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Research Article

Distribution Of Clinical Cases of Referral Patients for CBCT-3D Radiographic Examinations at RSKGMP Universitas Airlangga

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KEYWORDS

CBCT-3D;
radiography;
clinical case;
distribution;
health service

ABSTRACT

Introduction: CBCT-3D (Cone Beam Computed Tomography) is an advanced radiographic imaging technology that is currently being developed and utilized in dentistry, with the advantages of accurately depicting three-dimensional (3D) tissue structures, minimal distortion, and low radiation dose. RSKGMP Universitas Airlangga is an educational dental hospital and one of the few hospitals in Surabaya city and also East Java Province that provides CBCT-3D examination services for various cases- thus becoming a referral center for the radiographic examination in the region. A lot of clinical case referrals have been recorded, but no one has researched the distribution of clinical cases referred for CBCT-3D examination. **Objective:** This study is aimed to determine the distribution of clinical cases referred for CBCT-3D radiographic examination at RSKGMP Universitas Airlangga based on origin, age, and gender. **Methods:** This study is a descriptive study with a sample of all clinical case medical records, CBCT-3D examination reference data at RSKGMP Universitas Airlangga from July 2015 to March 2020, which met the sample criteria. Furthermore, the data is tabulated and displayed using pie charts and bar charts. **Results:** Most referrals for CBCT-3D radiography came from internal referrals of RSKGMP Universitas Airlangga (78%). The elderly patients (46 years and over) had the most referrals (59%) of all age groups with the most indication for implant cases (78.9%). Female patients slightly more dominated the total referrals (57.5%) than male patients (42.5%). **Conclusion:** Most of the clinical cases of referral for CBCT-3D radiographic examination were implants and came from internal RSKGMP Universitas Airlangga, with the most referral age category being elderly and dominated by female patients.

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INTRODUCTION

CBCT (Cone Beam Computed Tomography) is a radiographic technology that is currently being developed with the advantages of accurately depicting three-dimensional (3D) tissue structures, minimal distortion, and low radiation dose.¹ The advantage of CBCT-3D is that it can display images of the maxilla, mandible, and their supporting structures with a relatively high resolution besides that CBCT-3D also produces 3D images that include axial, coronal, and sagittal and can measure bone density.^{2,3} The advantage of CBCT-3D is that it makes it easier for clinicians to handle complicated cases, including in establishing a diagnosis, determining a treatment plan during treatments, and evaluating the results of treatments that have been carried out.

Application of CBCT-3D imaging based on a literature review by Alamri et al.⁴ showed that the distribution of cases varied with 34 cases for oral and maxillofacial surgery (26,3%), 33 cases of endodontic (25,6%), 21 cases of implant dentistry (16,3%), 15 cases of orthodontics (11,6%), 12 cases of general dentistry (9,3%), 7 cases of temporomandibular joint (5,4%), 6 cases of periodontics (4,65%), and 1 case of forensic dentistry (0,8%). The accuracy of the CBCT-3D examination can also help special cases in pediatric dentistry, such as supernumerary teeth and odontomas.³ Not only that, CBCT-3D imaging is also used in other cases such as surgical evaluation for impacted teeth, cysts, and tumors, as well as identification of fractures and inflammatory disorders of the jaw and sinuses.⁵

Sociodemographic factors play an important role in identifying the use of CBCT-3D, one of which is age and gender. Age and gender are useful in classifying a case, that age can be associated with the presence of a disease and can be useful for determining dose, radiation protection, and motion artifacts. Radiation exposure for a certain age needs to be considered, such as young people (<10-15 years) more easily absorbing radiation so that it can increase the risk of cancer.⁶ On the other hand, age can also affect motion artifacts; for example, at the age of 60, patients tend to perform involuntary muscles during the CBCT-3D examination, causing artifacts.⁷ Because women have a higher level of anxiety than men, they are more likely to see motion artifacts. This can be avoided by modifying tools and implementing additional safe guards.⁸

The advancement of CBCT-3D radiography technology in dentistry is influenced by two primary factors: more sophisticated computer technology with low speed and cost and the capacity of CBCT-3D software to produce numerous CBCT-3D dental imaging

applications for broad diagnoses.⁹ Because of its benefits, many cases must be sent to the RSGM (Dental and Oral Hospital) to employ CBCT-3D as a supporting examination for more accurate diagnosis. RSGM is a place for dental and oral health services for treatment and recovery to prevent disease and be a means of referral services. RSKGMP Universitas Airlangga is an educational dental hospital of Faculty of Dental Medicine Universitas Airlangga and one of the few hospitals in Surabaya city and East Java province that provides as a referral center and offers various supporting examination services, including CBCT-3D radiography, in handling various cases.

