in 16% of his patients no endodontic treatment was performed in such case. The differences may be caused by selection criteria of the examined group, i.e. age, center where the treatment was performed, patient education, profession etc. (13).

In the own material over one-half of the teeth had root canal improperly filled, while in only 31.3% of the cases root canals were properly filled. These results are comparable with the results obtained by other authors. Saunders et al. (14) found that in the examined Scottish population 39% of teeth with crown-root inlays had properly filled root canal, while according to Grieve et al. (6), the percentage was 34%. In the study carried out by Peak et al. (13), as many as 50% of teeth with inlays had improperly filled root canals. So far there have been no data in the Polish literature concerning this issue.

When comparing the obtained results with the results of endodontic treatment without further prosthetic treatment it can be concluded that they are analogous. Bołtacz-Rzepkowska (2) examined the population of the Łódź region and obtained comparable results – only 31.6% of teeth were filled according to the rules. The same author in another study found even higher percentage of teeth with correctly filled root canals (38.9%). However, the prevalence could be different in groups with incorrect and correct endodontic filling. Radiological image may be identical when the root canal is not properly prepared and inlay inserted in it as well as in an untreated tooth with an inlay (14). However, this does not influence the basic fact that both such situations are incorrect as they may lead to the development of periapical lesions.

The quality of endodontic treatment is crucial in long-term prognosis (11). Most of the authors agree that the poor quality of root canal filling is related to appearance of periapical lesions. The main reason of failures of endodontic treatment is leaving of bacteria in the root canal or introducing them or their toxins in the root apex region and to periapical tissues (2, 14).

In 25% of the teeth in the own material 25% had periapical lesions – of which 30% were widening of periodontal ligament space, while in 70% they consisted of rarification of bone structure. Grieve et al. (6) obtained different results – 54% and 46% respectively, while the results of studies by Saunders et al. (14) as well as Peak et al. (13) were in concordance with the own material as there were 77% and 69% of periapical lesions respectively. The percentage of correctly endodontically treated teeth in the studied group with periapical lesions was almost 16%, while 19% of improperly treated teeth were the ones with periapical lesions.

However, the diagnostic value of a single radiogram should not be overestimated, as one radiogram is a static presentation of a dynamic pathological process. Therefore lesions undergoing healing may produce a false negative result (14).

The own results testify to the fact that dentists in general do not comply all the requirements of a correct preparation of a tooth for a fixed prosthesis. In the studied material over one-half of the crown-root inlays were placed on teeth that had improperly filled the root canal and lack of the filling material in distal one-third of the root canal leads to inflammatory lesions of the periapical region. It means that the teeth should be more thoroughly prepared when fixed prosthesis is planned.

Digital radiograms proved useful for evaluation of the necessity of the endodontic treatment as well as the state of periapical tissues of teeth with crown-root inlays.

