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Bone Stimulation Implemented Using the L-PRF Technique within the Clinical Setting in Kentucky and Tennessee

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BONE STIMULATION IMPLEMENTED USING THE L-PRF TECHNIQUE WITHIN
THE CLINICAL SETTING IN KENTUCKY AND TENNESSEE

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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2015

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ABSTRACT

Leukocyte Platelet Rich Fibrin (L-PRF) is an autologous graft that is obtained from the patient's blood. This provides a condensed network of fibrin that is saturated with cytokines, growth factors, and platelets. L-PRF speeds up the healing process and also optimizes bone grafting results.

Dental treatment options are expanding and new techniques within the office setting are constantly being developed. Present treatment modalities can assist with the stimulation of tissue formation after dental surgical procedures, leading to various results. The placement of L-PRF provides enhanced healing following specific dental procedures using the patient's donor tissue; therefore, reducing the opportunity for infection and optimizing the final outcome.

A survey was conducted among dentists throughout the states of Kentucky and Tennessee to determine the level of awareness and use of L-PRF within the office setting. The results revealed there is a moderate awareness and low occurrence of use in the states of Kentucky and Tennessee based on the responses received.

Keywords: Leukocyte, fibrin, bone stimulation, dentistry, L-PRF

Dedicated to my family, friends, and the amazing WKU Dental Hygiene faculty who have supported me throughout this journey.

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CHAPTER 1

INTRODUCTION

As dental treatment options are expanded, new techniques within the office setting are constantly being developed. Present treatment modalities can assist with the stimulation of tissue formation after dental surgical procedures leading to various results. The placement of Leukocyte Platelet Rich Fibrin (L-PRF) provides enhanced healing following specific dental procedures using the patient's donor tissue and therefore optimizes the final outcome. As a dental hygienist, it is important to understand current available dental techniques to inform patients of viable treatment alternatives and to educate fellow dental professionals regarding this approach.

L-PRF mimics and prolongs the effects of typical physiologic wound healing. By releasing the cytokines and platelets necessary for healing over an extended period of time, healing begins more rapidly and is accomplished at a faster rate. This is especially important in dentistry because many procedures require multiple steps before completion with each step building and relying on the success of the previous one. For instance, in order for an implant to be placed, a patient must have an adequate amount of bone present for the implant to be stable and successful. If a tooth has been extracted or bone has been lost over time, the patient must endure subsequent procedures to prepare the site before a dental implant can be placed. It can take as long as six months to one year before the patient completes treatment.

The use of L-PRF can condense appointments and provides the patient with enhanced healing, fewer appointments, and a faster end result. Added to the minimal risk of infection or complications, this is an excellent treatment modality that can be utilized in the dental office in many ways to better benefit patients.

CE/T Statement

There will be a low level of awareness and use of the L-PRF technique among the dental community of Kentucky and Tennessee. Because this is a relatively new procedure, many dentists will either be unaware of the technique or not currently practicing its use. The purpose of this study is to determine the extent of awareness and active practice of the L-PRF technique within Kentucky and Tennessee. In addition to determining the state of practice, the researcher will focus on whether there is a correlation between the use of L-PRF and the age of the practitioner, scope of dentistry being practiced, number of years each dentist has been practicing, number of practitioners in each office, and size of the surrounding population. This will help to better determine if there is a trend behind its use within the clinical setting.

CHAPTER 2

REVIEW OF LITERATURE

There are many circumstances in dentistry in which a patient may greatly benefit from a bone graft or other treatment options that influence new bone growth. There are many bone grafting procedures available to patients, each with its own limitations. These constraints encourage the continual discovery of new treatment alternatives.

A graft is defined by Weinberg, 2010, as “any tissue or organ used for implantation or transplantation.” Bone grafts use human, animal, and synthetic substitutes to implement growth. They are divided into four categories based upon the origin of the bone: autografts, allografts, alloplasts, and xenografts.

Autografts and allografts are associated with human donors. An autograft is bone taken from and placed in the same individual. These have the highest potential for success since the bone is obtained from the recipient. Unfortunately, this is not always an option for patients and an allograft is necessary. Allografts are retrieved from one individual and placed in a different individual. They typically consist of demineralized freeze-dried bone that is taken from a cadaver. Similar to the autograft, allograft studies have shown high success rates, greater bone growth, and the construction of a new attachment apparatus.

Alloplasts are synthetic bone substitutes which means they are made of nonliving materials. They offer more of a support system for surrounding bone and are present for

bone to grow around, but do not have the capability to form bone, unlike a tissue-derived graft. However, alloplasts carry no risk of disease transmission and the patient does not have to undergo any additional procedures to collect bone. An example of an alloplast is a dental implant. Although the implant cannot stimulate bone growth itself, most manufacturers now spray implants with a hydroxyapatite coating which induces bone growth to help healing and stabilization occur more quickly. Xenografts are bone substitutes taken from a different species, such as bovine (Weinberg, 2010).

Because these modalities are limited in their results, it is necessary for dentistry to continue evolving and discovering new treatment approaches. Leukocyte Platelet Rich Fibrin (L-PRF) is an autologous graft that is obtained from the patient's blood. This provides a condensed network of fibrin that is saturated with cytokines, growth factors, and platelets. L-PRF speeds up the healing process and also reduces the need for bone grafts. It is capable of generating both soft tissue and bone and can be used in conjunction with a bone substitute or alone. There are many circumstances where bone growth needs to be implemented for the success of a procedure.

The L-PRF procedure is a simple one beginning with drawing a patient's blood and placing it in a centrifuge for twelve minutes without the addition of an anticoagulant. During the centrifuge process, the blood coagulates and separates into three distinct layers. The bottom layer is a red blood cell (RBC) layer that is removed and discarded while the top layer encompasses a cell-free layer that is also unused. The middle layer is a mesh network which contains the majority of the platelets and fibrin. This layer can be compressed into a membrane or shaped into a plug depending on what treatment is

needed. The fibrin is easily manipulated and placed, allowing it to be used with many different treatment options.

Once placed, the L-PRF continues to release growth factors for up to seven days which speeds up healing time. It is very pliable, which makes it a convenient and minimally invasive addition to dental procedures. The cost for this procedure is lower than many options for patients due to the fact that fewer materials are needed since the patient is supplying his or her own tissue (blood) for the procedure. Additionally, because the tissue is taken from the patient, its use removes the risk of infection and disease transmission which greatly diminishes the chance of rejection. L-PRF is currently being researched in association with many dental procedures. Some examples include extractions, implant placement, and sinus lifts.

Peck, Marnewich, and Stephen conducted a case study in 2011 to determine the success of placing L-PRF in an extraction site to aid in alveolar ridge preservation in preparation for implant placement. Their subject was a 43-year old healthy female who presented with the need for an implant in her upper right quadrant. The prognosis for the only remaining molar was poor and extraction deemed the best course of action. The patient's tooth was extracted and blood drawn to be centrifuged. Three membranes were made from the L-PRF layer of the blood, placed in the extraction site, and sutured into place. The patient was prescribed a 0.2% chlorhexidine gluconate rinse and seen two weeks later to monitor healing.

At the follow-up appointment, the patient reported very little discomfort following the procedure. The extraction site revealed that the membrane was still discernable, in position, and free of inflammation or infection. The patient returned four

weeks later for implant placement (a total of six weeks following tooth extraction). Radiographs were taken throughout the entire process to track the progress. The patient returned again at three months for another follow-up appointment and radiograph. The radiograph revealed peri-implant bone maturation and stability. The implant remains functional and without complications.

The researchers found this to be a simple procedure that offers a less expensive alternative to other treatment modalities by requiring less need for synthetic grafting materials. L-PRF initiates bone formation and healing at a more rapid rate than other grafting procedures and greatly diminishes the possibility of infection.

Also interested in the effect of placing L-PRF in an extraction site while simultaneously placing an implant, EL Kenawy, EL Shinnawi, Salem, & Ahmed (2014) conducted a study on 15 individuals. Similar to other studies, each patient rinsed with chlorhexidine gluconate prior to the procedure. A flap was prepared and the tooth extracted. The socket was then irrigated and curetted thoroughly. Each site for implant insertion was continuously irrigated while being drilled to necessary dimensions based on implant size. Implants were inserted two to three millimeters beyond the original apex level to aid in stability. Following this, the space left between the socket wall and implant was packed with deproteinized bovine bone material (DBBM). An L-PRF membrane was positioned and sutured into place.

Following treatment, each patient was prescribed 500 mg of amoxicillin for five to seven days. Oral hygiene instructions were demonstrated and a soft food diet was recommended for the next one to two weeks. Sutures were removed seven days post treatment and exams were scheduled every week for the following three weeks. At four

to six months, patients returned for healing cap placement, then two weeks later for abutment delivery.

The implants were re-assessed every three months over a one-year period. Implant success was evaluated based on stability, sulcular bleeding, peri-implant pocket depth, and radiographic findings. Results of this study revealed a 100% percent success rate with ideal osseointegration and no post-operative problems.

