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Assessment of Knowledge, Awareness and Perception Regarding the Usage of Cone Beam Computed Tomography (CBCT) in Pediatric Dentistry Among Dentists in Ahmedabad City: A Cross-Sectional Survey

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ABSTRACT

Background: X-ray images are mostly needed in order to diagnose the problems of the patients. But some cases require advanced imaging techniques such as Cone Beam Computed Tomography (CBCT), but when it comes to the applications in Pediatric Dentistry, CBCT requires careful selection of areas of use in children. In pediatric population, exposure should be kept reasonably low but some situations require accurate diagnosis which can be achieved by the use of CBCT.
Aim: The purpose of the study is to evaluate the knowledge, awareness & perception regarding uses of CBCT in Pediatric Dentistry among various dental practitioners & PGs in Ahmedabad city.
Methodology: A structured questionnaire was designed to assess knowledge, awareness & perception regarding the usage of CBCT. The form was distributed among 250 dentists which comprised of students who were dental post-graduates, MDS (Pediatric branch), MDS from other specialties and general practitioners (BDS) practicing in Ahmedabad city.
Results: A definite gap in knowledge & prescription of CBCT applications existed between different categories of dental specialists with respect to their years of experience. Current PG dental students have been provided with appropriate CBCT education while new age practitioners had better knowledge as they were taught CBCT in their curriculum as compared to senior practitioners.
Conclusion: Fostering cognizance and positive attitudes among dentists towards CBCT would tremendously boost the present-day dental diagnosis. Its promotion through optimal hands-on sessions, workshops would aid in its efficient application especially in pediatric population.

Keywords: *3D imaging, X-ray, diagnosis, Pediatric Dentistry*

INTRODUCTION

Dental radiology has been a crucial part of diagnosing and treating dental diseases in dentistry since the invention of X-rays. However, conventional radiographic techniques such as periapical and panoramic radiography have limitations in showing 2D representations of images. Limitations such as magnification, superimposition and distortion of images have raised many questions over the years.[1] Over the last few decades, diagnostic imaging has significantly improved with the addition of various imaging technologies and complex physical principles.[2]

In the late 1990s, a new 3D-imaging technology called Cone Beam Computed Tomography (CBCT) was introduced in dentistry. Due to continuous technological development of devices and software, CBCT has become more accessible for clinicians and patients over the time Additionally, CBCT seems to have many advantages over conventional computed tomography (CT), conventional panoramic and intraoral imaging, which has led to its increased use in dentomaxillofacial imaging.[3]

Although it was originally intended for use in implant dentistry, it is now being used in all branches of dentistry, including Pediatric Dentistry. CBCT provides high-quality images with sub-millimeter resolution that can capture both soft and hard tissues in a short scanning time (10-70 seconds) and with radiation dosages reportedly up to 15 times lower than those of conventional CT scans.[5] Although the initial cost of establishment may be high but with increased usage, it is a viable option for routine dental practice.

Nowadays, dentists are using advanced technology to offer better and more advanced treatments for children. However, some practitioners are still doubtful about the use of CBCT in children. There is little literature available on the evaluation of knowledge, awareness and perception regarding the usage of CBCT in Pediatric Dentistry among dentists. Thus, this study was done to ascertain knowledge, awareness and perception regarding usage of CBCT in Pediatric Dentistry among dentists of Ahmedabad city.

MATERIALS & METHODS

A preformed, structured questionnaire was designed to ascertain the knowledge, awareness & perception of CBCT usage in Pediatric Dentistry. These forms were distributed among 250 dentists which comprised of PG students (Pediatric Dentistry), PG students (Other branches), general practitioners (BDS), MDS (Pediatric Dentistry) & MDS (Other branches) practicing in Ahmedabad city. The study was carried out from July 2023 to September 2023 and was approved by the institutional ethical committee. The total number of questions in the questionnaire included 16 multiple choice questions that were regarding qualifications and experience, 4 were about knowledge, 3 were about awareness, 6 were about perception. 232 responses were received which were subjected to statistical analysis by software SPSS VERSION 20.2.

RESULTS

The study population (232) was classified on the basis of qualification and years of clinical experience. The participants were categorized as PG students (Pediatric Dentistry), PG students (Other branches), general practitioners (BDS), MDS (Pediatric Dentistry) & MDS (Other branches) in relation to qualification. On the basis of clinical experience, they were divided as less than 5 years (new age practitioners), 5-10 years, more than 10 years of experience (senior practitioners). The demographic distribution of data is represented in Table 1.

