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Analyzing the Regionalized Awareness of Distraction Osteogenesis

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AN ANALYSIS OF THE REGIONAL AWARENESS OF DISTRACTION OSTEOGENESIS

A Capstone Experience/ Thesis Project
Presented in Partial Fulfillment of the Requirements for
the Degree Bachelor of Science with
Honors College Graduate Distinction at Western Kentucky University

By:

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2016

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ABSTRACT

There are multiple treatment options available to initiate bone growth within the oral cavity. Distraction osteogenesis is a surgical dental procedure performed to initiate new bone growth in the maxillofacial region. This procedure is an important advancement to dental professionals because of the minimal complications and great outcome of bone growth it offers. As dentistry is always evolving, it is imperative to relay current trends to other professionals within the field of dentistry.

The goal of this research was to analyze the regionalized awareness of distraction osteogenesis. A survey was conducted among dentists in Kentucky and Tennessee with multiple questions to determine their knowledge and use of distraction osteogenesis. As a dental hygienist, it is important to be aware of these various procedures to provide current treatment options and inform each individual patient based on his/her particular needs. The survey sent to dentists in Tennessee and Kentucky provided vital information on the awareness of distraction osteogenesis. Results show that dentists are aware of the procedure although it is not an often-used technique.

ACKNOWLEDGEMENTS

There are so many people that have helped me on this journey to becoming a dental hygienist and I couldn't be more appreciative of them.

I would like to thank Dr. Joseph Evans for the countless hours of helping revise and construct this thesis project. Without his help, this process would have seemed impossible. He is such a wonderful educator and I am so thankful to have had his guidance through this program.

Thank you Mrs. Barbara Bush for being my second reader and spending time to revise and put your knowledge into my paper. Your wisdom on Dental Hygiene has taught me so much through this program and has challenged me to be better.

Thank you to all the members of the Dental Hygiene faculty and staff, without your guidance and expertise this journey would not have been the same.

To my parents, you have been the best support system and greatest strength through this long process. I would have not completed this program without your help and kind words along the way. I could not thank you enough for the love and support you have shown me.

VITA

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CHAPTER I INTRODUCTION

Advancements are being made nearly each day in the dental field to enhance the health of individuals everywhere. Surgical procedures can be an important component to provide optimal health when genetic disorders or syndromes have altered the oral cavity. Distraction osteogenesis is a surgical technique that is not often considered. Malocclusion, sleep apnea, TMJ ankylosis, Pierre Robbins syndrome, alveolar ridge augmentation and Class II malocclusion are all conditions which contribute to a poor oral status for individuals. These conditions can often be corrected with distraction osteogenesis. It is important for dentists and dental hygienists to be aware of the new procedures being performed to provide the best care possible for their patients.

CE/T STATEMENT

It is anticipated that the results of the study will indicate that there is a low incidence of awareness regarding the distraction osteogenesis surgical procedure. The primary goal of this study is to analyze the regional use of distraction osteogenesis by surveying dentists in Tennessee and Kentucky. A questionnaire of fifteen questions will determine different demographics of the participants and if they are aware of and if they perform this procedure. After

the data is collected, it will be analyzed to determine if this surgical procedure is being utilized. If the awareness of this procedure is high, it will impact the way dentist's treatment plan for an individual's needs. Similarly, if awareness of the procedure is low, it will be important to educate dental professionals so that they may be better versed in treating their patients' needs.

Chapter II

Review of the Literature

While many professionals in the dental field are unaware of the advancements that distraction osteogenesis has given, many studies have proven this procedure to be very effective. These clinical studies acknowledge abnormalities that can benefit from this advancement and how long-term success of the oral cavity can be attributed to this procedure. The majority of this literature will reveal the long-term success and beneficial factors that distraction osteogenesis creates.

Two different types of distraction osteogenesis are performed on the mandible, horizontal and vertical growth. Mohotany, Kumair, and Ravindar (2015) followed ten patients who had a vertical defect in the alveolar bone. Patients' ages ranged from 16-64, and each patient was maintained within the ASA 1 and ASA 2 classification. Thorough medical histories were reviewed and patients were either put under local anesthesia or general anesthesia, depending on how much bone needed to be achieved.

Researchers implemented a device which is used in this surgical technique and made up of two 2mm mini-plates fixed with a screw. One plate was fixed to one portion of the bone while the other was moveable to

achieve the distraction and bone regrowth. Each one of the distraction devices was made individually for each patient. After the device was placed, there were different activations the patient instigated for optimal bone growth. After the fourth post-operative day, the distractor device was turned twice daily with 0.5mm of separation of bone at each turn; equaling 1mm per day of bone growth. Depending upon the patient and the amount of vertical bone growth needed, the device was activated until the optimal growth was achieved. After this period of turning the device, a consolidation phase of 3-5 months was in place for the bone to harden and stabilize. After the device was removed, calculations of total bone growth were recorded. Each growth of bone ranged from 4-24 mm. Two of the patients' transport segment resorbed and the surgical procedure was not successful. Although two of the ten patients did not achieve the bone height hoped for, eight other patients successfully gained vertical alveolar bone and were able to receive implants and full or partial prosthetic dentures.

The researchers stated that distraction osteogenesis is a more effective treatment option than vertical guided bone regeneration because of the greater amount of bone achieved. This procedure presents with less infection rate and more bone height achieved, giving it a better prognosis for the patient. Patients are given a chance for a better functioning oral cavity with this procedure.

Another study conducted by Ahmed, Ola, Doaa, Shahira (2016), supports this procedure with seven cases of deformities that were corrected with the procedure of distraction osteogenesis. Patients with airway obstruction (four), facial asymmetry (two), and one with aesthetic concerns took part in this clinical study.

Pediatric and adult patients' medical histories were reviewed, pre-treatment radiographs were obtained, and study models were constructed during this clinical study.

Because the ages of the patients ranged from 2-24, the distraction phase was different for each patient. Pediatric patients started the distraction phase on postoperative day 3, and adult patients on postoperative day 7. The distractor was turned twice a day with 0.5 mm of distraction on each turn. Each patient activated the distractor until the amount of length needed was achieved. Although the researcher describes the post treatment of these patients, the amount of pain or discomfort was not included in the study.

Of the seven patients observed, five had TMJ ankylosis, and the others presented with a skeletal Class III malocclusion and congenital mandibular micrognathia. The amount of distraction that needed to take place was dependent on the severity of the case. Growth ranged from 9.0 to 19.2 mm in each patient. Ultimately patients were satisfied with their treatment. Three of the patients with TMJ ankylosis needed additional surgery to correct the condition. Follow-up visits were made 12-28 months after surgery to monitor progress. Minor complications took place in three of the patients. Lower lip parasesthesia was noticed after the osteotomy in a single patient, and the barrel of the device inverted deep into the soft tissue in another. After these complications took place, changes were made with the barrel and the patients proceeded with the normal recovery. Overcorrection was made in the amount of bone lengthening produced because of the suspected relapse after the distractor device was removed.

In conclusion, the researchers of this study believe that this procedure can effectively correct facial deformities and provide an optimal amount of bone needed. Through this study, they demonstrated that with the bone height obtained, it efficiently gave patients a better aesthetically pleasing profile and/or pain free facial region.

In related studies, distraction osteogenesis has been a very effective treatment option for Robin Sequence Syndrome. This defect is described as a triad of retrognathia, glossoptosis, and airway obstruction. This abnormality forms during fetal development but can be corrected with the procedure of distraction osteogenesis.