Sinus lifts are conducted for many reasons, but the most common reason is so there is enough bone available to place an implant. A study was conducted by Mazor, et al (2009) to determine the success of using L-PRF in a simultaneous sinus lift and implant placement procedure. Sinus lifts are necessary when a natural tooth has been lost and the floor of the maxillary sinus, the Schneiderian membrane, begins to collapse into an edentulous area which prevents bone development from occurring. A sinus lift is performed to lift this membrane to allow more space for bone expansion. Additionally, bone or bone-implementing material is placed to encourage bone growth in the area so as to stabilize a future dental implant. Typically, the graft must be placed four to six months prior to implant placement; however, new methods are improving the success of completing both procedures at the same time.

The use of L-PRF is compared to two known sinus lift techniques in this study. The first sinus lift technique is the Caldwell-Luc osteotomy technique, which uses a window cut into the lateral side of the maxilla for optimal direct vision. The Schneiderian membrane is lifted and an absorbable collagen membrane is placed between it and the bone graft. The second is the Osteome Technique (Summers Technique) which is less invasive and an implant can be placed immediately. It is performed by creating a

small hole in the jaw, lifting the sinus floor, and placing bone grafting material between the sinus floor and the remaining bone.

Between June 2007 and June 2008, Mazor, et al (2009) collected data from 20 subjects by performing 25 sinus elevations and placing 14 implants. There was no control group, but participants had to be in general good health and meet certain criteria. Each implant placed was either tapered or micro-threaded. All were similar in length and width and there was approximately 2.9 millimeters of bone height remaining in each edentulous area. A full tissue flap was elevated and an ultrasonic lancet used to open a bony window. The Schneiderian membrane was delicately lifted and the bony window attached to support the new sinus floor. This protects the sinus membrane and promotes bone development. Several vials of blood (72mL) were taken from each subject and centrifuged. The PRF clots were removed and membranes compressed to be placed in each sinus. One to two PRF membranes were placed on the Schneiderian membrane in case there were any undetectable holes created during the procedure. The implants were placed with the tips acting in a “tent peg” manner to hold the new sinus floor in place. One to two more PRF membranes were placed over the window before the flap was replaced to prevent invagination of the gingival mucosa. Patients were put on a 14-day chlorhexidine gluconate rinse regimen, six days of amoxicillin, and instructed to take ibuprofen as needed.

Eight to ten days following the procedure, a panoramic radiograph revealed no obvious change in bone density; however, six months later, the treated sites were filled with a dense bone-like tissue. Also noted at the six month reassessment, there was

minimal discomfort and ideal healing for each subject and all implants presented in a stable state.

While no control group was present in this study, subjects were required to meet criteria within a specific range. Six months after treatment, the procedure was deemed to have been 100% successful. This study helps reveal new avenues and methods in bone implementation using L-PRF. Ultimately, it allows more progressive treatment, fewer appointments, and advanced healing for patients.

Also interested in sinus floor elevation using L-PRF, was Toffler, Toscano, and Holtzclaw, 2010. They treated 110 patients with 138 sites of implant placement from November 2008 to January 2010. The remaining bone height per site ranged from 4-8 millimeters (mm) with the average being 6.6 mm.

Each patient was pre-medicated one hour prior to surgery with either 2.0 g of amoxicillin or 500 mg of azithromycin. Additionally, each patient rinsed with chlorhexidine gluconate for one minute before the procedure began. The researchers used a method similar to the Summers' technique with a few modifications. Two to six vials of blood were drawn from each patient and centrifuged to create L-PRF clots which were removed and compressed to create plugs. A full thickness flap was reflected and the crestal bone site prepared using calibrated drills. A greenstick fracture of the sinus floor was induced using a rapid-expansion-limited-bone. As the cortical bone making up the sinus floor was displaced apically, the Schneiderian membrane moved with it. In order to check for undetectable membrane perforations, the researchers used the Valsalva method. This is done by having the patient pinch the nostrils closed and blow through the nose while the site of the osteotomy is being viewed. Any perforations observed were

patched with L-PRF for repair and the plugs placed in each prepared implant site. As the implants were placed, the researchers were careful to stay 0.5-1 mm below the new sinus floor level to minimize the likelihood of perforating the membrane, but were able to place the tip of each implant at least 2 millimeters apical to the original sinus floor level. Similar to the study conducted by Mazor, et al (2009), the tips of the implants were used in the same manner as tent pegs to hold the membrane in place.

Post-surgery, each patient received a prescription for an antibiotic, a non-steroidal anti-inflammatory drug (NSAID), and chlorhexidine gluconate rinse. Patients were instructed on home care and to sneeze with an open mouth for seven days. Additionally, post-operative instructions included informing the patient not to smoke or drink through a straw. The patients were also instructed to avoid nose blowing and the use of nasal spray for 72 hours.

Success of treatment was based upon the absence of implant mobility, patient pain, and peri-implant infection or radiolucency. After 11 months, the success rate of the implants was calculated at 97.8%. Three implants failed, but two were able to be replaced and deemed successful. On average, the increase of bone height per implant site ranged from 2.5 mm to 5 mm, with the average being 3.4 mm.

The use of L-PRF in conjunction with this particular procedure produces relatively predictable results. Its use is consistently efficient and reduces both the sinus graft healing time as well as patient treatment time overall. L-PRF provides protection to the Schneiderian membrane during osteotome use and aids in wound closure in the event a perforation occurs.

In conclusion, the use of L-PRF is an asset to the dental procedures listed above. It is added to a treatment modality to make the surgical and healing process easier on the patient. Using the patient's own tissue greatly aids in a quicker healing time and minimal to no risk of infection.

Still missing from the literature, however, are studies which examine the trend of the awareness and use of the L-PRF technique throughout the states of Kentucky and Tennessee. The next chapter describes the methodology used to conduct the study.

CHAPTER 3

METHODOLOGY

A survey (Appendix A) was conducted among dentists throughout the states of Kentucky and Tennessee to determine the level of cognizance and implementation of L-PRF within the office setting. The survey contained 13 questions and began by collecting demographic, age, gender, and current practice related information. The remaining questions followed the theme inquiring who is aware of the L-PRF technique and how it is used in an office environment. Western Kentucky University Institutional Review Board (IRB) approval was granted for the project in November 2014 (WKU IRB #15-199).

Email addresses for all dentists within Kentucky and Tennessee were provided by their respective Boards of Dentistry. Each dentist received an email with a link to answer a questionnaire pertaining to the awareness and/or use associated with the L-PRF procedure. The email provided a greeting (Appendix B) from the researcher and an invitation for participation via a link to the survey. Each recipient read an informed consent document (Appendix C) with an explanation about the survey and then had the option to continue with participation. The survey was conducted through the use of Qualtrics survey software provided by Western Kentucky University. The identity of each participant was protected by the software through the use of a personal identification number to represent each individual and keep the response anonymous.

The survey was “live” for a two-month period. An email was sent at the beginning of the two month period as well as a reminder email approximately one-month later with an invitation for survey participation. There were no anticipated risks associated with this survey.

Following the end of the two-month period, SPSS® software was used to validate the data and descriptive statistics were used to analyze the data. The data was reviewed and compared to the survey results to better understand the actual appreciation and practice of the L-PRF technique within the clinical setting of Kentucky and Tennessee. The next chapter details the results of this study.

CHAPTER 4

RESULTS

This chapter will examine the findings of the survey that was distributed to dentists in the states of Kentucky and Tennessee. The questions were formatted to determine who is aware of the L-PRF technique, who is using the technique, and the location of where they are practicing. The remaining questions were asked to determine each dentist's age and gender to see if this technique is more prominent in one aspect or another. Questions were also asked regarding the length of time each dentist has been practicing along with the size of his or her office and number of dentists on staff. Several questions focus on demographics to aid in evaluating where this procedure is being used most frequently. Each dentist was asked to enter his or her zip code and the population surrounding his or her practice to determine this information. Additionally, the dentists were questioned regarding what scope of dentistry they currently practice and what procedures they perform within their clinical setting.

Each dentist was questioned if he or she is familiar with the L-PRF technique (Figure 3). There were 225 total responses to the question with 83 dentists (36.9%) being familiar and 142 (63.1%) being unfamiliar. Of the 83 who are familiar with this technique, 43 (51.8%) practice in Kentucky and 35 (42.2%) practice in Tennessee. There were also 5 out of state responses that will not be counted in the data since they are outside the states of focus.

Dentists were also questioned on whether they are actively using L-PRF in the office setting (Figure 4). Of the 226 responses, 18 dentists (8.0%) are using this technique in their practice and 208 (92.0%) are not. Of the 18 who use L-PRF, 8 practice in Kentucky, 8 practice in Tennessee, and 2 practice in Florida. The Florida responses will not be included in the data because they are outside the states of interest.

The overall results in regards to the state of practice reveal that 216 dentists responded with 114 (52.8%) practicing in Kentucky and 102 (47.2%) practicing in Tennessee.

Of the 222 responses regarding the size of their surrounding area, 21 (9.5%) dentists practice in an area with a population of 0-10,000; 94 (42.3%) practice in an area of 10-100,000; and 107 (48.2%) practice in an area of over 100,000.

