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THESIS APPROVAL PAGE FOR MASTER OF SCIENCE IN ORAL BIOLOGY

Title of Thesis: " Assessment of Patients' Perceptions of CBCT and Endodontic Treatment "

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Master of Science Degree **30-Jun-2020**

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Assessment of Patients' Perceptions of CBCT and Endodontic Treatment

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ABSTRACT

Introduction: Cone Beam Computed Tomography (CBCT) has had a significant impact in endodontic diagnosis and treatment planning. Previous studies have investigated provider attitudes and utilization of CBCT technology, but little is known about patients' perceptions of the use of CBCT in endodontics. This study assessed the perceptions of patients regarding the application of CBCT for endodontic treatment. **Methods:** 103 consecutive volunteer patients who were prescribed a CBCT study according to the AAE/AAOMR guidelines were given a Likert-type survey that recorded an initial level knowledge and attitudes regarding the use of CBCT in endodontics. Following standardized patient education in the form of a 2-minute video presentation describing the applications and risks associated with CBCT technology, CBCT volumes were acquired. A second survey was administered to record the patients' perceptions of the benefits and risks associated with CBCT. **Results:** Following the video, 43% of the participants had a significantly more positive opinion of CBCT technology and 31% a more positive opinion, 56% felt that CBCT was essential, and 42% felt it was beneficial. From the participants, 22% reported CBCT having significantly less radiation than they previously thought and 28% thought it was less, while 10% thought it was either more or significantly more radiation. A total of 46% felt strongly about seeking out a provider who utilizes CBCT if treatment is needed in the future, 38% agreed, and 15% were neutral. **Conclusion:** When presented with basic information, most patients perceive CBCT imaging to have an important role in endodontic treatment.

Key Words: Cone beam computed tomography (CBCT); radiology, endodontic diagnosis

Significance: Little is known about the patient's perception about CBCT. This study demonstrated that with basic information patients perceive CBCT important in the treatment.

INTRODUCTION

In the interest of providing appropriate and effective treatment, it is of paramount importance that a clear and accurate diagnosis is established. In recent years, Cone Beam Computed Tomography (CBCT) has gained significant attention due to its applicability in endodontic diagnosis and treatment. Weighing the safety vs. the benefits of CBCT is a priority for dental providers and patients alike.

The American Association of Endodontists (AAE) released a position statement on the use of CBCT in 2015 with a subsequent update in 2016 (1). Interestingly, CBCT is described as the imaging modality of choice for most clinical presentations that an endodontist would encounter while diagnosing and treatment planning. With the information obtained on a CBCT, providers can perform better diagnosis, create more appropriate treatment plans, and anticipate challenges with complicated tooth morphology and proximity

to vital anatomical structures (2, 3). While these applications are easily recognized by most dental providers, patients may harbor preconceptions that result in a different perception of the risks and benefits of CBCT.

CBCT is a powerful tool for diagnostic purposes in endodontics, this can significantly impact the treatment planning dynamic between the patient and the provider (3-6). If a patient received educational information about CBCT, their perception about diagnosis, treatment planning, and the use of CBCT may become more favorable. Utilizing this information would allow the dental professional to ensure the patient is granted a thorough informed consent. The purpose of this study was to assess the patient's perception of CBCT as a diagnostic and treatment planning tool in endodontic treatment.

MATERIALS AND METHODS

The protocol was in accordance with the U.S. Army human research requirements for dental research. More specifically, the 32CFR 219 regulation for a survey study without identifiable information from the patient who is participating in a study that poses no risks to the patient does not require an IRB review. The project was approved by Uniformed Services University of the Health Sciences Postgraduate College Bethesda, Maryland.