A retrospective study conducted by Hong and Kearns (2015), included 16 cases, all presenting with Pierre Robins Syndrome. The ages of the patients ranged from 21-121 days old. In addition to the syndrome, 9 other patients presented with cleft palate and 6 others with an associated genetic syndrome. All patients were observed prior to treatment, watching their breathing and the severity of their obstruction. Severity was also measured with a midsagittal-computed tomography by abnormalities in the facial region. An internal fixator for the distraction process was placed in each patient. Unlike other studies, the fixator was activated on the first day of the placement. It was activated until no discrepancies were found and stayed stable in the oral cavity 6-8 weeks to fulfill the consolidation period.

Prior to treatment, all patients were suspected to be in need of a tracheostomy. After treating each patient with distraction osteogenesis, only 4 of the 16 patients were still indicated for the tracheostomy. Tracheostomies were needed

in two of the patients because of a multilevel obstruction that mandibular distraction could not fix alone.

Like other cited literature, these authors support the use and effectiveness of distraction osteogenesis. This procedure supports many corrective techniques to improve the oral cavity and health for each patient.

Many studies have shown incredible ways that this procedure can help correct a patient's syndrome, abnormality, or esthetics. Although there are great outcomes, long-term success is always the key to any procedure being performed. Bezuhly, Bezuhly, Graham, Hong, Kearns, Taylor(2012), conducted a retrospective study to determine the long term success of bilateral mandibular distraction osteogenesis and its effects on developing deciduous molar teeth.

Ten children who received this procedure were selected to follow-up and examine the events that had occurred in the oral cavity since distraction. Radiographs and dental examinations made by the patients' pediatric dentists were the main source used to note any major dental anomalies that took place. With the young age of these patients, concerns were made for the future health of the oral cavity of these young individuals.

A major statistic, outlined by these researchers, was a review of another study that showed only 1 out of 589 cases had a complication regarding tooth damage from mandibular distraction. Also reported was a questionnaire sent to reconstructive surgeons, which indicated that 2% of patients had a dental injury from the procedure. These researchers specifically involved multiple studies to provide substantial information to support the use of distraction osteogenesis in

young infants and children. As shown in these clinical studies, tooth abnormalities or development will not be disrupted by the procedure.

Similar to other studies, Hussain (2009) conducted a study regarding the external frame distraction osteogenesis of the midface in the patient with a cleft palate. The researchers believed this would provide enough growth and give the patient the oral cavity status they needed for health. Prior to the surgery taking place, each patient consulted with a surgeon, orthodontist, and speech pathologist. The orthodontist performed procedures to ensure optimal height of the palate and bone grafting was done if needed. Prior to the study, evaluating the preoperative speech of the patients to examine if a nasoendoscopy was needed, was found essential for an optimal outcome. Models were constructed to place the device and establish a mock representation of what the patients' outcomes would be.

Complications included bleeding during the osteotomy phase and asymmetrical distraction which was affected by the rate and rhythm of the distraction phase. Monitoring these two factors is essential for the production of supportive bone. Overcorrection of 20-25% was made to compensate for the relapse after the vector was removed. With overcorrection, an open bite can be produced, although this was not the case in this review.

In summary, the researchers conclude that distraction osteogenesis was an effective treatment option for these patients. It is a highly recommended route for the corrective treatment with cleft palate but ages need to be monitored because of the growth that is taking place in young adolescents. Also, post-operative appointments are very important in maintaining the growth that was produced.

Literature reviews continually support the use of distraction osteogenesis as one of the best options for full corrective surgery for many different abnormalities. Still missing from the literature, however, are studies which evaluate the awareness of the procedures in Kentucky and Tennessee. The next chapter details how the researcher will gather information regarding awareness of distraction osteogenesis throughout the states of Kentucky and Tennessee.

Chapter III

METHODOLOGY

To collect data, a survey was conducted by sending a questionnaire to dentists in Tennessee and Kentucky about the use and awareness of distraction osteogenesis. The survey was constructed of 15 questions (Appendix A), which asked the state, age, type of practice, and their use, if any, of the surgical procedure. The number of cases treated, applications for use, and effectiveness were also inquired. There was also the opportunity for participants to provide further insight into the subject. The project was approved by the Western Kentucky University Institutional Review Board, IRB #831165-1.

An email was sent to each dentist providing information about the study. Each recipient was greeted with an email that provided the link to complete the survey. The dentists agreed to an informed consent document before they began answering the questionnaire. The survey was compiled through the WKU Qualtrics® system. Each dentist remained anonymous. The survey was active for a month, with a reminder sent two weeks into the survey. Retired dentists and dentists who were not practicing were removed from the lists.

When the time period expired the results were reviewed to determine the regionalized awareness of distraction osteogenesis. Each question was carefully analyzed to understand the background and knowledge of each dentist. Results

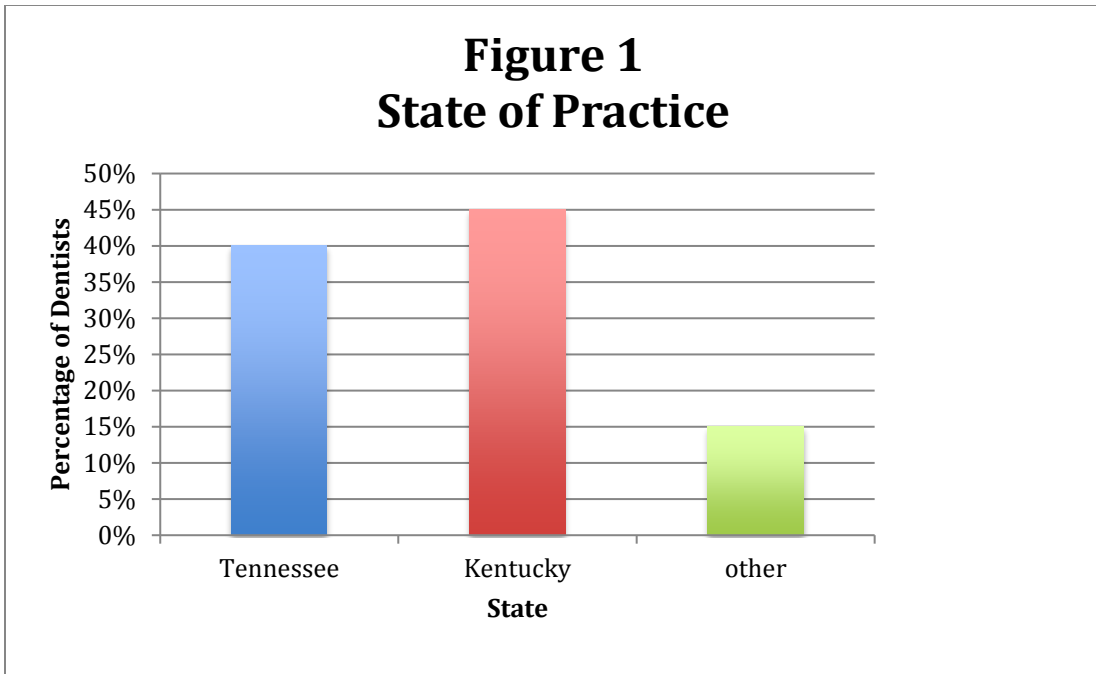
of the survey will be discussed in the next chapter