Many clinical case referrals have been recorded for conducting CBCT-3D imaging as a supportive examination at the RSKGMP Universitas Airlangga, but no one has researched the distribution of clinical cases referred for CBCT-3D examination. This study is aimed to establish the distribution of clinical cases based on the source of the referral, age, and gender. Furthermore, research was carried out to improve services and as a reference for developing CBCT-3D in dealing with diverse clinical cases using CBCT-3D. The findings of this study will be utilized to describe clinical cases in CBCT-3D examinations from diverse specialized fields in dentistry and evaluation material in supporting examination services, particularly CBCT-3D at RSKGMP Universitas Airlangga.

MATERIALS AND METHODS

This research has obtained approval from RSKGMP Universitas Airlangga and the Health Research Ethical Eligibility Commission (KKEPK) Faculty of Dental Medicine Universitas Airlangga with certificate number 394/HRECC.FODM/VII/2021.

This study is a descriptive study that will analyses the distribution of clinical cases referred for CBCT-3D examination in RSKGMP Universitas Airlangga. The research population were from medical records of patients referred for CBCT-3D radiographic examination at RSKGMP Universitas Airlangga taken using the total sampling method.

Secondary data of patients' medical records were used and analysed regarding the referral case data for radiographic examination. The inclusion criteria were clinical cases of CBCT-3D examination referrals at the RSKGMP Universitas Airlangga with range of time from July 2015 to March 2020, within the patients' age range of 5–79 years. Researchers collected data and then recorded, compiled, and sorted based on the distribution of clinical cases and sociodemographic factors, which is

based on age and gender. Sorted data is tabulated and displayed with pie and bar charts.

RESULTS

Based on the reference data for the CBCT-3D examination at the RSKGMP Universitas Airlangga, 319 referral patients were obtained with 33 clinical cases. In Figure 1, there are 33 clinical cases with the most cases being implants from referrals of 153 patients (48%), followed by impaction cases with a total of 74 referral patients (23,2%), then sequentially cyst cases as many as 11 patients (3,4%), endo-surgery cases were 7 patients (2,2%), tooth resorption cases were 6 patients (1,9%), supernumerary teeth cases were 6 patients (1,9%), open flap surgery cases were 6 patients (1,9%), dentoalveolar fracture cases were 5 patients (1,6%), corpus alienum cases were 5 patients (1,6%), abscess cases were 4 patients (1,3%), bone quality measurement cases were 4 patients (1,3%), edentulous ridge cases 3 patients (0,9%), TMJ cases 3 patients (0,9%), odontectomy cases 3 patients (0,9%), and bone graft cases 3 patients (0,9%); cases of root canal treatment were 2 patients (0,6%), cases of periodontal disorders were 2 patients (0,6%), cases of dental anomalies were 2 patients (0,6%), and cases of growth and development disorders were 2 patients (0,6%). Moreover, several cases are summarized into one part, namely other cases consisting of 8 clinical cases, including cases of infection in the left ramus, cases of pain in the lower jaw, cases of oro-antral, cases of viewing the mandibular canal, cases of sinus abnormalities, cases of dental inclination, residual root cases, pulp necrosis cases. The other cases amounted to 11 referral patients (3,4%). Figure 2 depicts the distribution of clinical cases of CBCT-3D examination based on the origin of the referral, with most referral cases coming from internal referrals, with as many as 248 referral patients (78%) compared to external referrals as many as 71 referral patients (22%).

Distribution of clinical cases of CBCT-3D examination based on age as shown in Figure 3 explains that based on age category according to the Indonesian Ministry of Health in 2009,¹¹ there are five age categories of human, including toddlers (0-5 years), children (5-11 years), adolescents (12-25 years), adults (26-45 years), and the elderly (46 years and over). Based on these data, the most referrals for CBCT-3D examination in the elderly age category were 114 patients (58%), then 102 patients (23%) were adolescents, 96 patients of adults (10%), and the rest were children (9%).