Seven providers were calibrated to discuss with patients four major key points: lesion detection, anatomy analysis, radiation safety, and potential risks. Providers offered the opportunity to participate in the study to every patient considered for CBCT imaging. The application of CBCT was decided at the calibrated provider's discretion based on established guidelines from the AAE/AAOMR position statement (1). Consent for the study was provided as part of a baseline Likert-type survey in printed form (Appendix A). The baseline survey recorded demographic information including age, gender, education level, previous experience with 3-dimensional imaging, opinion on radiation exposure risk, and the usefulness of 3-dimensional imaging. The initial survey was administered prior to viewing an educational video about CBCT. Then the patient had access to a short two-minute video describing the CBCT benefits and risks specifically related to endodontic treatment. After reviewing the video, the patient had the opportunity to complete the final Likert-type survey assessing their educated opinion and perception on CBCT. Subsequently, the CBCT volume was captured. Patients remained anonymous as no identifying information was recorded. Data was collected between the months of August 2019 and February 2020, and the final sample size at the conclusion of the study was 103 patients. The survey was collected via an anonymous drop box within the clinic.

STATISTICS

Chi-square statistical analysis was performed to evaluate the effects of education level and gender with the post video survey responses, respectively.

RESULTS

A total of 103 surveys were collected. The distribution of demographics and the preconceptions survey (Pre-Survey) are summarized in **Table 1**. The results of the post video-survey (Post-Survey) can be found in **Table 2**.

Table 1. Summary of Pre- Survey

	Total n (%)
1. Education Level	
High School	29
Some College	31
College	34
Master	8
Doctorate	1
Total	103
2. Gender	
Female	23
Male	80
Total	103
3. Age	
15-25	42
26-34	21
35-44	19
45-54	9
55-64	5
65-74	2
75-older	5
Total	103
4. Previous Experience with 3-D Imaging	
I've had one or more taken before	9
I have never had one taken before	62
I'm not sure	32
Total	103
5. Radiation exposure perception	
Significant risk	1
Some risk	22
Minuscule risk	52
No risk at all	29
Total	103
6. General perception of 3-D imaging	
Essential	39
Beneficial	64
Unnecessary	0
Disadvantageous	0
Total	103

Table 2. Summary of Post- Survey

	Total n (%)	Male n (%)	Female n (%)
1. After receiving information about Cone Beam CT, my thoughts about “Root Canals” are			
Significantly More Positive	44 (43.5)	37 (47.5)	7 (30.5)
More Positive	33 (31.5)	24 (29.5)	9 (39)
Unchanged	26 (25)	18 (23)	8 (30.5)
More Negative	0	0	0
Significantly more negative	0	0	0
Total	103	79	24
2. For the diagnosis and treatment of <u>my</u> tooth I feel the CBCT was			
Essential	58 (57)	44 (56)	14 (61)
Beneficial	45 (43)	35 (44)	10 (39)
Unnecessary	0	0	0
Disadvantageous	0	0	0
Total	103	79	24
3. Compared to what I thought previously, the amount of radiation associated with Cone Beam CT is			
Significantly More	4 (4)	3 (4)	1 (4)
More	7 (7)	5 (6)	2 (9)
Just what I thought	41 (40)	32 (41)	9 (40)
Less	28 (27.5)	23 (29)	5 (21)
Significantly Less	23 (21.5)	16 (20)	7 (26)
Total	103	79	24
4. In general, considering the comfort, time spent, and radiation exposure, I feel CBCT is			
Significantly Beneficial	54 (52)	46 (57.5)	8 (35)
Beneficial	46 (45)	32 (40)	14 (61)
Unsure	3 (3)	2 (2.5)	1 (4)
Burdensome	0	0	0
Unsure	0	0	0
Total	103	80	23
5. In the future, I will seek a provider that uses CBCT for diagnosis and treatment planning of “Root Canals.”			
Strongly Agree	48 (46.5)	40 (50)	8 (34.5)
Agree	40 (39)	30 (37.5)	10 (43.5)
Neutral	15 (14.5)	10 (12.5)	5(22)
Disagree	0	0	0
Strongly Disagree	0	0	0
Total	103	80	23

DISCUSSION

Little is known about patients’ perceptions related to radiological procedures in dentistry. Baseline demographics recorded in the Pre-Video Survey demonstrated that the distribution by gender greatly favored male participants. This finding is likely due to the setting of the study in a military dental clinic where the population is predominantly male (7). The sample was grouped into 2 categories: Category 1:

“College graduate” and above and Category 2 consisting of: “High school graduates” (including those with “some college experience”). Based on our results, the perceptions of CBCT imaging were not related to gender or education-level.