Chapter IV

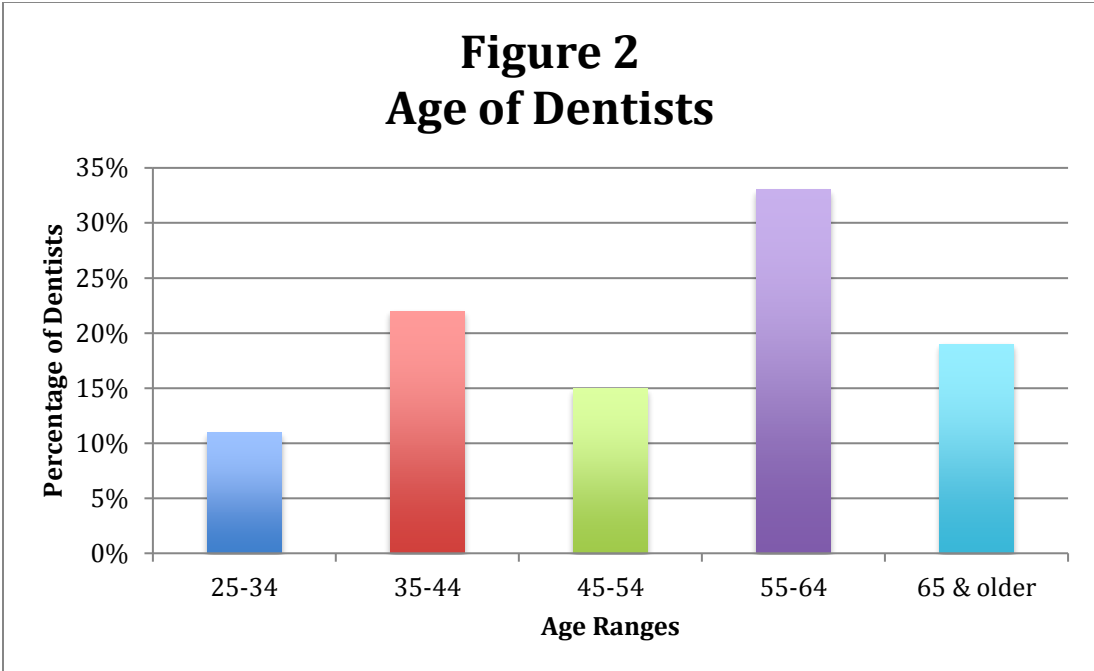
Results

Through this chapter, the results of the survey will be explained and examined in great detail. The questions were constructed by inquiring about each dentist's background in dentistry, location, specialty, and awareness of this procedure. Remaining questions examined each dentist's practice by zip code, gender, how long he/she has been practicing, and what was his/her main focus of dentistry. Additionally, questions asked if he/she had performed the procedure, what deformities he/she knew were corrected by this technique, and if he/she believed it was an effective treatment option for these patients. After the survey was shut off at the allotted time, the results were calculated and analyzed by the researcher.

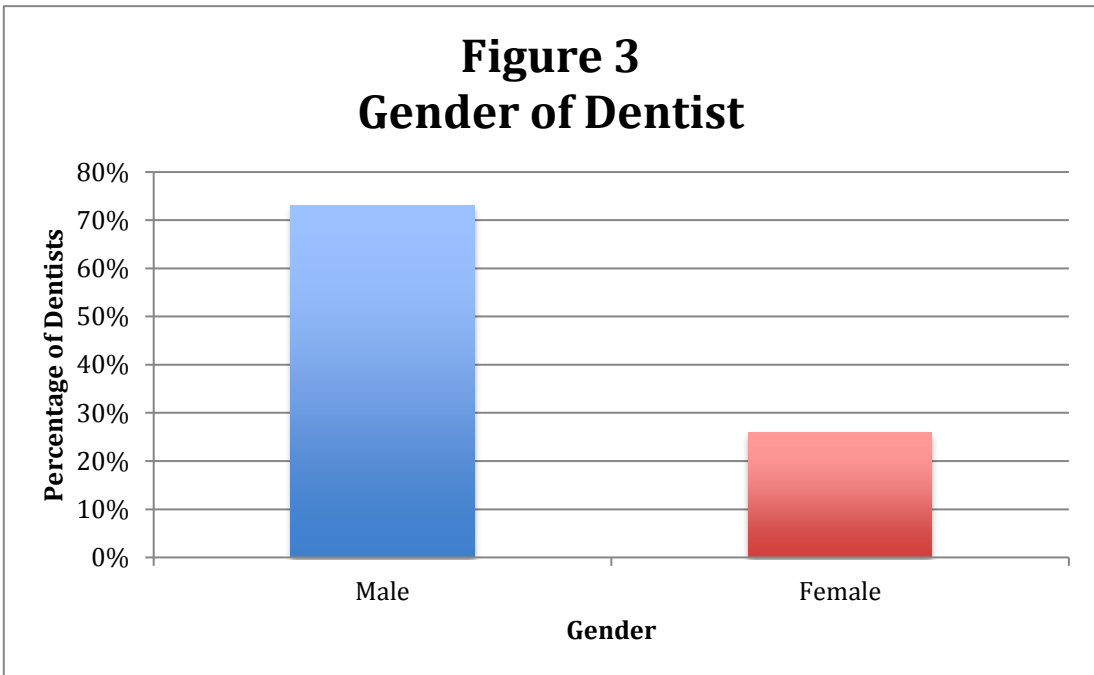
Consent to participate in the study was given by 315 practitioners. The first question concerned the state in which they currently practice. The majority of the respondents [(n = 142 (45%))] practiced in Kentucky, and an additional 127 respondents practiced in Tennessee. Last, 46 of the dentists practiced in another state, were retired, or were not currently practicing (Figure 1).



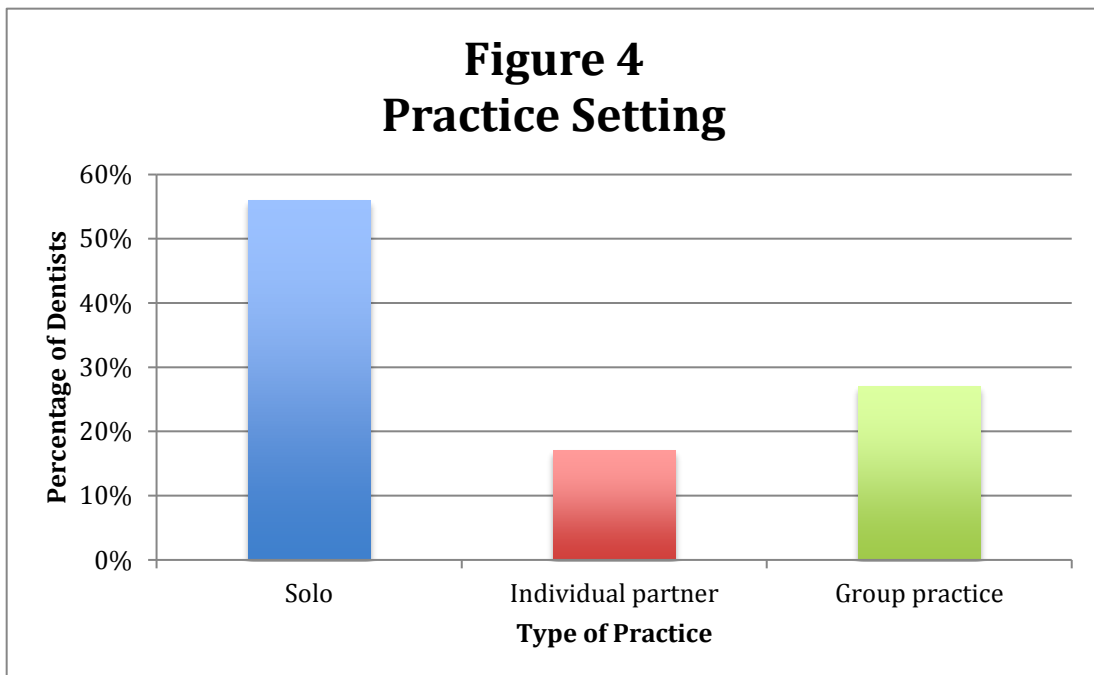
Next, the participants were asked their current ages. Answers were broken down into age ranges of 25-34, 35-44, 45-54, 55-64, and 65 or older. The greatest number of practitioners was between the ages of 55-64 (33.0%). This was followed by those between the ages of 35-44 (22.0%), 65 or older (19.0%), 45-54 (15.0%), and the last 11% of the respondents were between the ages of 25-34 (11%) (Figure 2).