Figure 4 shows that in the elderly age category, of the 114 patients referred for CBCT-3D radiographic examination, the most cases were implants as many as 90

patients (78,9%). In the adult age category of 96 patients, the most referred cases were implant cases as many as 44 patients (45,8%). In the adolescent age category, impaction cases were the most referred cases, as many as 48 patients out of a total of 102 patients (47,1%). Meanwhile, in the category of children's age, there were 7 patients with impaction cases which were the most referred, as many as 4 patients (57,1%).

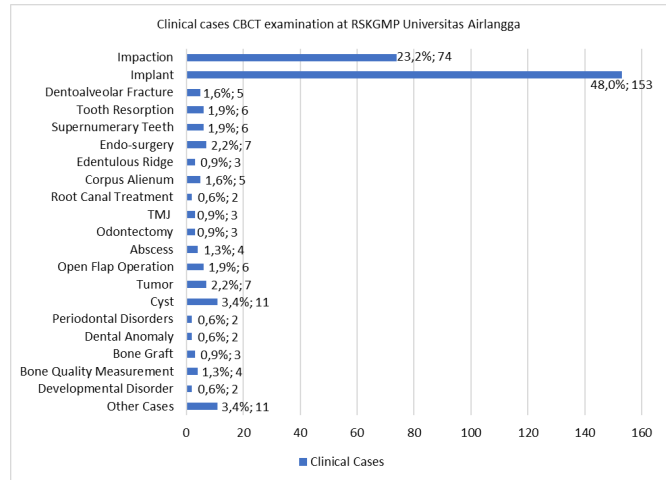


Figure 1. Distribution of clinical cases CBCT-3D examination at RSKGMP Universitas Airlangga

Distribution of clinical cases CBCT-3D examination by origin of reference

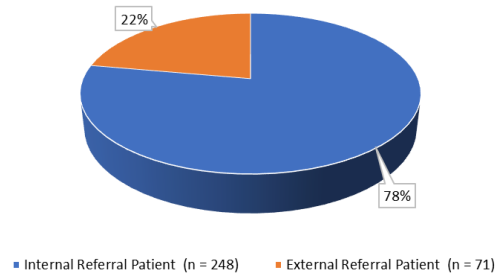


Figure 2. Distribution of clinical cases CBCT-3D examination by origin of reference