Age range was reported by 223 of dentists with 24 (10.8%) ranging from an age of 25-35 years; 35 (15.7%) from 36-45 years; 55 (24.5%) from 46-55 years; 71 (31.8%) from 56-65 years; and 38 (17.0%) were over the age of 65. The majority of the 224 dentists who responded to the question regarding gender were male with a response of 184 (82.1%) and the remaining 40 (17.9%) were female.

Of the 224 responses to the question regarding the length of time each dentist has been practicing, 10 (4.5%) have been practicing for fewer than 5 years; 23 (10.3%) practicing 5-10 years; 18 (8.1%) practicing 11-15 years; and 173 (77.2%) over 15 years.

There was a response of 218 dentists regarding the number of practitioners in each office with 114 (52.3%) practicing solo; 80 (22.9%) having 2-3 practitioners; and 24 (11.0%) having more than 3 practitioners. Of the 223 dentists who responded in regards

to the number of operatories present, 50 (22.4%) have 3 or fewer; 97 (43.5%) have 4-6; 46 (20.6%) have 7-10; and 30 (13.5%) have more than 10.

To better evaluate the main concentration of the dentists surveyed, there were eight disciplines listed from which the dentists were instructed to select all that applied. The eight fields listed were private practice as an owner; private practice as an associate; hospital; research; administration; education; consultant; and “other” with a text box for personalized responses. Of the 252 dentists who responded, 182 (72.2%) participants selected private practice as an owner; 21 (8.3%) selected private practice as an associate; 11 (4.4%) selected hospital; 3 (1.2%) selected research; 3 (1.2%) selected administration; 15 (6.0%) selected education; 5 (2.0%) selected consulting; and 12 (4.8%) wrote in other responses. The personalized responses consisted of public health, OMFS resident, public health (mobile unit), oral pathology, contract dentist for nursing homes, military, partner in a dental practice, private group practice, retired, and National Guard.

Similarly in the following question, there were eight options from which each dentist could select his or her main scope of practice. The eight options listed were general practice, oral surgery, periodontics, orthodontics, prosthodontics, endodontics, pediatrics, and an “other” option with a text box for manual entry of any option not listed. Responses totaled 226 with 158 (70.0%) practicing general dentistry, 16 (7.0%) practicing oral surgery, 11 (4.9%) practicing periodontics, 12 (5.3%) practicing orthodontics, 1 (0.4%) practicing prosthodontics, 4 (1.8%) practicing endodontics, and 14 (6.2%) practicing pediatrics. Ten (4.4%) selected the “other” option listing education, dental sleep medicine, general dentist seeing only children, implant dentistry, oral pathology, implantology, retired, and TMD/OFP/sleep medicine.

Each dentist was instructed to select as many applicable procedures from the options listed to gain a better understanding regarding the procedures performed by dentists participating in the survey. The procedures listed were extractions, implant placement, sinus lift, cleft palate repair, palatal expansion, distraction osteogenesis, treatment of osteonecrosis of the jaw, and bone grafting. There were 468 total responses with 197 (42.1%) dentists performing extractions, 77 (16.5%) performing dental implants, 46 (9.8%) performing sinus lifts, 8 (1.7%) performing cleft repairs, 30 (6.1%) performing palatal expansion, 8 (1.7%) performing distraction osteogenesis, 25 (5.3%) treating osteonecrosis of the jaw, and 77 (16.5%) performing bone grafting procedures.

If the dentists responded that they are currently using L-PRF in their office, they were asked two additional questions. The first was regarding the length of time the procedure had been used in their office (Figure 5). Of the 16 who responded, 4 (25.0%) have been using L-PRF for 0-6 months; 4 (25.0%) have been using L-PRF for 7 months to 12 months; and 8 (50.0%) have been using L-PRF for over 1 year. The second additional question inquired which procedures each dentist paired with the L-PRF technique (Figure 6). Dentists were given eight procedures from which to choose and were instructed to select all that applied. The procedures listed were extractions, implant placement, sinus lift, cleft palate repair, palatal expansion, distraction osteogenesis, treatment of osteonecrosis of the jaw, and bone grafting. The responses showed that 10 (16.4%) practitioners use L-PRF following extractions; 14 (23.0%) to aid in implant placement; 15 (24.6%) for sinus lifts; 0 are using it for cleft repairs or palatal expansion; 1 (1.6%) practitioner uses L-PRF for distraction osteogenesis; 2 (3.3%) use it for the

treatment of osteonecrosis of the jaw; 18 (29.5%) use it for bone grafting procedures; and 1 (1.6%) selected the “other” option listing soft tissue augmentation as its use.

To further break down the results from the survey, several questions were selected to evaluate the correlation between the dentists who are aware of and/or use L-PRF and their respective state, age, scope of dentistry, years in practice, number of dentists in the practice, population size, and zip code to determine the region of Kentucky or Tennessee in which they practice.

Eighty-three dentists responded that they are aware of the L-PRF technique; however, five of those responses were outside the states of focus and will not be used in the data (Figure 3). Of the 78 in-state responses, 43 (55.1%) practice in Kentucky and 35 (44.9%) practice in Tennessee. Based upon the 40 dentists who entered their zip code and are practicing in the state of Kentucky, 27 (67.5%) are practicing in Central Kentucky; 10 (25.0%) in Western Kentucky; and 3 (7.5%) in Eastern Kentucky (Figure 7). Out of the 29 dentists who entered their zip code and are practicing in the state of Tennessee, 20 (69.0%) are practicing in Central Tennessee; 7 (24.1%) in East Tennessee; and 2 (6.9%) in West Tennessee (Figure 8).

Related to the question asking dentists what scope of dentistry they currently practice, 78 responded (Figure 9). Of those 78, 48 (61.3%) are general dentists with 26 (54.2%) practicing in Kentucky and 22 (45.8%) in Tennessee. Eleven (14.1%) periodontists responded with 5 (45.5%) practicing in Kentucky and 6 (54.5%) in Tennessee. There were 7 (9.0%) oral surgeons with 5 (71.4%) practicing in Kentucky and 2 (28.6%) in Tennessee. Six (7.7%) pediatric dentists responded with 5 (83.3%) practicing in Kentucky and 1 (16.7%) in Tennessee. Education was selected by 1 (1.3%)

dentist who practices in Tennessee. Two (2.6%) focus primarily on implant placement, both of whom practice in Tennessee. Endodontics is practiced by 1 (1.3%) in Kentucky, and 2 (2.6%) practice orthodontics with 1 (50.0%) in Kentucky and 1 (50.0%) in Tennessee.

Of the 77 dentists who are aware of the L-PRF technique and who responded to the question regarding the number of years spent in practice (Figure 10), 1 (1.3%) has less than five years of experience and practices in Tennessee. There are 13 (16.9%) dentists who have been practicing from 5-10 years with 8 (61.5%) practicing in Kentucky and 5 (38.5%) in Tennessee; 9 (1.7%) have been practicing from 11-15 years with 4 (44.4%) in Kentucky and 5 (55.6%) in Tennessee; and 54 (70.1%) have been practicing for more than 15 years with 30 (55.6%) in Kentucky and 24 (44.4%) in Tennessee.

The question regarding age was answered by 77 dentists (Figure 11). Of those aware, 9 (11.7%) are from 25-35 years old with 5 (55.6%) in Kentucky and 4 (44.4%) in Tennessee; 17 (22.1%) are from 36-45 with 8 (47.1%) in Kentucky and 9 (52.9%) in Tennessee; 20 (26.0%) are from 46-55 with 14 (70.0%) in Kentucky and 6 (30.0%) in Tennessee; 20 (26.0%) are from 56-65 with 9 (45.0%) in Kentucky and 11 (55.0%) in Tennessee; and 11 (14.3%) are over the age of 65 with 6 (54.5%) in Kentucky and 5 (45.5%) in Tennessee.

The number of practitioners in each dentist's current practice collected a response from 74 dentists who are aware of L-PRF (Figure 12). Of those 74, 44 (59.5%) practice solo with 23 (52.3%) practicing in Kentucky and 21 (47.7%) in Tennessee; 23 (31.1%) have 2-3 dentists in their practice with 13 (56.5%) practicing in Kentucky and 10 (43.5%)

in Tennessee; and 7 (9.5%) have more than three dentists on staff with 4 (57.1%) of those practicing in Kentucky and 3 (42.9%) in Tennessee.

The population of the surrounding area was also evaluated (Figure 13). Of the 76 aware of the procedure, 10 (13.2%) practice in a population of 0-10,000 with 5 (50.0%) practicing in Kentucky and 5 (50.0%) in Tennessee; 27 (35.5%) practice in a population of 10,000-100,000 with 16 (59.3%) in Kentucky and 11 (3.7%) in Tennessee; and 39 (51.3%) practice in a population of greater than 100,000 with 20 (51.2%) in Kentucky and 19 (48.7%) in Tennessee.

There were 18 dentists who responded that they currently use the L-PRF technique in their office (Figure 4). Two of those were out of state and their data will not be included. Of the 16 who are using L-PRF in-state, 8 (50.0%) are practicing in Kentucky and 8 (50.0%) in Tennessee. Based upon the 7 dentists who entered their zip code and are practicing in the state of Kentucky, 5 (71.4%) are practicing in Central Kentucky and 2 (28.6%) in Western Kentucky (Figure 7). Out of the 8 dentists who entered their zip code and are practicing in the state of Tennessee, 7 (87.5%) are practicing in Central Tennessee and 1 (12.5%) in East Tennessee (Figure 8).