The results of this study demonstrate that patients favorably perceive CBCT use in endodontics. Prior to receiving information about CBCT, all participants considered it as an essential or beneficial tool. With the addition of a brief, 2-minute educational intervention, we were still able to positively improve the opinion of 74% of the participants as indicated by their Post-video survey responses. A positive perception towards CBCT and RCT is an optimistic finding in a setting where patients might be very anxious about their treatment.

Misconceptions about radiation exposure exist among patients and surprisingly also among some providers in the medical community. In one study by Hollada et al. (8), more than half of the women surveyed overestimated the radiation in a mammography study. On the other hand, a survey conducted at the University of Toronto found that 82% of patients reported not being informed of the radiation associated with their prescribed radiological procedure (9). Most of them thought that Computed Tomographic Scans had lower radiation exposure than radiographs. This same study showed that more than 90% of patients reported not having an encounter where they received educational information about exposure levels/risk. Lack of resources to educate patients may be a fundamental problem that can undermine the risk/benefit perception in the dental community and especially in endodontic patients undergoing CBCT imaging.

Our results demonstrated that nearly 60% of patients previously overestimated or underestimated the actual radiation doses associated with CBCT scans. This finding presents an opportunity for improving both the public perception and the individual patient’s understanding of CBCT imaging. In this study, the use of the educational video served to close the gap between informed and uninformed patients. In one randomized, controlled trial evaluating informed consent with trauma patients, this method of informing patients was observed to trend towards a better understanding of the proposed treatment plan. (10). None of the participants perceived CBCT as unnecessary or disadvantageous which is indicative of a positive perception regarding the modality. In terms of selecting a provider in the future, 86% of the participants will consider the use of CBCT in their decision.

These results must be interpreted with caution since survey participants might be response-biased to answer in a manner that is expected socially (11). The anonymity of the study aimed towards reduction of this influence. The 4-5-point scale in the pre-survey compelled the participant to take a stand in their opinion by not making available a neutral position in the answer choices. This was essential to assess the positive or negative tendency of their perceptions. After the informational video was presented and the knowledge was “standardized,” the post-survey was administered. In the post-survey, the neutral response was an option to reduce response bias from being recently subjected to an educational video. In our opinion, assessment of perception with a post survey after educational intervention provided a more realistic set of results, similar to a setting in which patients are adequately educated as part of their informed consent regarding CBCT and endodontic treatment.

This study was limited by the clinical setting. Military patients comprised most of the participants, creating a somewhat homogenous sample. Another significant limitation is the absence of a patient financial

burden associated with dental procedures in the military setting. This factor could have an effect in the desire of a patient to seek an endodontic provider with a CBCT if it incurs extra costs. Additional studies that look at a more heterogeneous population may provide more applicable findings.

CONCLUSION

In order to respect the patient's autonomy, it is the provider's responsibility to adequately educate them regarding all treatment planning decisions. Understanding the prior knowledge and attitudes of our patients will improve our effectiveness in achieving this goal. Endodontic patients have a positive perception about CBCT in their endodontic treatment even though they may initially perceive greater radiation doses involved with CBCT scans. A simple video with educational information about the benefits and risks associated with CBCT can contribute to better knowledge influencing their perception of CBCT imaging positively.

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APPENDIX A

By completing this survey I agree for this anonymous information to be used for statistical analysis in scientific research.

PRE-VIDEO SURVEY

<p>1. Age</p> <p>15-25 26-34 35-44 45-54 55-64 65-74 75 and older</p>
<p>2. Gender:</p> <p>Female Male I prefer not to answer</p>
<p>3. Education Level</p> <p>a. Did not finish high school d. College degree</p> <p>b. High school or equivalent e. Master degree</p> <p>c. Some college training f. Doctoral degree</p>
<p>4. What is your experience with Cone Beam Computed Tomography (CBCT) / 3-Dimensional radiographs?</p> <p>a. I've had one or more taken before b. I have never had one taken before c. I'm not sure</p>
<p>5. When taking radiographs, there is a certain amount of radiation involved in the process. What is your opinion on the risk of radiation exposure from 3-Dimensional dental radiographs?</p> <p>a. Significant risk b. Some risk c. Minuscule risk d. No risk at all</p>
<p>6. In your opinion, how useful is 3-D imaging for diagnosis and treatment planning for "Root Canals?"</p> <p>a. Essential b. Beneficial c. Unnecessary d. Disadvantageous</p>

