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Examination Of Cone-Beam Computed Tomography Request Reasons In Patients Admitted To Akdeniz University Faculty Of Dentistry

Akdeniz Üniversitesi Diş Hekimliği Fakültesi'ne Başvuran Hastalarda Konik Işınlı Bilgisayarlı Tomografi İstem Nedenlerinin İncelenmesi

ABSTRACT

Objective:

The objective of this study is to retrospectively examine the reasons of cone-beam computed tomography (CBCT) requests and the distribution of these requests according to age, gender, departments and requested area in a group of patients.

Methods:

CBCT request forms obtained from the archive records were evaluated retrospectively. Age, gender, requesting departments, request reasons, requested areas and requesting departments were recorded. The data were analyzed by descriptive statistics methods with SPSS.

Results:

679 CBCT request forms were included in the study and the mean age of the patients was 37.44±17.39. The most common request reason was assesmen of intraosseous lesions (29.6%), the most CBCT requesting department was Department of Oral and Maxillofacial Radiology (51.4%) and the most requested area was maxillofacial region (52.9%).

Conclusion:

The results of the study showed that most of the CBCT images were requested for assesment of intraosseous lesions. Evaluating the request reasons of CBCT by physicians and determining the usage areas of CBCT can be beneficial in terms of improving the technique.

Key Words:

Cone-beam computed tomography, Dentistry, Radiography

ÖZ

Amaç:

Bu çalışmanın amacı, bir grup hastada konik ışınli bilgisayarlı tomografi (KİBT) istem nedenlerini ve bu istemlerin yaş, cinsiyet, istemi yapan bölüm ve istem alanlarına göre dağılımını geriye dönük olarak incelemektir.

Yöntem:

Arşiv kayıtlarından elde edilen KİBT istek formları geriye dönük olarak değerlendirildi. Yaş, cinsiyet, istemde bulunan bölümler, istem nedenleri, istem alanları ve istem yapan bölümler kayıt altına alındı. Veriler tanımlayıcı istatistik yöntemleri kullanılarak SPSS ile analiz edildi.

Bulgular:

Çalışmaya 679 KIBT istemi dahil edildi ve hastaların yaş ortalaması 37,44±17,39 idi. En fazla yapılan istem nedeni kemik içi lezyon değerlendirilmesi (%29,6), en çok KIBT talep eden bölüm Ağız, Diş ve Çene Radyoloji Anabilim Dalı (%51,4) ve en çok talep edilen bölge maksillofasiyal bölge (%52,9) idi.

Sonuç:

Çalışmanın sonuçları, KIBT görüntülerinin çoğunun kemik içi lezyonun değerlendirilmesi için istendiğini göstermiştir. KIBT 'nin talep nedenlerinin hekimler tarafından değerlendirilmesi ve KIBT 'nin kullanım alanlarının belirlenmesi tekniğin geliştirilmesi açısından faydalı olabilir.

Anahtar Sözcükler:

Konik ışınli bilgisayarlı tomografi, Diş hekimliği, Radyograf

INTRODUCTION

Conventional radiographic imaging techniques (periapical, panoramic, occlusal etc.) in dentistry provide two-dimensional examination. For that reason these techniques provide limited information about anatomical structures and their pathologies (1). There are disadvantages in these techniques; such as superposition of surrounding tissues, magnification and distortion of images (2).

Cone beam computed tomography (CBCT) was which allows to dentistry in the end of 1990s by Mozzo and Arai (3, 4). CBCT is a system based on the cone beam technique which allows three dimensional imaging of maxillofacial structures (4). With its widespread use, CBCT has shown benefits in different areas for all departments of dentistry (5). CBCT provides a three-dimensional image by preventing superposition of anatomical structures compared to conventional radiography (6, 7). On the other hand, because of higher radiation dose than conventional techniques (5), it is important to justify the reason for the requests for CBCTs.

The aim of this study is to retrospectively examine the reasons of CBCT requests in Akdeniz University Faculty of Dentistry, Department of Oral and Maxillofacial Radiology and the distribution of these requests according to age, gender, departments and requested areas.

METHODS

This study was approved by the Clinical Research Ethics Committee of the Faculty of Medicine, Akdeniz University and the study was carried out in accordance with the ethical rules of the Declaration of Helsinki (approval number was KAEK-370 Date: 26.05.2021). Necessary permissions were obtained from the hospital administration for the study.