The 16 who responded are divided among four scopes of dentistry (Figure 14). There are 9 (56.2%) who practice as general dentists with 6 (66.7%) practicing in Kentucky and 3 (33.3%) in Tennessee; 3 (18.7%) periodontists, all of whom practice in Tennessee; 3 (18.7%) oral surgeons with 2 (66.7%) in Kentucky and 1 (33.3%) in Tennessee; and 1 (6.3%) dentist in Tennessee who focuses primarily on placing implants.

Of the 15 who use this technique and responded to the question regarding the number of years each dentist has been in practice (Figure 15), 1 (6.7%) has been

practicing in Tennessee for fewer than five years; 4 (26.7%) have been practicing 11-15 years with 1 (25.0%) in Kentucky and 3 (75.0%) in Tennessee; and 10 (66.7%) have been practicing for over 15 years with 6 (60.0%) in Kentucky and 4 (40.0%) in Tennessee.

Eleven dentists who are currently using L-PRF responded to the question regarding their age (Figure 16). Of those, 1 (6.7%) is 25-35 years old and practices in Tennessee; 4 (26.7%) are 46-55 with 3 (75.0%) practicing in Kentucky and 1 (25.0%) practicing in Tennessee; 4 (26.7%) are 56-65 with 1 (25.0%) practicing in Kentucky and 3 (75.0%) in Tennessee; and 2 (13.3%) are over the age of 65, both of whom practice in Kentucky.

Of the 14 dentists who responded to the number of practitioners in their office (Figure 17), 6 (42.9%) are practicing solo with 3 (50.0%) in Kentucky and 3 (50.0%) in Tennessee; 5 (35.7%) are working with 3-5 practitioners with 2 (40.0%) in Kentucky and 3 (60.0%) in Tennessee; and 3 (21.4%) are working with more than 3 practitioners with 1 (33.3%) in Kentucky and 2 (66.7%) in Tennessee.

There were 15 responses to the question regarding the size of the dentists' immediate population where they practice (Figure 18). Four (26.7%) are practicing in a population of 10-100,000 with all practicing in Kentucky and 11 (73.3%) are practicing in a population of over 100,000 with 3 (27.2%) being in Kentucky and 8 (72.7%) in Tennessee.

The survey data was analyzed using SPSS®, version 15. Descriptive statistics were utilized to describe the sample characteristics. Moreover, a bivariate analysis included Pearson's Chi Square test (Figure 19). It was performed to examine the relationship between awareness and current use of the L-PRF technique.

The obtained asymptotic value (0.000) was less than the significance value ($p = 0.05$). This indicates a statistically significant relationship between the awareness of the technique and its current use. It could be inferred from the obtained results that if the dentists are aware of the L-PRF technique, they are more likely to implement its use. The Pearson Chi-Square value (30.868) indicates that the test was statistically significant and thus we could reject the null hypothesis.

CHAPTER 5

CONCLUSION

The previous chapter analyzed the results of the survey that was sent to dentists throughout the states of Kentucky and Tennessee. Based on the results drawn from the data, the researcher found there to be a higher level of awareness and use than was anticipated. The trends of both awareness and use are comparable as the majority of the characteristics are similar in both groups. The majority of the dentists who are aware of the L-PRF technique range from 46-65 years old, are practicing general dentistry in an area with a surrounding population of over 100,000 located in the central region of their respective state, and have been practicing dentistry for over 15 years as a solo practitioner. The awareness of the technique was fairly evenly distributed among the states of Kentucky and Tennessee with Kentucky having a slightly higher level of awareness.

The same information is reflected for those who are currently practicing the L-PRF technique. In addition to the above information, the majority of those who are using L-PRF have been doing so for over one year and use it primarily for bone grafting, sinus lifts, and implant placement.

As evidenced in the aforementioned review of research, L-PRF is a technique that greatly benefits dentistry as a whole. Its use achieves a more advanced and enhanced

healing experience for patients and allows some surgical procedures, such as implants, to be completed in fewer appointments.

L-PRF seems to have limitless possibilities and uses when it comes to bone and soft tissue regeneration. Areas for future research could cover its use in various other bone grafting procedures such as cleft palate repair, distraction osteogenesis, and treatment of osteonecrosis of the jaw. Additionally, further research could indicate this as an adjunct technique that could potentially be used to stimulate gingival growth and aid in the repair and/or regeneration of lost attachment as a result of periodontal disease.

One of the primary objectives as a dental hygienist is to educate patients and discuss all treatment options. In order to better benefit patients, it is necessary to be aware of viable treatment alternatives that could encourage a more favorable result. L-PRF is an advantageous technique that provides optimal results when used in conjunction with many dental procedures and is truly an asset to the dental profession.

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APPENDIX A
L-PRF SURVEY

1. In which state do you currently primarily practice dentistry?
 - Tennessee
 - Kentucky

2. What is the zip code of your practice?

3. What is your age range?
 - 25-35
 - 36-45
 - 46-55
 - 56-65
 - Over 65

4. What is your gender?
 - Male
 - Female

5. How long have you been practicing as a dentist?

- Less than 5 years
- 5-10 years
- 11-15 years
- More than 15 years

6. How many dentists do you have in your present work environment?

- Solo
- 2-3
- More than 3

7. How many dental operatories are present in your practice?

- 3 or less
- 4-6
- 7-10
- More than 10

8. What is the population of the surrounding area of your practice location?

- 0-10,000
- 10,000-100,000
- Over 100,000

9. Which of the following disciplines are you currently practicing? Check all that apply.

- Private practice, owner of practice
- Private practice, associate dentist
- Hospital
- Research
- Administration
- Education
- Consultant
- Other _____

10. What is your main scope of practice?

- General Practitioner
- Oral surgery
- Periodontics
- Orthodontics
- Prosthodontics
- Endodontics
- Pediatric

11. What procedures do you currently perform in your practice? Check all that apply.

- Extractions
- Implant placement
- Sinus lift
- Cleft Palate repair

- Palatal expansion
- Distraction Osteogenesis
- Treatment of Osteonecrosis of the jaw
- Bone grafting

12. Are you familiar with the Leukocyte Platelet Rich Fibrin (L-PRF) technique?

- Yes
- No

13. Do you currently use L-PRF in your practice?

- Yes
- No

If participants responded “yes” to number 13, additional questions were prompted.

14. How long have you been using L-PRF?

- 0-6 months
- 7-12 months
- Over one year

15. With which procedures do you use L-PRF? Check all that apply.

- Extractions
- Implant placement
- Sinus lift
- Cleft palate repair
- Palatal expansion
- Distraction Osteogenesis
- Treatment of Osteonecrosis of the jaw
- Bone grafting

Other _____

APPENDIX B

L-PRF GREETING LETTER

Bone Stimulation Implemented Using the L-PRF Technique Within the Clinical Setting
Your participation is requested and appreciated in a survey about the awareness and application

Of the Leukocyte Platelet Rich Fibrin (L-PRF) procedure and its use in Kentucky and Tennessee. Data collected will be used in an Honors undergraduate thesis project through the Western Kentucky University Program of Dental Hygiene. Your input will help to assess existing understanding and implementation of the L-PRF procedure within this region. This survey should take you less than five minutes to complete.

Please select the link below or cut and paste the URL into your browser to access the survey.

https://wku.co1.qualtrics.com/SE/?SID=SV_b7uAptiNk1WoJKJ

Your input is very important to this research. All responses, opinions, and information received will remain completely confidential and will be used for undergraduate research. Thank you for your time and participation!

Kyndall Hudson

kyndall.hudson641@topper.wku.edu

WKU Program of Dental Hygiene

APPENDIX C

INFORMED CONSENT DOCUMENT

Project Title: Bone Stimulation Implemented Using the L-PRF Technique Within the Clinical Setting

Investigator: Kyndall Hudson, Department of Allied Health, 270-745-6274

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.

A basic explanation of the project is written below. Please read this explanation and discuss with the researcher any questions you may have via email to kyndall.hudson641@topper.wku.edu.

- 1. Nature and Purpose of the Project:** As dentistry continuously evolves, many aspects of patient treatment can change and lead to more optimal results. Many factors can play a role into what treatment modality is selected. As a dental hygiene student, it is important to know the awareness of specific procedures and their application within the clinical setting. This project consists of a survey to analyze the knowledge and use of the Leukocyte Platelet Rich Fibrin (L-PRF) procedure in Kentucky and Tennessee.
- 2. Explanation of Procedures:** Please follow the link to answer a questionnaire pertaining to existing knowledge and use of the L-PRF technique. The survey is being conducted through the use of 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 are no known associated discomforts or risks.
- 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. All participants will be protected using Qualtrics software to maintain

anonymity.

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.