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POST-CBCT SURVEY

7. After receiving information about Cone Beam CT, my thoughts about "Root Canals" are

- a. Significantly more positive
- b. More positive
- c. Unchanged
- d. More negative
- e. Significantly more negative

8. For the diagnosis and treatment of my tooth I feel the CBCT was

- a. Essential
- b. Beneficial
- c. Unnecessary
- d. Disadvantageous

9. Compared to what I thought previously, the amount of radiation associated with Cone Beam CT is

- a. Significantly More
- b. More
- c. Just what I thought
- d. Less
- e. Significantly Less

10. In general, considering the comfort, time spent, and radiation exposure, I feel CBCT is

- a. Significantly Beneficial
- b. Beneficial
- c. Unnecessary
- d. Burdensome
- e. Unsure

11. In the future, I will seek a provider that uses CBCT for diagnosis and treatment planning of "Root Canals."

- a. Strongly agree
- b. Agree
- c. Neutral
- d. Disagree
- e. Strongly disagree

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I'm not sure	32
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5. Radiation exposure perception	
Significant risk	1
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Minuscule risk	52
No risk at all	29
Total	103
6. General perception of 3-D imaging	
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Beneficial	64
Unnecessary	0
Disadvantageous	0
Total	103

Table 2. Summary of Post- Survey

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More	7 (7)	5 (6)	2 (9)
Just what I thought	41 (40)	32 (41)	9 (40)
Less	28 (27.5)	23 (29)	5 (21)
Significantly Less	23 (21.5)	16 (20)	7 (26)
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Beneficial	46 (45)	32 (40)	14 (61)
Unsure	3 (3)	2 (2.5)	1 (4)
Burdensome	0	0	0
Unsure	0	0	0
Total	103	80	23
5. In the future, I will seek a provider that uses CBCT for diagnosis and treatment planning of “Root Canals.”			
Strongly Agree	48 (46.5)	40 (50)	8 (34.5)
Agree	40 (39)	30 (37.5)	10 (43.5)
Neutral	15 (14.5)	10 (12.5)	5(22)
Disagree	0	0	0
Strongly Disagree	0	0	0
Total	103	80	23

DISCUSSION

Little is known about patients’ perceptions related to radiological procedures in dentistry. Baseline demographics recorded in the Pre-Video Survey demonstrated that the distribution by gender greatly favored male participants. This finding is likely due to the setting of the study in a military dental clinic where the population is predominantly male (7). The sample was grouped into 2 categories: Category 1:

“College graduate” and above and Category 2 consisting of: “High school graduates” (including those with “some college experience”). Based on our results, the perceptions of CBCT imaging were not related to gender or education-level.

The results of this study demonstrate that patients favorably perceive CBCT use in endodontics. Prior to receiving information about CBCT, all participants considered it as an essential or beneficial tool. With the addition of a brief, 2-minute educational intervention, we were still able to positively improve the opinion of 74% of the participants as indicated by their Post-video survey responses. A positive perception towards CBCT and RCT is an optimistic finding in a setting where patients might be very anxious about their treatment.

Misconceptions about radiation exposure exist among patients and surprisingly also among some providers in the medical community. In one study by Hollada et al. (8), more than half of the women surveyed overestimated the radiation in a mammography study. On the other hand, a survey conducted at the University of Toronto found that 82% of patients reported not being informed of the radiation associated with their prescribed radiological procedure (9). Most of them thought that Computed Tomographic Scans had lower radiation exposure than radiographs. This same study showed that more than 90% of patients reported not having an encounter where they received educational information about exposure levels/risk. Lack of resources to educate patients may be a fundamental problem that can undermine the risk/benefit perception in the dental community and especially in endodontic patients undergoing CBCT imaging.