Table 1: Demographic distribution on the basis of years of clinical experience & qualification

Experience	Qualification				
	MDS (Pediatric Dentistry)	MDS (Other branches)	PG Student (Other branches)	PG Student (Pediatric Dentistry)	BDS
< 5 years	27%	34%	84%	88%	42%
5-10 years	42%	22%	8%	5%	28%
> 10 years	31%	44%	8%	7%	30%
Total	38	52	48	38	56

Most of the participants were utilizing digital imaging and all of the dentists were familiar with the term CBCT. They also agreed that CBCT should be the preferred method for 3-D imaging in modern times but had limited knowledge about its uses in children. In Pediatric Dentistry, CBCT is not the first choice for all children visiting dental clinics or dental colleges [Table 2].

Table 2: Belief regarding CBCT as preferred 3D imaging in Pediatric Dentistry

Question	Qualification				
	MDS (Pediatric Dentistry)	MDS (Other branches)	PG Student (Other branches)	PG Student (Pediatric Dentistry)	BDS
Do you believe that CBCT should be preferred for 3D imaging in Pediatric dentistry?**					
Yes	97%	100%	98%	100%	96%
No	2%	0%	2%	0%	4%
p-value	0.570**				

Level of Significance $p \leq 0.05$, * Significant, ** Non Significant

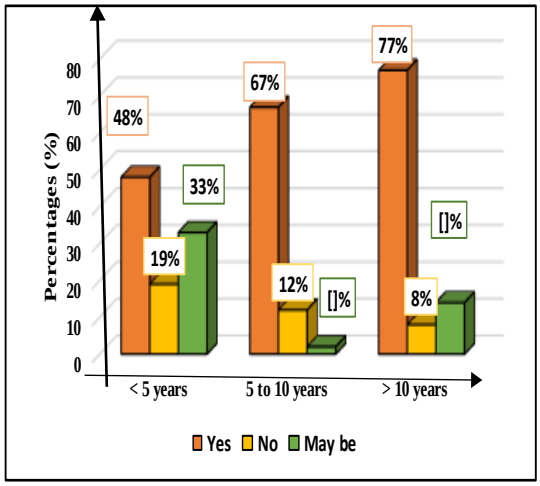
There were no significant differences in the attitude towards using CBCT in Pediatric Dentistry for various indications such as ectopic tooth, supernumerary tooth, pathologic lesion, cleft lip and palate, dental trauma and salivary stone. When dentists were enquired about preferred imaging modality for assessing pediatric dental trauma, majority of clinicians opted for CBCT which was statistically significant with *p*-value of 0.007 [Table 3]. However, for root resorption and root fractures, regardless of dental specialties, the majority of participants preferred IOPA.

Table 3: Preferred imaging modality for dental trauma in children

Question	Qualification				
	MDS (Pediatric Dentist)	MDS (Other branches)	PG Student (Other branches)	PG Student (Pediatric Dentistry)	BDS
Which the following technique will you prefer for analyzing dental trauma in children?*					
IOPA	19%	12%	19%	24%	64%
OPG	29%	8%	23%	8%	31%
CBCT	52%	80%	58%	68%	5%
***p*-value**	**0.007 ***				

Level of Significance $p \leq 0.05$, * Significant, ** Non Significant

When practitioners were questioned regarding the reasons for not prescribing CBCT in children, 77% of senior practitioners cited inability to interpret CBCT as a major reason compared to other participants. It was observed that new age practitioners prescribed CBCT more readily as compared to senior practitioners [Graph 1].



Graph 1: Difficulty in interpretation of CBCT

It was observed that new age practitioners which primarily comprised of post-graduates were well aware about interpreting the CBCT as compared to senior practitioners which was statistically significant with *p*-value 0.003 [Table 4].

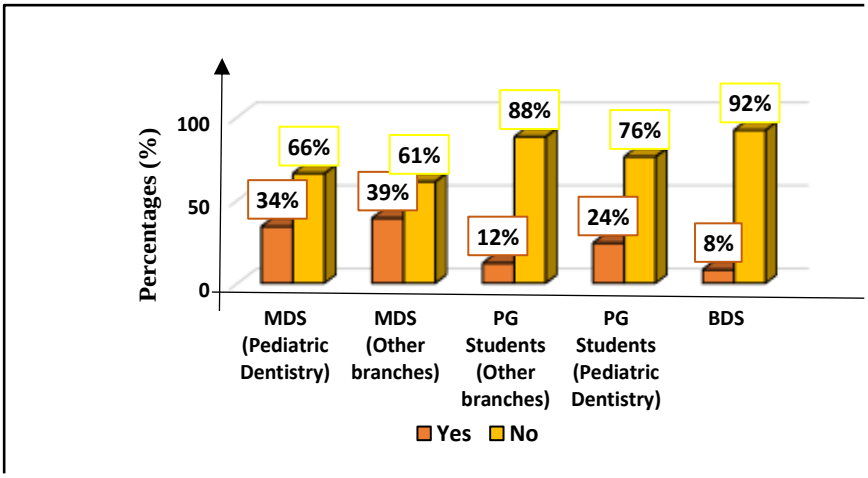
Table 4: **Awareness regarding interpretation of CBCT**

Question	Years of Clinical Experience		
	< 5 years	5 to 10 years	> 10 years
Are you aware about how to interpret CBCT?*			
Yes	64%	21%	26%
No	36%	79%	74%
***p*-value**	**0.003***		

Level of Significance $p \leq 0.05$, * Significant, ** Non Significant

There were notable differences in the knowledge of radiation protection guidelines between different groups. The highest level of knowledge was found among pediatric dental PG students (76%) compared to other specialties with a statistically significant *p*-value of 0.01.