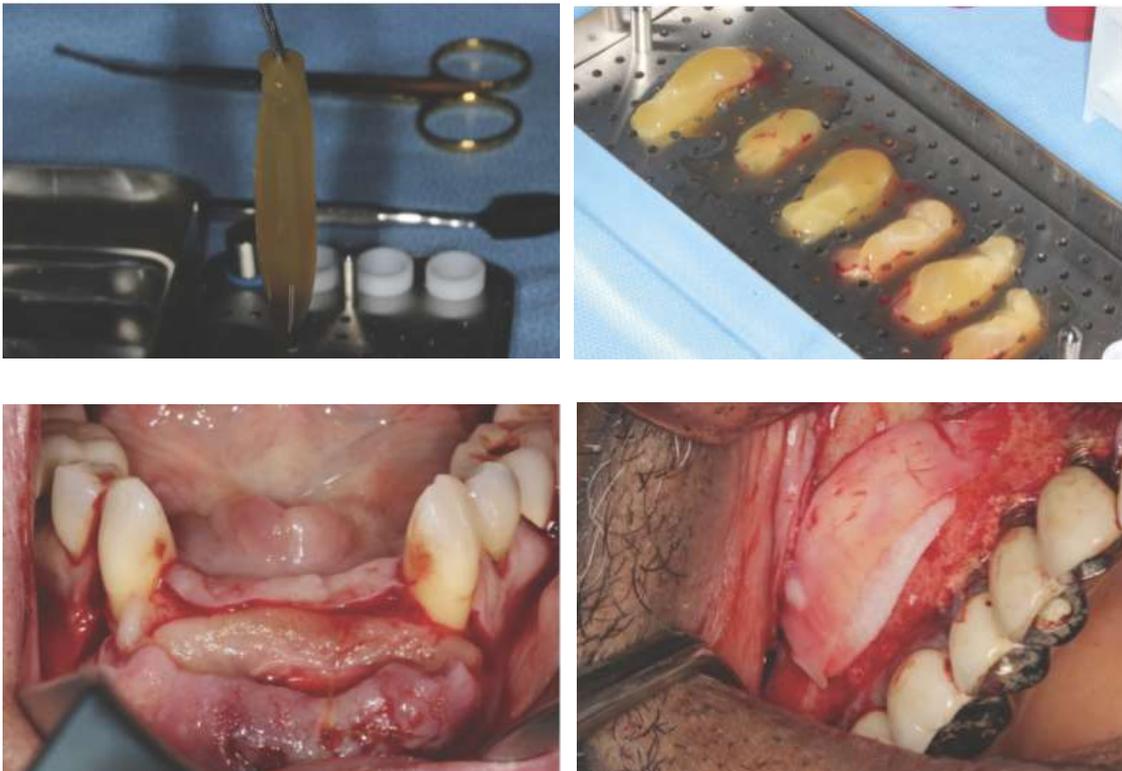
Your continued cooperation with the following survey implies your consent.

THE DATED APPROVAL ON THIS CONSENT FORM INDICATES THAT
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# 15-199
Approval - 11/12/2014
End Date - 5/5/2015
Expedited
Original - 11/12/2014