Our results demonstrated that nearly 60% of patients previously overestimated or underestimated the actual radiation doses associated with CBCT scans. This finding presents an opportunity for improving both the public perception and the individual patient’s understanding of CBCT imaging. In this study, the use of the educational video served to close the gap between informed and uninformed patients. In one randomized, controlled trial evaluating informed consent with trauma patients, this method of informing patients was observed to trend towards a better understanding of the proposed treatment plan. (10). None of the participants perceived CBCT as unnecessary or disadvantageous which is indicative of a positive perception regarding the modality. In terms of selecting a provider in the future, 86% of the participants will consider the use of CBCT in their decision.

These results must be interpreted with caution since survey participants might be response-biased to answer in a manner that is expected socially (11). The anonymity of the study aimed towards reduction of this influence. The 4-5-point scale in the pre-survey compelled the participant to take a stand in their opinion by not making available a neutral position in the answer choices. This was essential to assess the positive or negative tendency of their perceptions. After the informational video was presented and the knowledge was “standardized,” the post-survey was administered. In the post-survey, the neutral response was an option to reduce response bias from being recently subjected to an educational video. In our opinion, assessment of perception with a post survey after educational intervention provided a more realistic set of results, similar to a setting in which patients are adequately educated as part of their informed consent regarding CBCT and endodontic treatment.

This study was limited by the clinical setting. Military patients comprised most of the participants, creating a somewhat homogenous sample. Another significant limitation is the absence of a patient financial

burden associated with dental procedures in the military setting. This factor could have an effect in the desire of a patient to seek an endodontic provider with a CBCT if it incurs extra costs. Additional studies that look at a more heterogeneous population may provide more applicable findings.

CONCLUSION

In order to respect the patient's autonomy, it is the provider's responsibility to adequately educate them regarding all treatment planning decisions. Understanding the prior knowledge and attitudes of our patients will improve our effectiveness in achieving this goal. Endodontic patients have a positive perception about CBCT in their endodontic treatment even though they may initially perceive greater radiation doses involved with CBCT scans. A simple video with educational information about the benefits and risks associated with CBCT can contribute to better knowledge influencing their perception of CBCT imaging positively.

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APPENDIX A

By completing this survey I agree for this anonymous information to be used for statistical analysis in scientific research.

PRE-VIDEO SURVEY

<p>1. Age</p> <p>15-25 26-34 35-44 45-54 55-64 65-74 75 and older</p>
<p>2. Gender:</p> <p>Female Male I prefer not to answer</p>
<p>3. Education Level</p> <p>a. Did not finish high school d. College degree</p> <p>b. High school or equivalent e. Master degree</p> <p>c. Some college training f. Doctoral degree</p>
<p>4. What is your experience with Cone Beam Computed Tomography (CBCT) / 3-Dimensional radiographs?</p> <p>a. I've had one or more taken before b. I have never had one taken before c. I'm not sure</p>
<p>5. When taking radiographs, there is a certain amount of radiation involved in the process. What is your opinion on the risk of radiation exposure from 3-Dimensional dental radiographs?</p> <p>a. Significant risk b. Some risk c. Minuscule risk d. No risk at all</p>
<p>6. In your opinion, how useful is 3-D imaging for diagnosis and treatment planning for "Root Canals?"</p> <p>a. Essential b. Beneficial c. Unnecessary d. Disadvantageous</p>

By completing this survey I agree for this anonymous information to be used for statistical analysis in scientific research.

POST-CBCT SURVEY

7. After receiving information about Cone Beam CT, my thoughts about "Root Canals" are

- a. Significantly more positive
- b. More positive
- c. Unchanged
- d. More negative
- e. Significantly more negative

8. For the diagnosis and treatment of my tooth I feel the CBCT was

- a. Essential
- b. Beneficial
- c. Unnecessary
- d. Disadvantageous

9. Compared to what I thought previously, the amount of radiation associated with Cone Beam CT is

- a. Significantly More
- b. More
- c. Just what I thought
- d. Less
- e. Significantly Less

10. In general, considering the comfort, time spent, and radiation exposure, I feel CBCT is

- a. Significantly Beneficial
- b. Beneficial
- c. Unnecessary
- d. Burdensome
- e. Unsure

11. In the future, I will seek a provider that uses CBCT for diagnosis and treatment planning of "Root Canals."

- a. Strongly agree
- b. Agree
- c. Neutral
- d. Disagree
- e. Strongly disagree