CBCT request forms, obtained from the archive records of 713 patients who applied to Akdeniz University Faculty of Dentistry, Department of Oral and Maxillofacial Radiology between February 2020 and January 2021 were analyzed retrospectively. Incompletely filled request forms (one or more missing data such as age, gender, reason for request, requesting department and requested area) were excluded

from the study and total of 679 CBCT requests were included in the study. Age, gender, requesting departments, request reasons and requested areas were recorded. Age was divided in two groups: <18 years and ≥ 18 years. Request reasons were classified as intraosseous lesion, orthodontics, endodontics, impacted tooth, dental anomaly, soft tissue calcification, preoperative, trauma, implant surgery, evaluation of temporomandibular joint bone structure, and other reasons. Requesting departments were classified as Department of Oral and Maxillofacial Radiology, Department of Oral and Maxillofacial Surgery, Department of Orthodontics, Department of Endodontics and others. Requested areas were classified as maxilla, mandible, maxillofacial region and single tooth area. The data were analyzed using the Statistical Package for the Social Sciences (SPSS) software program (SPSS v. 20.0 for Windows, Chicago, IL). The descriptive analyses and frequencies were calculated for age, gender, reason for request, requesting department and requested area.

RESULTS

Total of 679 patients' CBCT request forms (346 (51%) male and 333 (49%) female) were evaluated. Patients' ages ranged between 6 years and 79 years and mean age was 37.44 ± 17.39). 104 (15.3%) patients were <18 years and 575 (84.7%) patients were ≥18 years.

There were 23 different reasons for CBCT request and 13 of these reasons were combined under the heading "other reasons" as they accounted for less. The most common request reason was assessment of intraosseous lesions (n= 201 (29.6 %)) and Table I shows distribution of the CBCT request reasons.

Table I: The CBCT request reasons.

Reason	Female (n/%)	Male (n/%)	Total (n/%)
Intraosseous lesion	93/ 27.9	108/ 31.2	201/ 29.6
Orthodontic purpose	9/ 2.7	18/ 5.2	27/ 4
Endodontic purpose	63/ 18.9	50/ 14.5	113/ 16.6
Impacted tooth	28/ 8.4	18/ 5.2	46/ 6.8
Dental anomaly	9/ 2.7	15/ 4.3	24/ 3.5
Soft tissue calcification	9/ 2.7	14/ 4	23/ 3.4
Pre-operative	21/ 6.3	19/ 5.5	40/ 5.9
Trauma	14/ 4.2	21/ 6.1	35/ 5.2
Implant surgery	42/ 12.6	38/ 11	80/ 11.8
Temporomandibular joint	14/ 4.2	11/ 3.2	25/ 3.7
Others	31/ 9.3	34/ 9.8	65/ 9.6
Total	333/ 100	346/ 100	679/100

The distribution of intraosseous lesions was radiolucent lesion, radiopaque lesion, and radiolucent+radiopaque lesion, respectively (n=141 (70.15%), n= 34 (16.92%), and n= 26 (12.93%), respectively). Almost all of the CBCTs requested for orthodontic purposes were for evaluation of the craniofacial anomalies (n= 26 (96.3%)). The requested CBCT distribution for endodontic purposes was apical lesion assessment, root canal anatomy assessment, root resorption assessment,

and perforation suspicion respectively (n=73 (64.6%), n= 18 (15.93%), n= 18 (15.93%) and n=4 (3.54%), respectively). The requested CBCT distribution for impacted tooth assessment was impacted canine assessment, impacted third molar assessment, and impacted premolar assessment, respectively (n=27 (58.7%), n= 10 (21.74%) and n= 9 (19.56%), respectively). The requested CBCT distribution for dental anomaly was assessment of supernumerary tooth, dens invaginatus and ectopic tooth, respectively (n=19 (79.17%), n= 3 (12.5%) and n= 2 (8.33%), respectively).

The most CBCT requesting department was Department of Oral and Maxillofacial Radiology (n=349 (51.4%)) and Table II shows distribution of the CBCT requesting departments.

Table II: Distribution of the CBCT requesting departments.

Department	Female (n/%)	Male (n/%)	Total (n/%)
Oral and Maxillofacial Radiology	176/ 52.9	173/ 50	349/ 51.4
Oral and Maxillofacial Surgery	97/ 29.1	101/ 29.2	198/ 29.2
Orthodontics	23/ 6.9	35/ 10.1	58/ 8.5
Endodontics	20/ 6	18/ 5.1	38/ 5.6
Others	17/ 5.1	19/ 5.5	36/ 5.3
Total	333/ 100	346/ 100	679/ 100

Other departments distribution was Department of Pedodontics, Department of Periodontology, Department of Prosthetic Dentistry and Department of Restorative Dentistry (n= 13 (31.11%), n= 12 (33.33%), n= 8 (22.22%) and n=3 (8.33%), respectively). While the most common requested reason was intraosseous lesions (n=141 (40.4%)) for the Department of Oral and Maxillofacial Radiology, the most common requested reason was implant surgery (n=55 (27.78%)) for the Department of Oral and Maxillofacial Surgery.