When clinicians were asked about attending CBCT related courses, it was found that 39% of MDS from other specialties had attended courses regarding CBCT compared to the other participants which was also statistically significant with *p*-value of 0.003 (Graph 2).



Graph 2: Prior Experience of attending CBCT related courses

DISCUSSION

In recent years, there has been a shift in imaging technology from conventional to advanced modalities. Advanced imaging techniques have enabled the conversion of two-dimensional images to three-dimensional life-like images, resulting in more accurate interpretation and diagnosis, particularly in specialties other than Pediatric Dentistry. The present study aimed to understand how effectively traditional and modern oral radiology principles and practices are being followed in Pediatric Dentistry. Additionally, the study assessed the subjects' knowledge of CBCT and their opinions on the implications regarding usage of CBCT in children.

Despite the availability of small units in India, the use of Cone Beam Computed Tomography (CBCT) is not widely accepted by dental practitioners. Kamburoglu *et al* (2011)[6] conducted a study on 472 dental students (280 pre-graduate and 192 post-graduate) in Turkey regarding the knowledge and attitude towards CBCT. They concluded that efforts should be made to improve students' knowledge base regarding CBCT and the dental school curriculum should devote more time to this promising new technology which is in contrast to our study wherein new age practitioners and PGs had better knowledge as they were taught CBCT in their curriculum.

According to Van Acker *et al* (2015)[7], most patients who were referred for Cone Beam Computed Tomography (CBCT) were children aged 12 years who had experienced trauma. 14% of these cases were due to dento-alveolar trauma, while 18% were due

to other reasons which is in accordance with present study wherein when we enquired the reasons for prescribing CBCT we observed that MDS (other branches) chose CBCT as preferred modality for diagnosis of dental trauma in children compared to other specialties.

In a study conducted by Gumru B *et al* (2021)[8], they evaluated 149 CBCT scans of children under the age of 14, which accounted for 5% of all scans. The most common region of interest for CBCT was the maxillary canine region, which was found in 85.55% of scans. The most common indications for CBCT were impacted teeth (41.4%), bone pathology (31%), dental anomalies (29.6%), and orofacial clefts and syndromes (11.6%). In the present study, CBCT was found to be the preferred choice for diagnosis in all of these conditions. This underscores the importance of utilizing advanced imaging techniques to ensure accurate diagnosis and effective treatment planning for patients.

According to a systematic review conducted by De Grauwe A *et al* (2019)[9], CBCT is a suitable choice for diagnosing cleft lip and palate due to its lower radiation exposure and shorter duration. In our study, participants were aware that CBCT can be used to detect cleft lip and palate in children. It is understandable that MDS who deal with more complicated cases on a daily basis, possess greater knowledge regarding the availability of CBCT in their surroundings.

However, Aditya *et al* (2015)[10] found that CBCT is still not very frequently used by dental specialists due to factors such as less availability of the technique, high cost, or inability of case selection for CBCT imaging by the dentists. This is in accordance with our study findings, where practitioners with more than 10 years of experience encountered difficulties in prescribing CBCT.

On the other hand, Jianru Yi *et al* (2017)[11] observed that CBCT has a good diagnostic value for identifying root resorption as compared to periapical radiographs. However, in our study, most dentists preferred the use of IOPA over CBCT for identifying root resorption and root fracture.

In the present study, it was found that dentists lacked sufficient knowledge about the use of CBCT in Pediatric Dentistry. Only a few believed that it is safe to be used in children. Therefore, it is necessary to raise awareness among dentists regarding its use in Pediatric Dentistry. The results also indicate that senior practitioners had less awareness about CBCT and require an enhancement of knowledge towards this promising new technology.

CONCLUSION

There is a lack of familiarity with the use of Cone Beam Computed Tomography (CBCT) among senior dental practitioners. Practitioners with over 5 years of experience found it difficult to use CBCT due to lack of gaining knowledge during their academic tenure. This has resulted in a decreased practical application of CBCT in Pediatric Dentistry. In order to improve dental healthcare practices in the future, we recommend increasing the number of continued dental education programs to enhance knowledge on the use of CBCT in Pediatric Dentistry and its applications. However, the use of CBCT in children should be based on the case such that it outweighs the potential risks of radiation exposure. The judicious use of advance digital imaging can pave the way for accurate and precise diagnosis and treatment planning.

Declaration by Authors

Ethical Approval: Approved

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