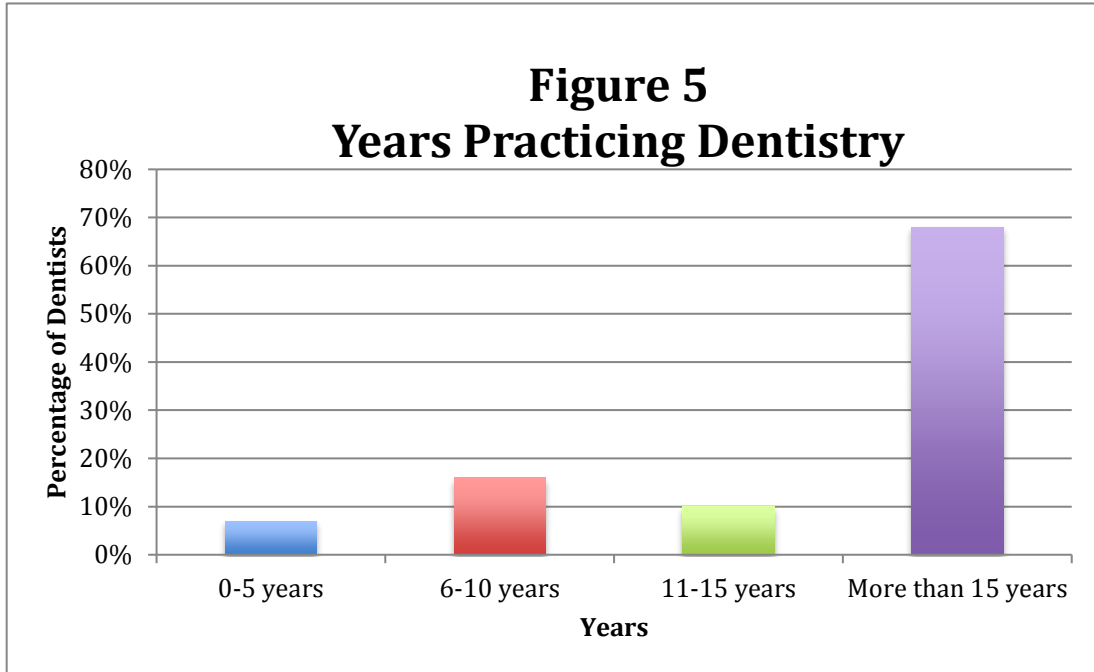
To further the researcher's knowledge of demographic information of each dentist, the next question inquired the gender. The majority of the respondents were male [n = 196 (74.0%)] and 69 (26.0%) were female (Figure 3).



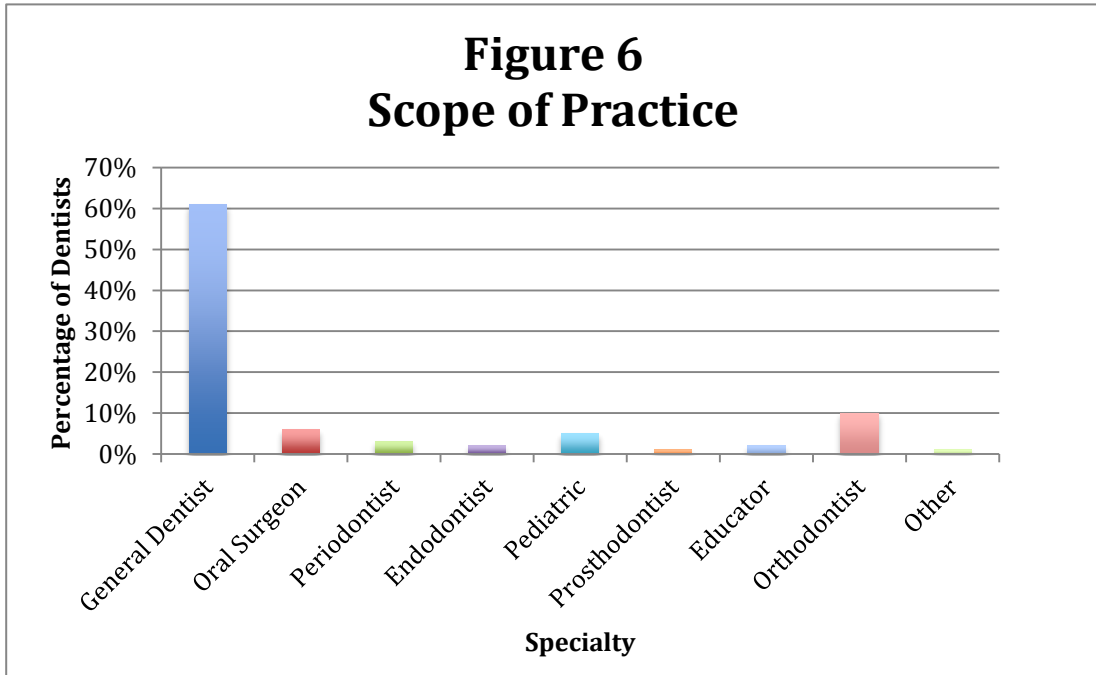
Next, each respondent was asked to describe his/her practice setting. The respondents could choose among solo, with an individual partner, or within a group of 3 or more dentists. Results indicated that the majority of respondents [n = 147(56%)] had a solo practice, 71 (27.0%) practiced in a group practice, and 44 (17.0%) practiced with a partner (Figure 4).