FIGURES

FIGURE 1



<https://www.dentistry.ucla.edu/learning/platelet-rich-fibrin-prf>

FIGURE 2

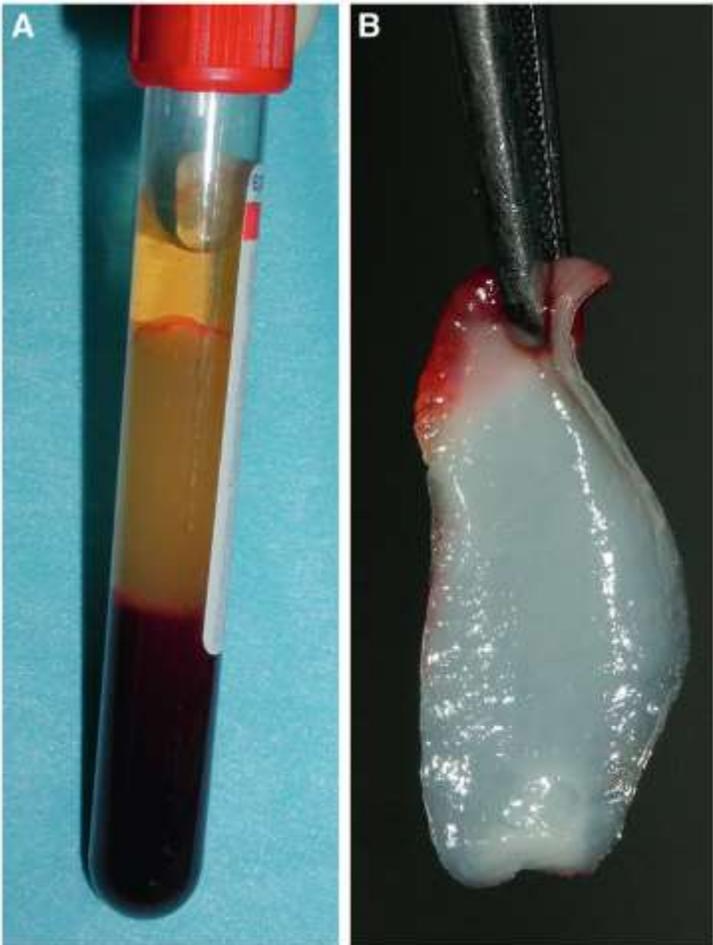


FIGURE 3

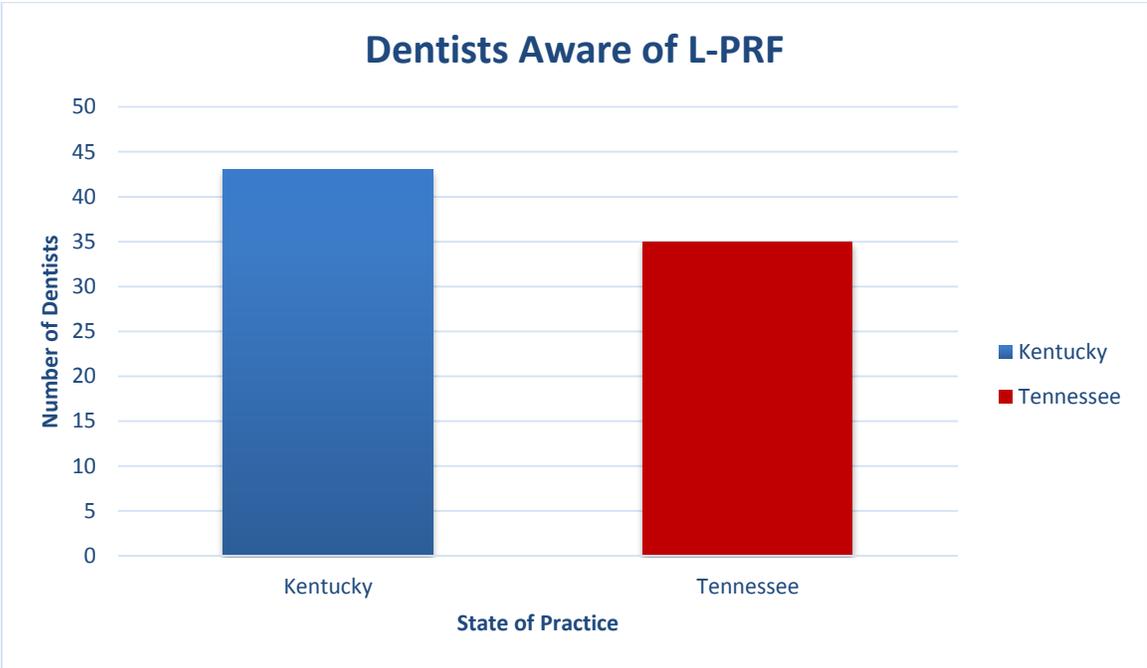


FIGURE 4

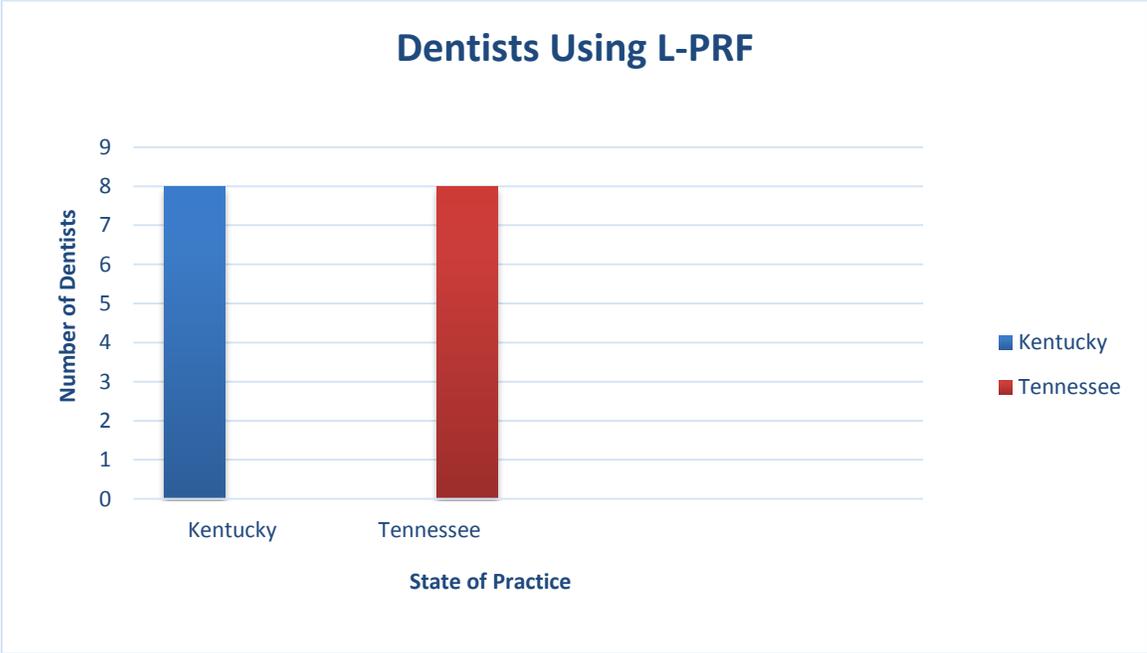


FIGURE 5

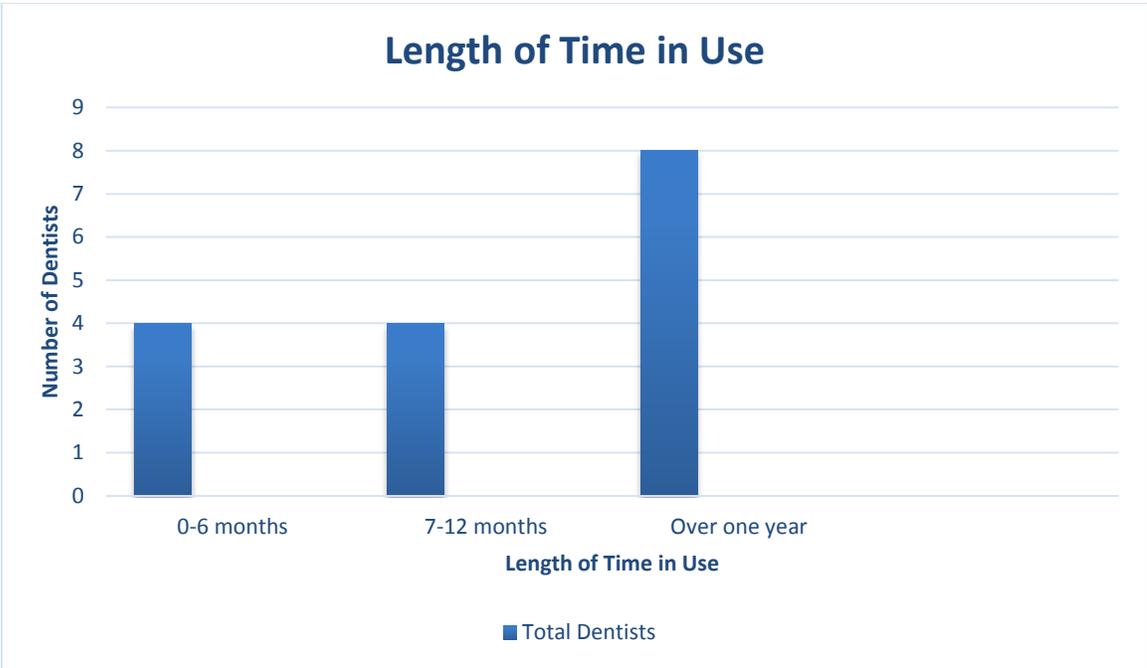


FIGURE 6

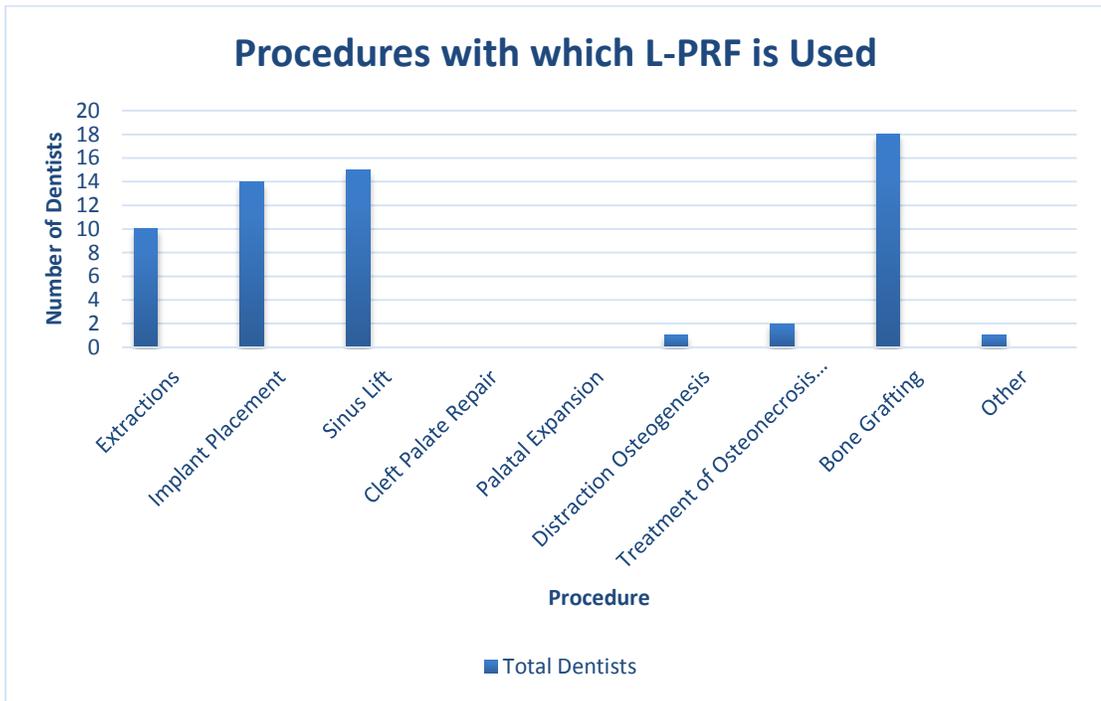


FIGURE 7

The state of Kentucky divided into three regions: Western, Central, and Eastern.