CBCT-3D examination based on age

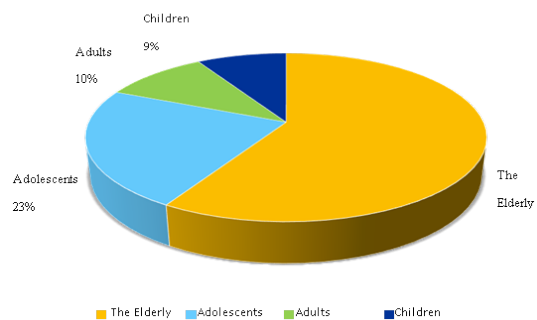


Figure 3. Distribution of clinical cases CBCT-3D examination by age of patients

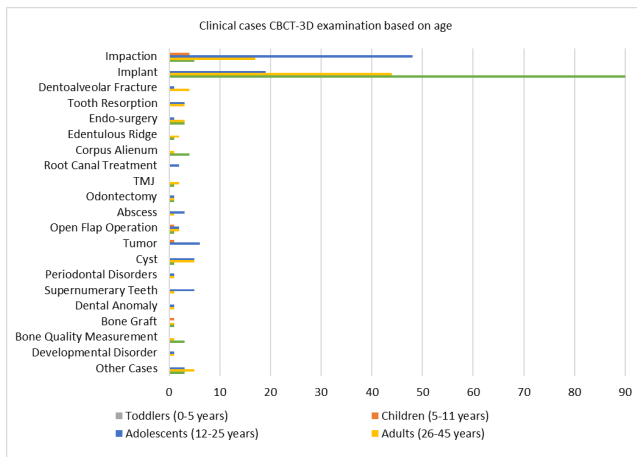


Figure 4. Clinical cases CBCT-3D examination based on age

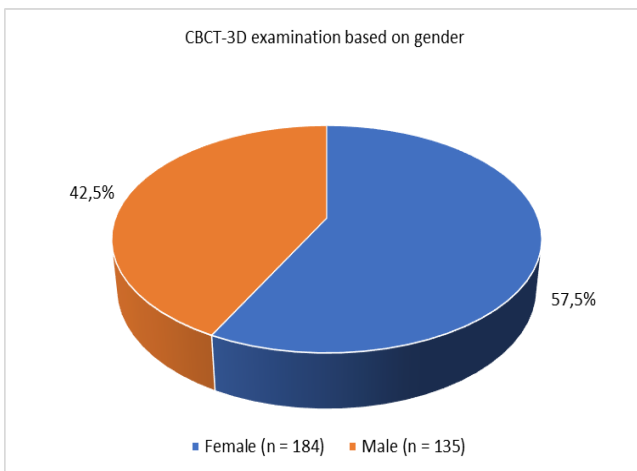


Figure 5. Distribution of clinical cases CBCT-3D examination by gender

Figure 5 describes the distribution of clinical cases of CBCT-3D radiographic examination by gender; female patients were referred more frequently with a total of 184 referrals (57.5%), while male patients received as many as 135 referrals (42.5%).

DISCUSSION

The CBCT-3D examination at the RSKGMP Universitas Airlangga was available for referrals from June 2015 to March 2020, with a total of 319 patients who met the criteria. The study's findings included 33 clinical cases and 319 referral patients separated into two groups: internal and external referrals. Of the total 319 referral patients, based on clinical cases, most cases referred for CBCT-3D examination were implant cases with a total of 153 referral patients. Implant cases are the most common because CBCT-3D examination often makes it easier for practitioners to assist in placing

implants in patients. The advantages of CBCT-3D in implant placement can be seen from its usefulness in helping in the early to late stages. The initial stage of implant placement can use CBCT-3D from assessing the patient's bone quality, then measuring the distance, thickness, and width of the bone implant area, and in the final stage, it is used to see the success of implant placement which is characterized by osteointegration.¹² Compared to using a two-dimensional radiographic examination to measure the distance to the implant placement area, CBCT-3D has been proven to be more accurate since the measurement is carried out through multiplanar planes of axial, sagittal, and coronal, in the desired area or any region of interest, to avoid measurement errors.¹²

The number of implant cases referred for CBCT-3D examination has led to the development of several devices on CBCT-3D to support various cases regarding implants, one of which is a surgical guide device.¹³ Surgical guides are used for special cases such as edentulous patients by facilitating the placement of implants accurately into bony structures. The operation of the surgical guide when it is placed in the jaw, using sleeves will position the instrument guide to the appropriate position accurately. The device reduces work time, minimizes trauma and swelling pain, shortens recovery time, and accurate transfer from virtual to clinical settings. At RSGKMP Universitas Airlangga, CBCT-3D can be combined with SmartFusion technology to support the development of side-by-side implant cases with the most referrals, making it simple to combine CBCT-3D reconstruction with intra-oral scanning to visualize the patient's surgical area more easily in planning treatment, see the use of available bone, and avoid the prosthetic barrier.¹³

The trend of using CBCT-3D in impaction cases can be seen from impaction cases being the second case that is often referred to for CBCT-3D examination. The advantage of CBCT-3D in impaction cases is that it makes it easier to determine the location of the impaction in the buccal-palatal and angulation areas, determine the proximity of the impacted tooth to the root structure, and determine the degree of resorption, thereby reducing the risk of root resorption.¹⁴ On the other hand, other cases were referred for CBCT-3D examination, such as 11 patients referred for cyst cases. Practitioners prefer CBCT-3D as a supporting examination for cyst cases because it can identify early signs of cysts, allowing dentists to take immediate actions such as surgical excision. In addition, CBCT-3D imaging can be used to monitor the development of new lesions at the cyst site while the bone heals following cyst surgery.¹⁵ Other cases referred for the CBCT-3D examination at the RSKGMP

Universitas Airlangga, as shown in Figure 1, support the statement that CBCT-3D can be an accurate supporting imaging examination with several advantages for practitioners in their clinical practice, particularly to aid in the diagnosis, treatment planning, and treatment evaluation of various cases. In addition, it shows that the CBCT-3D at the RSKGMP Universitas Airlangga can be used for the right referral center in handling cases that require supporting examinations from outside the RSKGMP Universitas Airlangga or internally.