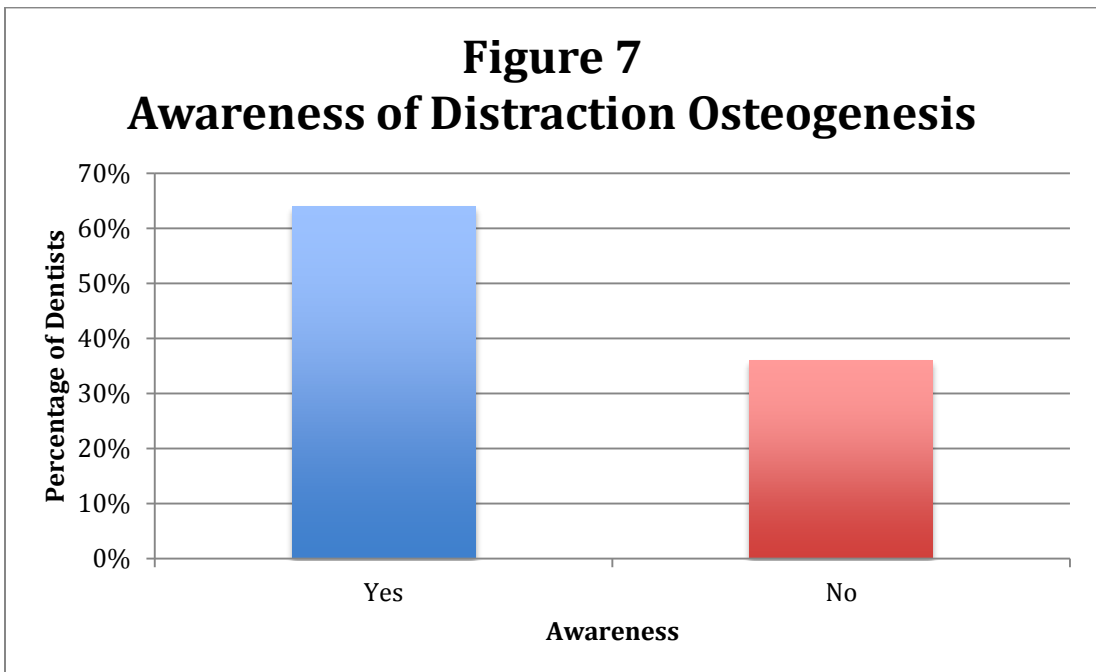
Another demographic question asked how long each dentist had been practicing in the dental field. The majority [n = 179(68%)] stated they had been practicing more than 15 years, 41 (16.0%) stated they had been practicing for 6-10 years, 25 (10.0%) stated they had been practicing for 11-15 years, and 18 (7.0%) stated they had been practicing fewer than 5 years (Figure 5).



To know more about the participants, the next question asked each to describe the primary focus of their practice. Answers included general dentistry, oral surgeon, periodontist, orthodontist, pediatric dentist, prosthodontist, endodontist, educator, or other. The results indicated that the majority of dentists [n = 161(61%)] stated they practiced as a general dentist, 30 (11.0%) stated they practiced as an orthodontist, 27 (10.0%) stated they practiced as oral surgeons, 16 (6.0%) stated they practiced as pediatric dentists, 12 (5.0%) stated they practiced as periodontists, 7 (3.0%) stated they practiced as endodontists, 4 (2.0%) educators, 3 (1.0%) stated they practiced as prosthodontists, and 3 (1.0%) stated they practiced in another capacity (Figure 6).

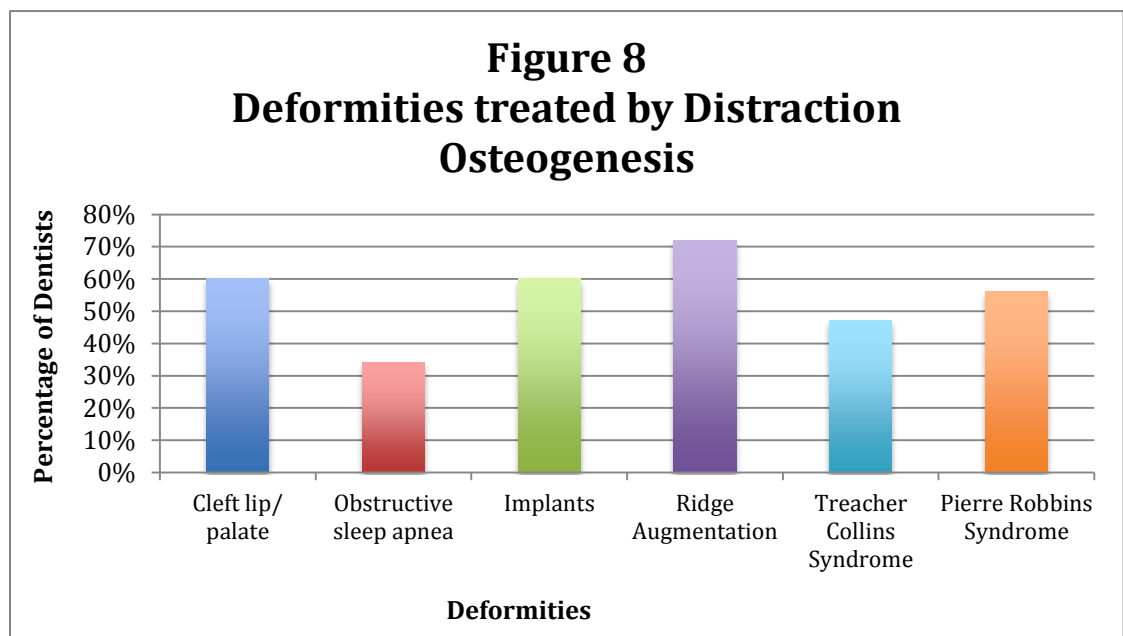


Next, to gain more insight on the procedure being researched, the dentists were asked if they were aware of the surgical procedure of distraction osteogenesis. The majority of respondents [n = 168(64%)] said they were aware and 95 (36.0%) said they were not aware of this procedure (Figure 7).

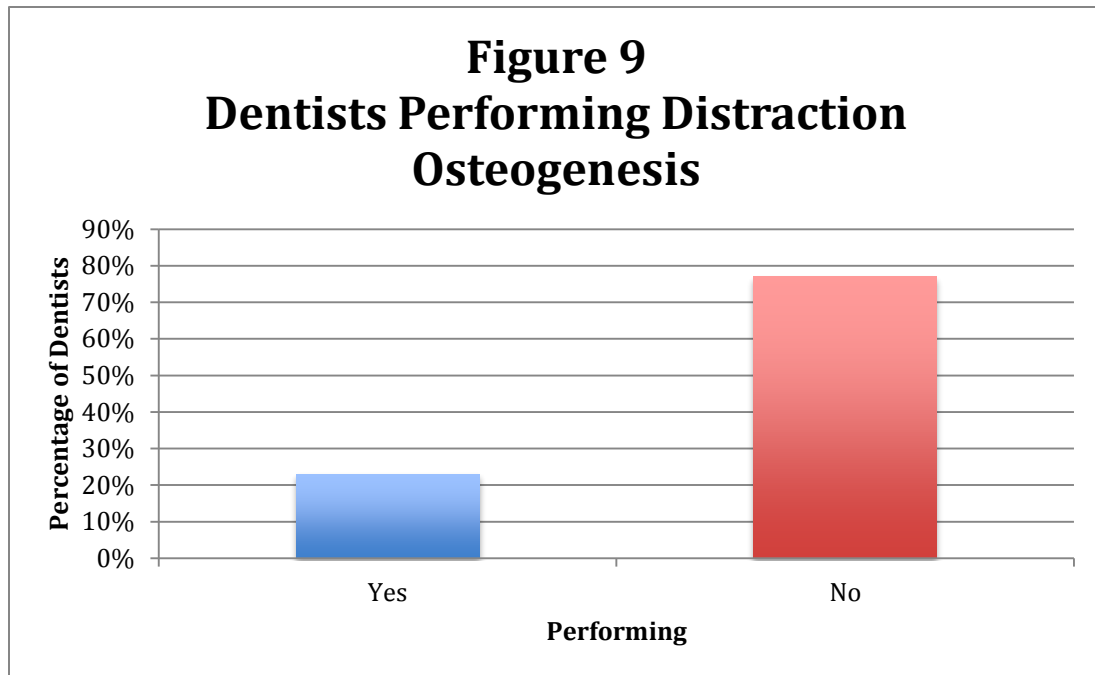


From this question, the responders who answered 'yes' continued on to the next question and the survey ceased for those who answered 'no'.