The most requested area was maxillofacial region (n= 359 (52.9%)) and this was followed by maxilla (n= 131 (19.3 %)), mandibula (n= 98 (14.4 %)) and single tooth area (n=91 (13.4 %)). Department of Oral and Maxillofacial Radiology was the department that requested the most CBCTs in all areas (n=73 (20.92%), n= 62 (17.77%), n=159 (45.56%) and n= 55 (15.75%), respectively for maxilla, mandibula, maxillofacial region and single tooth area). While in patients under 18 years of age, the most common request reason was orthodontic purposes (n= 22 (21.2%)), the most CBCT requesting department was Department of Orthodontics (n= 42 (40.4%)) and the most requested area was maxillofacial region (n= 47 (45.2%)). While in patients \geq 18 years of age, the most common request reason was intraosseous lesion (n= 180 (31.3%)), the most CBCT requesting department was Department of Oral and Maxillofacial Radiology (n= 338 (58.8%)) and the most requested area was maxillofacial region (n= 312 (54.3%)).

DISCUSSION

CBCT is an imaging method that provides three-dimensional imaging of the maxillofacial region and is widely used in

dentistry (8). CBCT can be taken for maxillofacial surgery, orthodontics and implantology, as well as in the fields of endodontics, periodontology, general dentistry, forensic dentistry and otolaryngology (8).

It has been reported that CBCT is used for especially the purpose of implant planning by dentists (9). American Academy of Oral and Maxillofacial Radiology supported the request for CBCT for implant planning (10). However, the radiation dose exposed and the benefit of this examination to the patient should be evaluated. For this reason, it is recommended to request CBCT in cases where more than one implant will be placed in order to protect against the harmful effects of radiation (11). While Akarslan et al. (12), Amuk et al. (5), Menziletoğlu et al. (13) and Yalçın et al. (14) determined the most common CBCT request reason was implant treatment (42.04%, 33.38%, 43.12% and 47.72%, respectively), in the current study, implant planning was in the third place (11.8%), as in the study of Ertaş et al. (15) (21.49%).

The use of CBCT provides great advantages in the evaluation of cysts, tumors, and different pathological structures and in examining the relationship of these pathologies with anatomical structures (16). According to the current study the most common CBCT request reason was intraosseous lesion assessment (29.6%). Intraosseous lesion assessment was found second by Akarslan et al. (12) (18.31%), Ertaş et al. (15) (23.62%), Menziletoğlu et al. (13) (19.61%) and Yalçın et al. (14) (23.07%). On the other hand, Amuk et al. (5) found this reason as third (12.92%). The differences between the frequencies found in the different studies is thought to be due to the difference in the number of CBCT requests included in the study.

The second common request reason was endodontic purposes at the present study (16.6%). This high incidence can be explained by the inclusion of small-sized apical lesions in the "endodontic purpose" classification in current study. Among the reference studies, "endodontic reasons" are not considered a separate request reason. It is thought that the requests for endodontic reasons are few and therefore included in the "other" classification in these studies. While Yalçın et al. (14) found the external root resorption as 0.2% among all request reasons, this frequency comprised 15.93% of CBCTs received for endodontic reasons at the current study. According to Rodriguez et al. (17) CBCT imaging is a useful tool with the potential to change the decision-making behavior of clinicians in endodontic cases, therefore, the authors recommend CBCT for endodontic purposes.

It has been reported that CBCT can be used in orthodontics to examine craniofacial morphology, patency of the airway and dental development (18). The frequency of CBCT requested for orthodontic purposes (4%) was found similar to Amuk et al. (5), Ertaş et al. (15), and Yalçın et al. (14) (3.23%, 3.19% and 3.76% respectively). In the current study, the frequency of CBCTs for craniofacial anomalies comprised almost all of the CBCTs for orthodontic purposes (96.3%).

Localization of impacted teeth and their relationship with surrounding critical anatomical structures can be examined with CBCT (14). In the present study, the frequency of CBCT requests for impacted teeth was lower than the referenced

studies, despite including third molars (6.8%). Amuk et al. (5), Ertaş et al. (15), Menziletoğlu et al. (13) and Akarslan et al. (12) found this frequency as 32.33%, 32.13%, 8.01% and 7.82%, respectively. Only Yalçın et al. (14) obtained similar results (6.73%) with the current study however third molar teeth were excluded in mentioned study.