Clinical cases referred to carry out a CBCT-3D examination at the RSKGMP Universitas Airlangga as shown in figure 2, most of the referrals came from internal RSKGMP Universitas Airlangga compared to patients from outside the RSKGMP Universitas Airlangga. RSKGMP Universitas Airlangga is the Main Teaching Hospital used by the Specialist Dentistry Education Program (PPDGS) of the Faculty of Dental Medicine, Universitas Airlangga, which must provide educational facilities that can support educational programs according to KKI standards.¹⁶ According to qualification level 8 KKNi, the use of CBCT-3D radiography technology in dentistry is one of the competencies that must be possessed in developing knowledge, technology, or art in the specialist field of science itself so that this CBCT-3D examination continues to develop in handling various referral cases.¹⁷

The sociodemographic variable of age is one that has been linked to clinical referral cases. According to the Indonesian Ministry of Health in 2009, there were six age categories, namely toddlers (0-5 years), children (5-11 years), adolescents (12-25 years), adults (26-45 years), elderly (46-65 years), and seniors (65 onwards). However, in the sense that the elderly and seniors have the same amount of hormone decline, five age categories were used in this study, combining the elderly and seniors into one age category, the elderly (46 and over). The category of elderly age is the category most referred to in conducting the CBCT-3D examination. Elderly age is related to signs of aging, such as changes in the hard tissue of the alveolar bone and teeth. These changes are because, with age, the edentulous ridge is too long, periodontal disease is not stable, the prosthesis is unstable, and systemic disease is present.¹⁸ Edentulous ridges that are not treated immediately become one of the factors causing bone resorption so that the frequency of implant placement increases. Elderly and adult age categories are similarly likely to be referred for CBCT-3D examination. In addition, the elderly, such as 60 years and above, tend to produce motion artifacts due to involuntary muscle movements when the CBCT-3D examination is performed.⁸

The age category of children and adolescents is the two categories of referrals for CBCT-3D examination, with the most impaction cases. Age factors play a role in impaction without being related to accompanying local factors such as heredity or post-natal factors.¹⁹ Several impactions often occur, namely impaction of third molars, canines, premolars, and incisors. The growth of impacted third molars usually occurs at the age of 16-24 years and can be later. Canines are one of the most common impactions after third molars, as evidenced by a study conducted by Maretna in 2013²⁰ that the age of 16-20 years often experienced canine impaction with a percentage of 40.81%. In the anterior maxillary teeth, the incisors are also a form of impaction caused by the wrong location of the seed.²¹ The toddler category could not be identified because the CBCT-3D examination process did not match the standards. Furthermore, age has a role in the risk of radiation delivered on the CBCT-3D examination, as children aged under 10 years have a three times higher risk of absorbing radiation than adults aged 30 years. As a result, children are more likely than adults to suffer radiation damage to the head and neck organs. This must be considered when using CBCT-3D for diagnosis; it is suggested to be used in difficult instances rather than regular diagnosis.²²

The distribution of clinical cases by gender is shown in Figure 5, which shows that female patients with 184 people or 57.5%, were the majority as referral patients for CBCT-3D examination compared to male patients with 135 patients (42.5%). The number of female patients is associated with women's self-awareness of appearance and more concerned with aesthetics than men, and using implants increases their confidence compared to using removable dentures.²³ In addition, female patients than male patients tend to take advantage of preventive care services for various clinical cases experienced.²⁴ However, due to the high proportion of female patients undergoing CBCT-3D examinations, studies have found that these patients experience greater levels of anxiety than male patients do, which can cause motion artifacts to appear in the CBCT-3D images.⁸

CONCLUSION

Many clinical cases referred for CBCT-3D radiographic examination at RSKGMP Universitas Airlangga were implants, with most referrals coming from within RSKGMP Universitas Airlangga. Patients referred for CBCT-3D radiographic examination were predominantly elderly, with a female gender predominating.

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CONFLICT OF INTEREST

All authors have no potential conflict of interest to declare for this article.

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