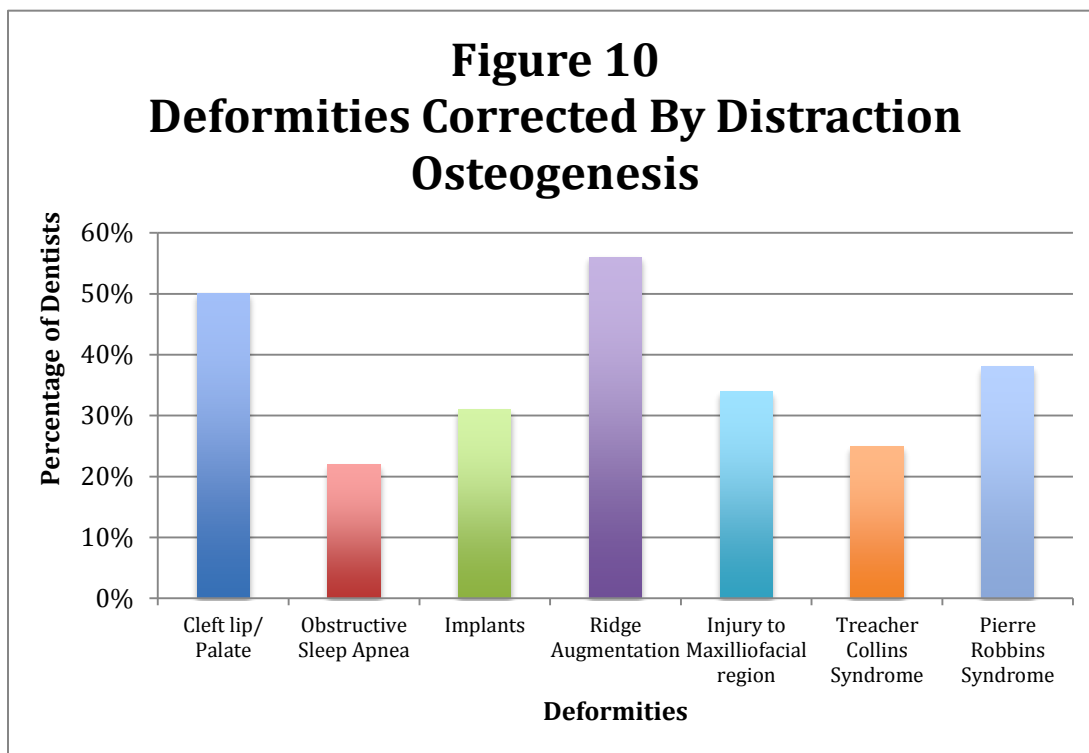
The next question examined knowledge of treatment options when using this technique. Options were provided to assess knowledge of dentists pertaining to treatment modalities associated with distraction osteogenesis. Implants, ridge augmentation, obstructive sleep apnea, traumatic injury to the maxillofacial region, cleft palate, Pierre Robbins syndrome, and Treacher Collins syndrome were the options available to check pertaining to this question. When analyzing the data, it was revealed that the most common response was ridge augmentation with 117 respondents (72.0%) followed by traumatic injury to the maxillofacial region with 109 respondents (67.0%), and 98 (60.0%) of the respondents were familiar with the use of distraction osteogenesis to treat cleft palate. Remaining responses included implants with 97 respondents (60.0%), Pierre Robbins syndrome with 90 respondents (56.0%), Treacher Collins syndrome with 76 respondents (47.0%), and obstructive sleep apnea with 55 respondents (34.0%) (Figure 8).



The next question sought to determine if the respondents had performed distraction osteogenesis. With 168 total responses (Figure 9), 129 (77.0%) replied no and 39 (23.0%) answered yes.

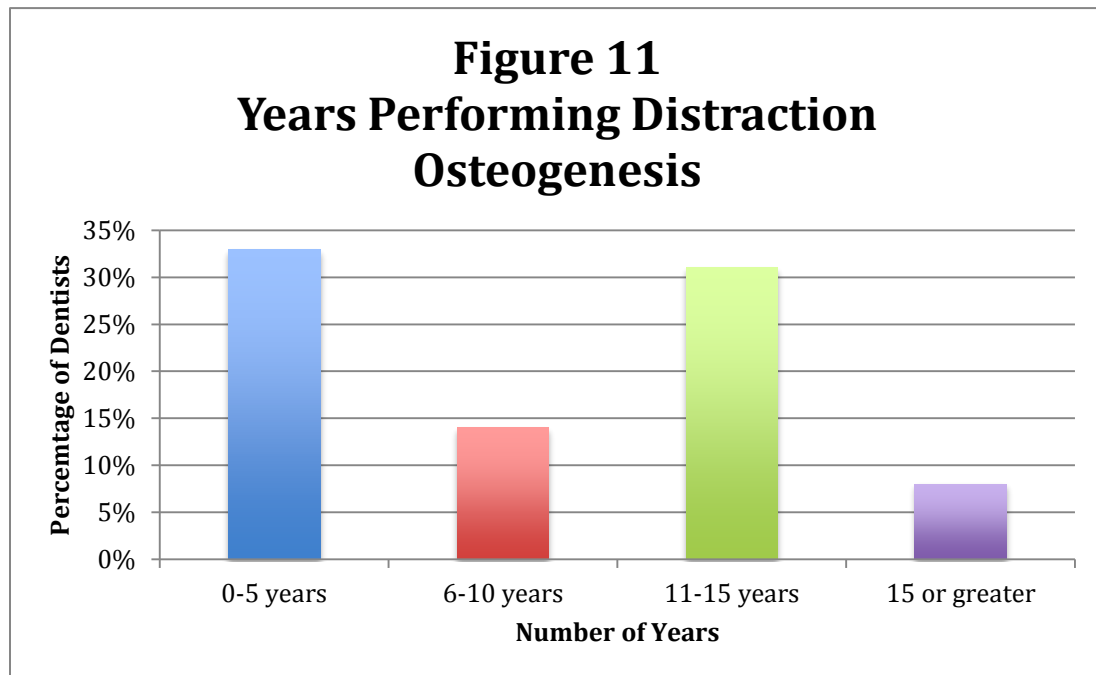


Further, the researcher wanted to know for which aspects these dentists have used distraction osteogenesis. Of dentists who have used this technique, 18 (56.0%) responded that they had used it for ridge augmentation, 16 (50.0%) had used it to treat cleft palate, 12 (38%) had used it to treat Pierre Robbins Syndrome, 11 (34.0%) had used it to treat traumatic injury to the maxillofacial region, 10 (31%) had used it to for implants, 8 (25.0%) had used it to treat Treacher Collins Syndrome, and 7 (22.0%) had used distraction osteogenesis to treat sleep apnea (Figure 10).