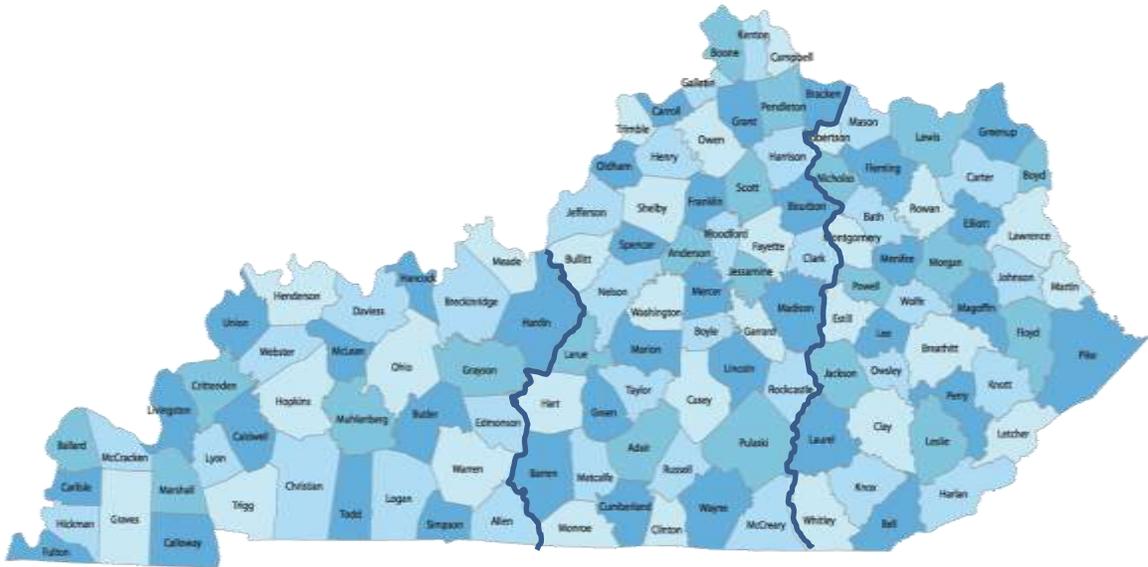


FIGURE 9

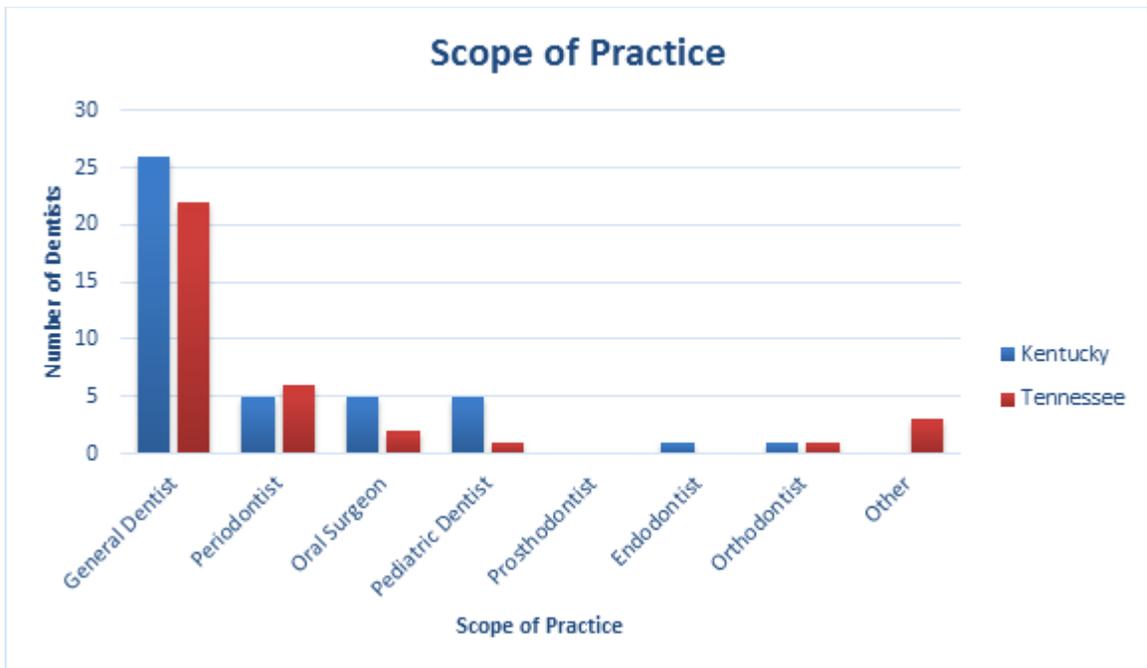


FIGURE 10



FIGURE 11

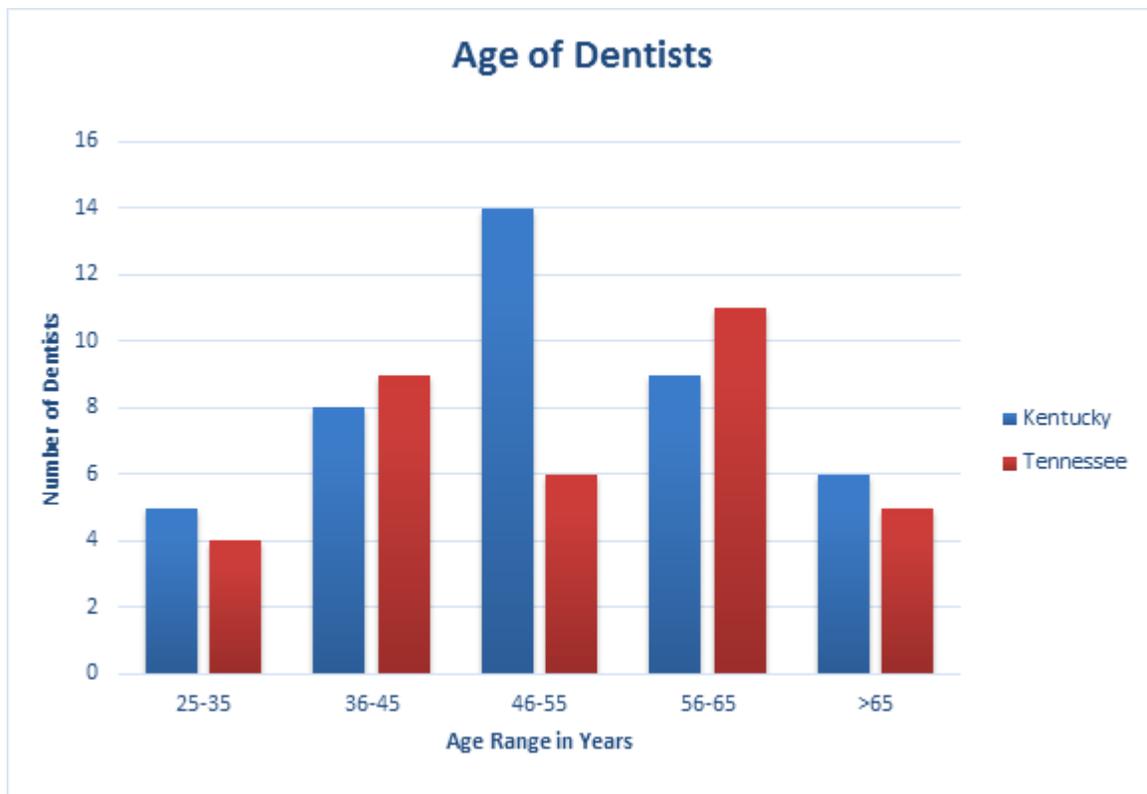


FIGURE 12

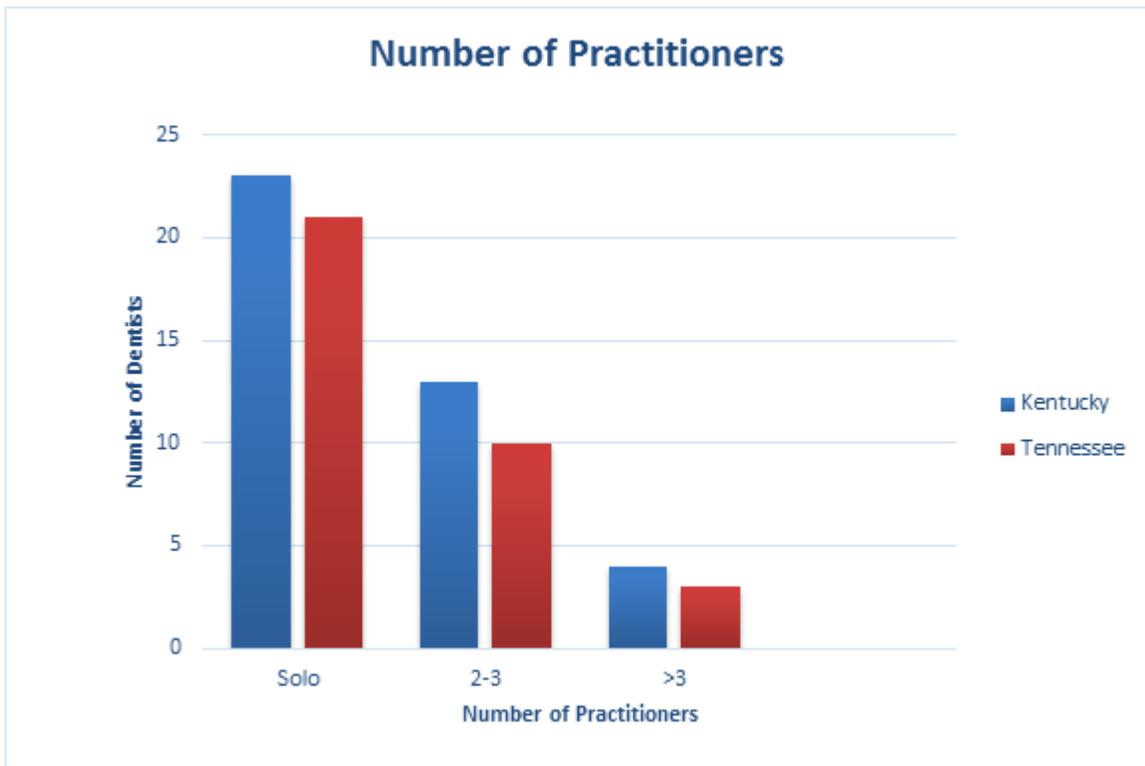


FIGURE 13

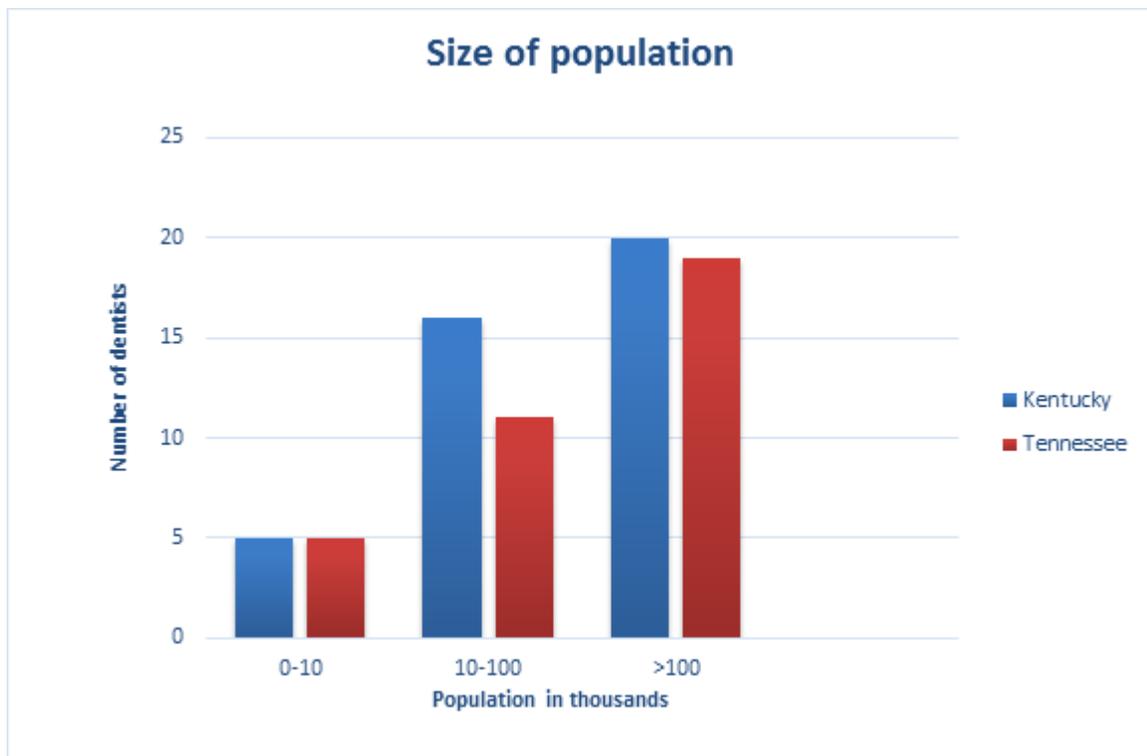


FIGURE 14

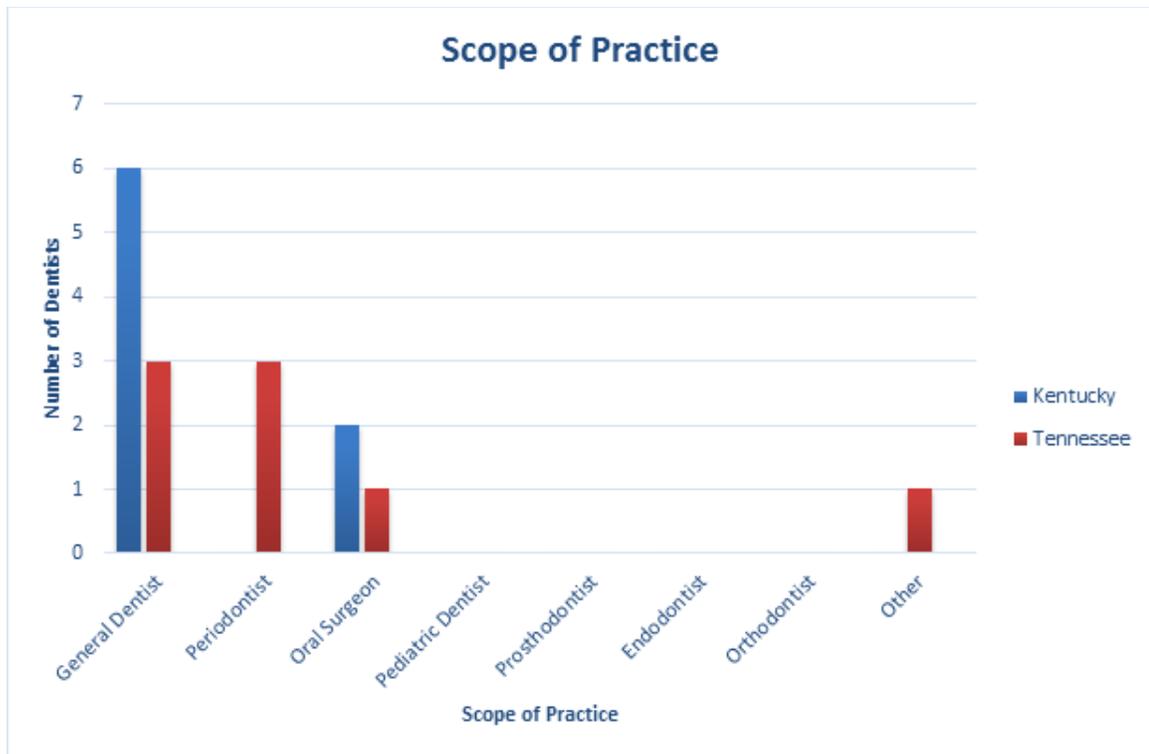


FIGURE 15



FIGURE 16

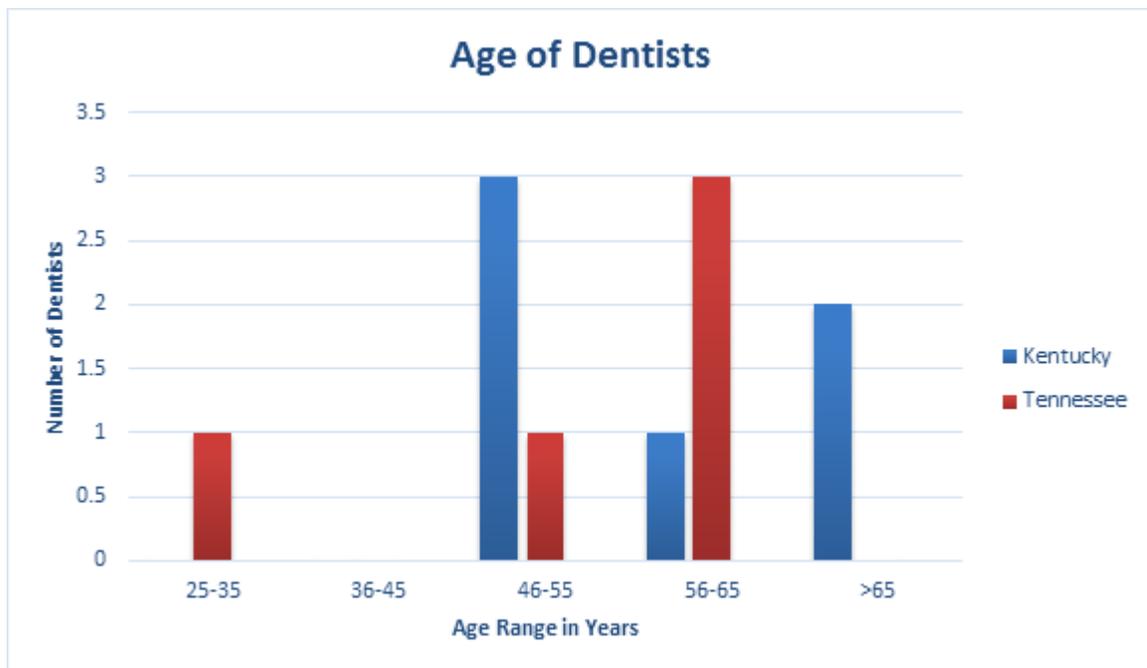


FIGURE 17



FIGURE 18