In the current study, the frequency of CBCT requests for dental anomalies was 3.5% and this frequency was lower than Amuk et al. (13.81%). While Yalçın et al. (14) found the frequency of CBCT requests for supernumerary teeth to be 2.87 %, this frequency was comprised 79.17% of CBCTs received for dental anomalies in the present study. Menziletoğlu et al. (13) reported only one CBCT request for the evaluation of dental fusion in their study. In mandibular fractures; because of superposition, the magnification, the presence of distortions, and the inability to follow the minimally displaced or oblique fractures of the mandible in panoramic radiographs, CBCT images give more accurate information (19). While the frequency of CBCT requests for trauma was 5.2% in the current study, Yalçın et al. (14), Akarslan et al. (12) and Menziletoğlu et al. (13) reported this frequency was 3.46%, 2.94% and 0.51%, respectively.

While CBCT can be used to diagnose changes in the bone surfaces of the temporomandibular joint, the diagnosis of disc and disc related pathologies is made with magnetic resonance imaging (20, 21). The frequency of CBCT requests for assessment of temporomandibular joint was 3.7% in the current study and this low frequency is similar with the referenced studies (5, 12-14). Contrary to the studies referenced in the present study, the most CBCT requesting department was Department of Oral and Maxillofacial Radiology (51.4%) (5, 14, 15). The reason for this situation may be that all necessary radiological examinations are made from Department of Oral and Maxillofacial Radiology before the patients are directed to other departments. Department of Oral and Maxillofacial Radiology was followed by Department of Oral and Maxillofacial Surgery (29.2%) and Department of Orthodontics (8.5%). Individuals in the process of orthodontic treatment are more sensitive to radiation than adults, since they are children or adolescents. Therefore, this should be taken into consideration when requesting CBCT for orthodontic purposes (22). In the present study, the Department of Oral and Maxillofacial Surgery was the department that requested the most CBCTs for implant planning. This finding contradicts Yalçın et al. (14)' study. In the mentioned study, the Department of Oral and Maxillofacial Radiology was the department requiring the most CBCTs for implant planning. According to Amuk et al. (5), for implant planning, CBCT requests were made by the Department of Oral and Maxillofacial Surgery and the Department of Periodontology.

The most common reason for request was intraosseous lesions (n=141, 40.4%) for the Department of Oral and Maxillofacial Radiology at the current study.

In CBCT devices, image volume is divided into so-called Fields of View and ranges from a few centimeters high to full head size reconstruction (8). Radiation dose; can be diminished by reducing the size of the field of view, increasing the voxel size, or reducing the number of projection images (23).

Requested areas were classified as maxilla, mandible, maxillofacial region and single tooth area at the current study. At the current study the most requested area was maxillofacial region (52.9%) and Department of Oral and Maxillofacial Radiology was the department that requested the most CBCTs in all requested areas. Considering the reasons and requested areas, the reason for the high number of requests in the Department of Oral and Maxillofacial Radiology can be explained that the requests for the patients who are referred to our faculty for CBCT request from external institutions (such as private clinics, various dental hospitals, etc.) are also made from this department. In addition, it is aimed to finalize all radiological evaluations before the patients are referred to other departments for treatment by this department. Diagnostic benefit should be taken into account in pediatric patients, appropriate size imaging should be considered and the dose should be adjusted according to the age and body weight of the child (14). The most common request reason was orthodontic purposes (21.2%), the most CBCT requesting department was Department of Orthodontics (40.4%) in <18 years of age patients at the current study. According to Yalçın et al. Department of Oral and Maxillofacial Surgery was the department requested the most CBCTs in the pediatric patient group.

CONCLUSIONS

The results of the study showed that most of the CBCT images were requested for assesment of intraosseous lesions, the most CBCT requesting department was Department of Oral and Maxillofacial Radiology and the most requested area was maxillofacial region. Increasing the awareness of the CBCT, evaluating the request reasons of CBCT by physicians and determining the usage areas of CBCT can be beneficial in terms of improving the technique.

Ethics Committee Approval:

This research complies with all the relevant national regulations, institutional policies and is in accordance with the tenets of the Helsinki Declaration, and has been approved by the Clinical Research Ethics Committee of the Faculty of Medicine, Akdeniz University (approval number: 2021/ 370).

Informed Consent:

Informed consent was not obtained because the study was conducted retrospectively.

Author Contributions:

Concept – H.T.A Design - H.T.A; Supervision - H.T.A; Resources - H.T.A; Materials - H.T.A; Data Collection and/or Processing - H.T.A; Analysis and/ or Interpretation - H.T.A; Literature Search - H.T.A; Writing Manuscript - H.T.A; Critical Review - H.T.A.

Conflict of Interest:

The authors have no conflict of interest to declare.

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