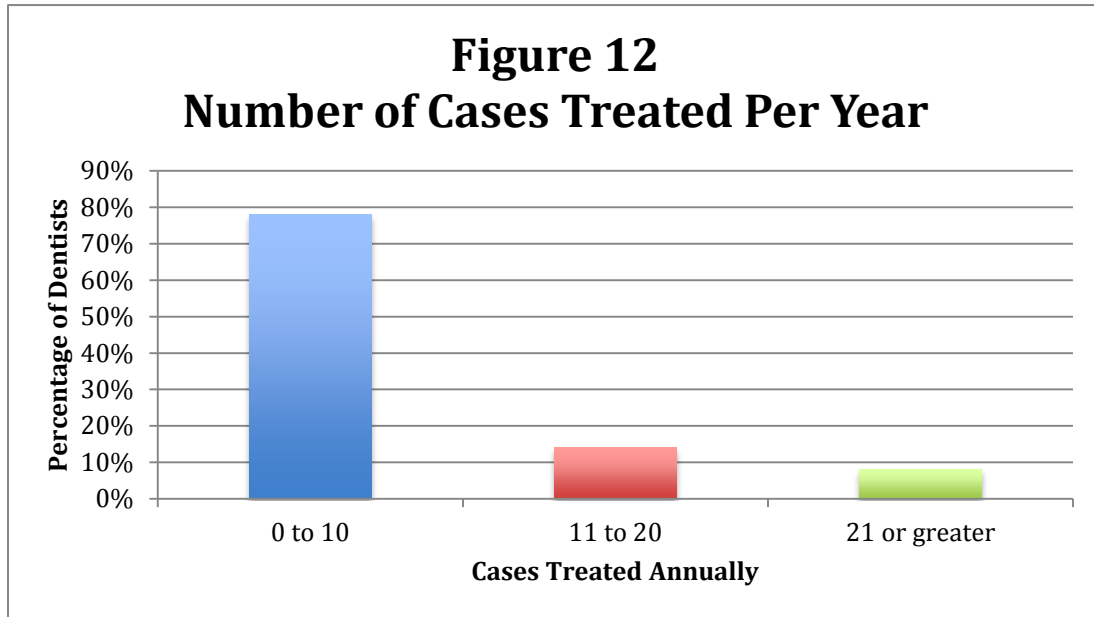


The researcher then sought to determine more information from those respondents who had used distraction osteogenesis. Information that was gathered included how long they have been performing distraction osteogenesis, the number of cases treated annually, and if they believe this is the best treatment option for their patients. The remaining dentists were given time increments of 0-5 years, 6-10 years, 11-15 years, 16-20 years, and 21 years or greater to determine how long they have been performing this procedure. With this information the researcher would be able to determine if this is a new procedure being used clinically. The majority of the respondents [n = 12(33%)] indicated that they had only been using distraction osteogenesis between 0 and 5 years. Eleven respondents indicated that they had been using distraction osteogenesis between 11 and 15 years. Five respondents indicated that they had been using distraction osteogenesis between 6 to 10 years

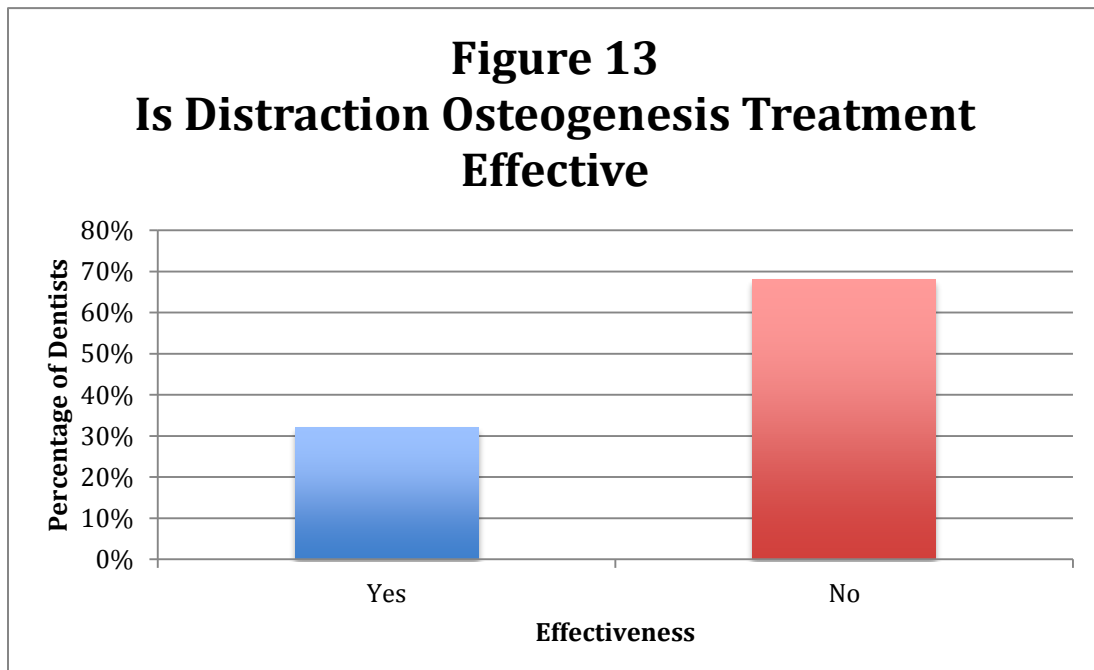
and five respondents indicated that they had been using distraction osteogenesis 21 years or greater. Lastly, 3 respondents indicated that they had been using distraction osteogenesis between 16 and 20 years. (Figure 11)



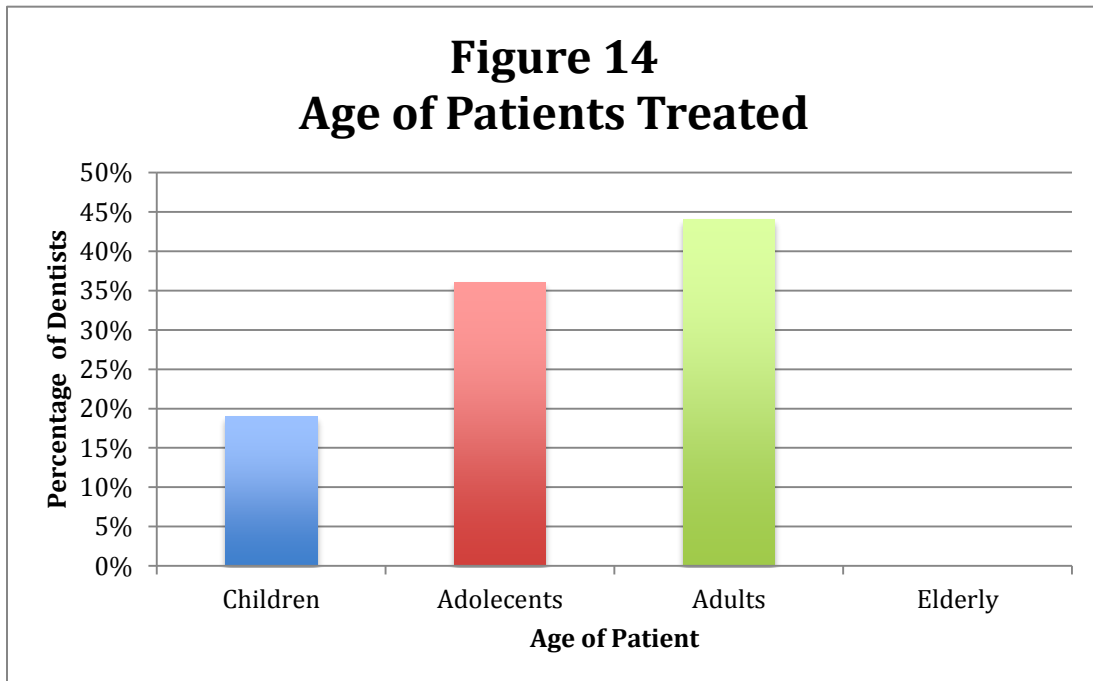
Knowing the average number of years practiced with this technique, the researcher furthered the questioning by asking how many cases per year each dentist treated cases with distraction osteogenesis. The majority of respondents (n = 28) said 0 -10 cases, 5 practitioners responded that they typically treat 11-20 cases per year with distraction osteogenesis, and 3 practitioners responded that they typically treat 21 cases or greater per year with distraction osteogenesis, (Figure 12)



Another question in the survey determined whether the respondents believe this is an effective treatment modality for their patients. The question asked if distraction osteogenesis is the most ideal treatment for implants and ridge augmentation. With 34 total responses, 11 (32.0%) replied yes, and 23 (68.0%) said no (Figure 13).