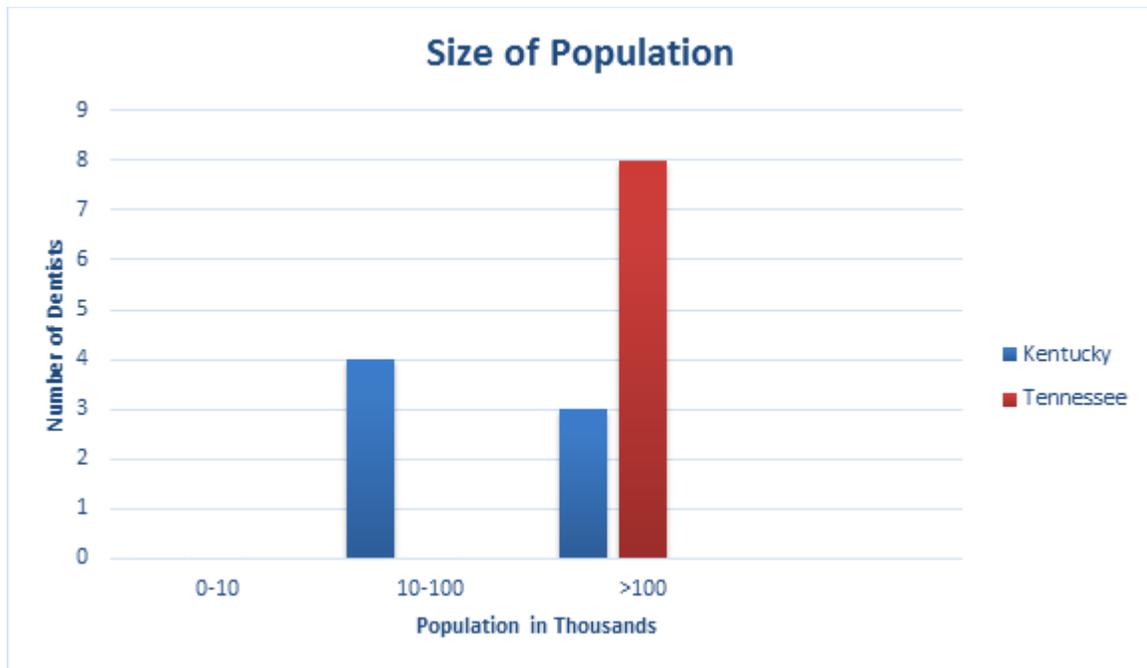


FIGURE 19

Pearson's Chi Square Test: Awareness of the L-PRF technique and the current use of the technique

	Value	df	Asymp. Sig. (2- sided)	Exact Sig. (2- sided)	Exact Sig. (1- sided)
Pearson Chi-Square	30.868 ^a	1	.000		
Continuity Correction ^b	28.038	1	.000		
Likelihood Ratio	35.881	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	30.731	1	.000		
N of Valid Cases	225				