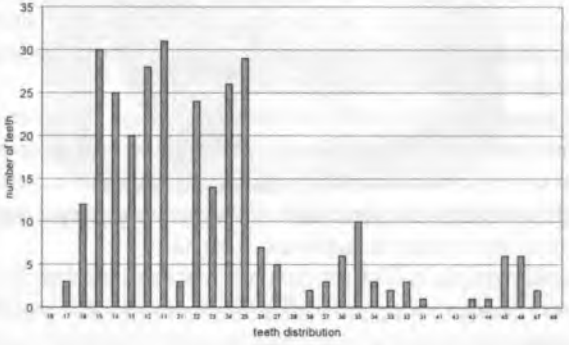

Fig. 5. Prevalence of crown-root inlays in the examined group

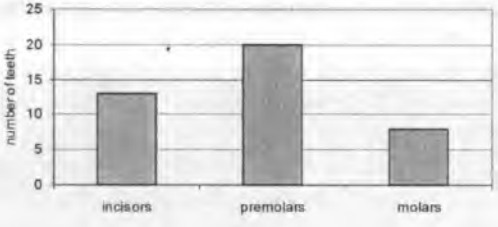

Fig. 6. Prevalence of crown-root inlays in the subgroups of teeth

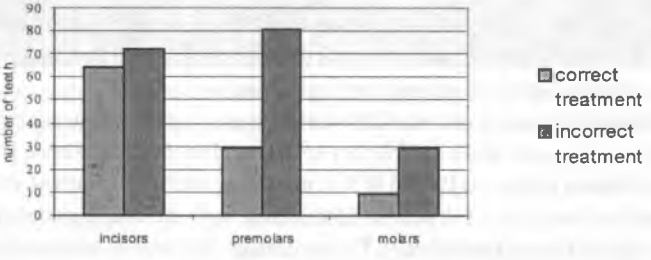

Fig. 7. Prevalence of endodontically treated teeth in the subgroups of teeth

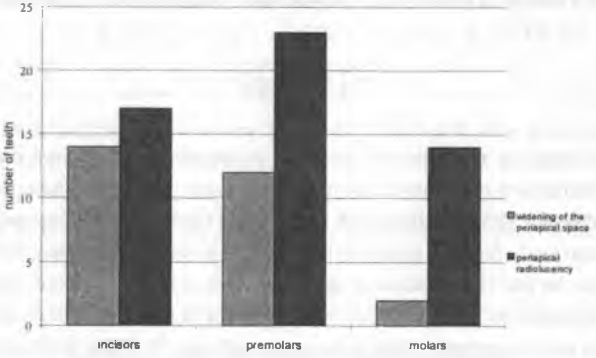

Fig. 8. Prevalence of periapical lesions in the subgroups of teeth for crown-root inlays

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SUMMARY

The aim of the paper is evaluation of the state of periapical tissues and needs for endodontic treatment in teeth with crown-root inlays. The material consisted of digital radiograms of 201 patients with crown-root inlays in 325 maxillary and mandibular teeth. There was assessed prevalence of endodontically treated teeth, faults in endodontic treatment as well as periapical inflammatory lesions. The results testify to the fact that dentists in general do not meet the terms of correct preparation of a tooth for a fixed prosthesis. In the studied material over one-half of the crown-root inlays were placed on teeth that had improperly filled root canal and lack of filling material in distal one-third of root canal leads to inflammatory lesions of the periapical region. It means that the teeth should be more thoroughly prepared when fixed prosthesis is planned. Digital radiograms proved useful for evaluation of necessity of endodontic treatment as well as state of periapical tissues of teeth with crown-root inlays.

Potrzeby leczenia endodontycznego w zębach z uzupełnieniami stałymi

Celem pracy jest ocena potrzeb leczenia endodontycznego i częstości występowania zmian zapalnych przyzębia przyszczytowego u pacjentów z założonymi wkładami koronowo-korzeniowymi. Materiał składał się z cyfrowych zdjęć rentgenowskich, wykonanych u 201 pacjentów z założonymi 325 wkładami koronowo-korzeniowymi. Oceniano ilość i jakość wypełnień endodontycznych, błędów w leczeniu endodontycznym, jak też zmian zapalnych przyzębia przyszczytowego. Uzyskane wyniki wskazują na małą dbałość stomatologów podczas przygotowywania zębów do wykonywania uzupełnień stałych, gdyż ponad połowa ocenianych uzupełnień została wykonana na zębach, które nie posiadały prawidłowo wypełnionego kanału korzeniowego mimo podjętej próby takiego leczenia. Brak materiału wypełniającego w okolicy przywierzchołkowej prowadzi do powstania stanów zapalnych tej okolicy. Oznacza to konieczność dokładniejszego przygotowania zębów pod uzupełnienia stałe. Wykazano również przydatność zdjęć cyfrowych do oceny potrzeb leczenia endodontycznego i stanu tkanek okołowierzchołkowych w zębach z wkładami koronowo-korzeniowymi.