The final question of the survey asked the respondents about the ages of the patients being treated. With 36 final responses, 16(44.0%) said adults, 14 (36.0%) said adolescents, 7 (19.0%) replied children, and no respondent indicated that they performed distraction osteogenesis on the elderly (Figure 14).



The next chapter will discuss implications of the survey results. It will also give indications as to future uses of distraction osteogenesis.

Chapter V

Conclusion

Having obtained many responses from dentists in Tennessee and Kentucky, the researcher has gained much knowledge on the clinical practice of distraction osteogenesis. This study gave the researcher more insight on what this technique is being used for and that the awareness of this procedure is greater than thought. Sixty four percent of the respondents indicated that they were aware of distraction osteogenesis. This number of respondents who were aware of the procedure is higher than the researcher hypothesized. Although only 39 participants responded to performing this technique, this was also a much higher number than anticipated by the researcher. Results showed that people are aware of distraction osteogenesis and this technique is being performed.

Surprisingly, 32% of the respondents believed that distraction osteogenesis was an effective procedure while 68% believed it was not. Since the vast majority of respondents do not believe distraction osteogenesis is effective, it is likely that this affects the number of cases being treated per year. If dentists do not believe it is an effective technique, it will not be a commonly used procedure in the future. Results show that the majority of the dentists that performed this procedure only treat 1-10 cases per year. This may have to do with the abnormality being treated or the type of patient being seen. More research will be needed to determine if this technique is

an effective treatment option.

Information gathered from the survey can be useful to practicing dental hygienists and dentists. Knowing treatment options is essential to provide optimal care for each individual patient. Although the survey responses indicated more than half of dentists knew of distraction osteogenesis, results showed these were newly practicing dentists. These results infer that this technique may be taught more in dental schools today and is a procedure that is on this rise.

Further research will be needed to know the awareness of this surgical technique in the United States. The scope in which the researcher surveyed is only a small sample of practicing dentists in the United States. The awareness of this procedure will only become more common if more clinical studies and research on the effectiveness of the procedure are conducted. Without more clinical studies to determine the efficacy of distraction osteogenesis, awareness could decrease. To better benefit patients at hand, educating dental professionals with this technique will be an essential asset to the awareness.

Appendix A

INFORMED CONSENT DOCUMENT

Project Title: Analyzing the Regionalized Awareness of Distraction Osteogenesis
Investigator: Ali Weinzapfel, Department of Allied Health, 270-745-6274,
ali.weinzapfel661@topper.wku.edu.

You are being asked to participate in a project conducted through Western Kentucky University. The University requires that you give your agreement to participate in this project.

The investigator will explain to you in detail the purpose of the project, the procedures to be used, and the potential benefits and possible risks of participation. You may ask any questions you have to help you understand the project. A basic explanation of the project is written below. Please read this explanation and discuss with the researcher any questions you may have. You should keep a copy of this form for your records.

1. **Nature and Purpose of the Project:** There are multiple treatment options available to initiate bone growth within the oral cavity. Distraction osteogenesis is one of many techniques performed within dentistry to achieve this ultimate goal. As a dental hygienist, it is important to be aware of these various procedures to provide current treatment options and inform each individual patient based on their particular needs. As dentistry is always evolving, it is imperative to relay current trends to other professionals within the field of dentistry.
2. **Explanation of Procedures:** Each dentist is requested to respond to a questionnaire pertaining to the awareness and/or use associated with the distraction osteogenesis procedure. A survey is being conducted through the use of WKU Qualtrics survey software. Upon data collection, results will be analyzed to determine awareness and implementation of the procedure within Kentucky and Tennessee.
3. **Discomfort and Risks:** There is no known associated discomfort or risk.
4. **Benefits:** The results from this survey will provide an idea of what percentage of practices are aware of this technique and are presently performing it. Gaining knowledge of what trends are seen throughout Kentucky and Tennessee will provide direction to inform the dental community about this procedure.
5. **Confidentiality:** All data will be maintained within the WKU Program of Dental Hygiene and securely kept. All participants will be protected using Qualtrics software through WKU with a personal identification number keeping the response confidential.
6. **Refusal/Withdrawal:** Refusal to participate in this study will have no effect on any future services you may be entitled to from the University. Anyone who agrees to participate in this study is free to withdraw from the study at any time with no penalty.

You understand also that it is not possible to identify all potential risks in an experimental procedure, and you believe that reasonable safeguards have been taken to minimize both the known and potential but unknown risks.

Your continued cooperation with the following research implies your consent.



THIS PROJECT HAS BEEN REVIEWED AND APPROVED BY
THE WESTERN KENTUCKY UNIVERSITY INSTITUTIONAL REVIEW BOARD
Paul Mooney, Human Protections Administrator
TELEPHONE: (270) 745-2129

WKU IRB# 16-231
Approval - 12/8/2015
End Date - 5/6/2016
Expedited
Original - 12/8/2015

Appendix B

1. After reading the informed consent document, do you agree to participate in the survey?
 - A. Yes
 - B. No
2. In what state do you currently practice?
 - A. Kentucky
 - B. Tennessee
 - C. Other
3. What is your current age?
 - A. 25-34
 - B. 35-44
 - C. 45-54
 - D. 55-64
 - E. 65 or older
4. What is your gender?
 - A. Male
 - B. Female
5. Please describe your practice setting?
 - A. Solo
 - B. With an individual partner
 - C. Within a group practice (3 or more dentists)?

6. How long have you been practicing dentistry?
 - A. Less than 5 years
 - B. 5-10 years
 - C. 11-15 years
 - D. More than 15 years

7. Which of the following best describes your primary focus of practice?
 - A. General Dentistry
 - B. Oral Surgeon
 - C. Periodontist
 - D. Pediatric Dentist
 - E. Prosthodontist
 - F. Endodontist
 - G. Educator
 - H. Other

8. What is your zip code in which you primarily practice?

9. Are you aware of distraction osteogenesis procedure?
 - A. Yes
 - B. No

10. Of the following aspects, which are you aware of distraction osteogenesis being a treatment option?
 - A. Implants
 - B. Ridge Augmentation
 - C. Obstructive Sleep Apnea

- D. Traumatic Injury to the Maxillofacial Region
 - E. Cleft Palate
 - F. Pierre Robbins Syndrome
 - G. Treacher Collins Syndrome
11. Have you performed a dental procedure using distraction osteogenesis?
- A. Yes
 - B. No
12. Of the following aspects, which of these treatment modalities have you performed using distraction osteogenesis?
- A. Impants
 - B. Ridge Augmentation
 - C. Obstructive Sleep Apnea
 - D. Traumatic Injury to the Maxillofacial Region
 - E. Cleft palate
 - F. Pierre Robbins Syndrome
 - G. Treacher Collins Syndrome
13. How long have you been performing this procedure?
- A. 0-5 years
 - B. 6-10 years
 - C. 11-15 years
 - D. 16-20 years
 - E. 21 years or greater

14. What is an estimate of cases treated per year using this technique?
- A. 0-10 cases
 - B. 11-20 cases
 - C. 21 cases or greater
15. Of the following groups, on whom do you primarily perform this procedure?
- A. Child
 - B. Adolescent
 - C. Adult
 - D. Elderly

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