PROTOCOL TITLE:

Post-operative Pain Following Treatment Using the Gentlewave System

PRINCIPAL INVESTIGATOR or FACULTY ADVISOR:

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VERSION NUMBER/DATE:

Version 001 / 05-07-2018

REVISION HISTORY

Revision #	Version Date	Summary of Changes	Consent Change?
01	08-27-2019	Updated Primary investigator and student investigator, Changed VAS to NRS to reflect the correct name of the scale being used, changed sample size, changed procedures involved to reflect multiple appointments and timing of pain assessment, updated inclusion criteria	yes
02	10-3-2019	Updated student investigator to add Dr Dale. Minor changes to study design, primary objective, sample size, duration of appointments to reflect collecting data from only symptomatic patients.	

NOTE: Leave this section blank for the initial submission. The revision history should be documented for modifications to approved studies.

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ABBREVIATIONS/DEFINITIONS

- AED: Automated External Defibrillator
- AHC-IS: Academic Health Center – Information Systems
- $Ca(OH)_2$: Calcium Hydroxide
- CBCT: Cone Beam Computed Topography
- EDTA: Ethylenediaminetetraacetic Acid
- NaOCl: Sodium Hypochlorite
- VAS: Visual Analog Scale
- NRS: Numeric Rating Scale

STUDY SUMMARY

Study Title	Post-operative pain following treatment using the Gentlewave system
Study Design	Confirmation of pre-operative pain (symptomatic status) will be determined by having the patient record their pain level to percussion at the initial examination using the NRS scale. Additionally, the force required to cause pre-operative pain to biting will be recorded using a digital occlusal force meter. The NRS will consist of a 100mm line where 0 equals 'no pain' and 100 equals the 'worst pain imaginable'. Patients will be divided into one of two treatment groups: 1) standard root canal cleaning and shaping procedures (control group) or 2) the Gentlewave technique, which uses sonic energy and irrigation for cleaning of the root canal system (research group). Patient demographics, anesthesia, cleaning and shaping instruments, irrigation technique, and obturation method and material will be recorded, along with the number of appointments, detailed notes of treatment rendered, and the occurrence of over-instrumentation or overfill of obturation material. Following the first and final appointment, patients will be given the same NRS to take home and record their level of pain at 6, 24, 72, and 168 hours post-treatment.
Primary Objective	To determine whether treatment with the Gentlewave system will significantly decrease the occurrence and of post-operative pain in symptomatic patients following endodontic treatment.
Secondary Objective(s)	If post-operative discomfort should occur, to determine the severity based on an NRS for pain assessment.
Research Intervention(s)/ Investigational Agents	Gentlewave system for root canal disinfection
Scientific Assessment	Not required, Minimial Risk Study
IND/IDE # (if applicable)	N/A
IND/IDE Holder	N/A

Investigational Drug Services # (if applicable)	N/A
Study Population	The target population of the study includes patients needing endodontic treatment in the University of Minnesota Graduate Endodontics clinic, ages 18+. Patients with teeth that have root apices in the maxillary sinus, teeth with immature root apices, and teeth with insufficient coronal tooth structure will be excluded.
Local Sample Size (number of participants recruited locally)	Approximately 150 participants will be recruited. Dr Grigsby's original study was approved for 50 pts, our study will break symptomatic patients into 1 of 2 symptomatic categories: necrotic or vital pulps. So 50 participants in each group, 100 total new patients will be recruited.

1. Objectives

1.1. Purpose: *The purpose of this study is to determine whether a new treatment modality for cleaning and disinfecting the root canal system will significantly affect the occurrence and severity of post-operative pain in symptomatic patients*.

2. Background

2.1. Significance of Research Question/Purpose: To further the scientific discussion and recognize treatment modalities that may eliminate the occurrence of post-operative pain.

2.2. Preliminary Data: N/A

2.3. Existing Literature: Once a tooth reaches a level of inflammation where healing can no longer occur or when the pulp space begins to go through necrosis, root canal treatment is indicated. The goal of root canal therapy is to clean, shape, disinfect, and obturate all canal systems within the tooth. Schilder's mechanical and biological objectives for cleaning and shaping includes: preparing a continuous tapering root canal funnel from access to apex, cross-sectional diameters should be wider at every point as you move coronally, the preparation should occupy as may planes as presented by the original canal and should follow the shape of the original canal, the apical foramen should remain in it is original spatial relationship to bone and to root surface, the apical opening should be kept as small as practical in all cases, complete cleaning and shaping in one appointment, procedures should be confined to the roots themselves, necrotic debris should not be forced

beyond the foramina, all tissues should be removed from root canal space, and sufficient space for intracanal medicaments and irrigation should be created (1). Peters added to these objectives in creating his own basic objectives for cleaning and shaping that include: removing infected soft and hard tissue, giving disinfecting irrigants access to the apical canal space, creating space for the delivery of intracanal medicaments and subsequent obturation, and retaining the integrity of radicular structures (2). Traditionally, the standard protocol for cleaning and shaping is completed using hand or rotary files. Various file systems are used to prepare root canal systems to the parameters set by Schilder's and Peters' principles. In addition, it is important to keep necrotic debris within the canal space as a means of preventing post-operative pain and flare-ups (3). Siqueira discovered that the factors that are commonly responsible for post-operative or interappointment pain include mechanical preparation and obturation beyond the apex, bacterial insults not present in the primary infection, and chemical extrusion of irrigant materials beyond the apex (3). Post-operative pain can occur hours to days following root canal procedures. Acute inflammation due to the aforementioned etiologic factors is the chief cause of post-operative pain. According to Gotler et al, post-operative pain typically occurs at a higher severity and incidence in vital teeth and retreatments as opposed to non-vital teeth (4). Irrigation dissolves organic material and kills microbes. It also helps prevent the binding of instruments, improves the cutting effectiveness of files, dissolves tissue, and cools the instrument and tooth (5). The most common endodontic irrigant is sodium hypochlorite (6). Sodium hypochlorite is an alkaline fluid with a pH of approximately 11-12. It hydrolyzes proteins and causes hemolysis of red blood cells which leads to the dissolution of vital, as well as necrotic tissue. Upon contact of organic debris, hypochlorus acid forms which disrupts bacterial metabolism by oxidizing the sulfhydryl group of bacterial enzymes. With the use of such a caustic material, there is always the possibility of complications. Most hypochlorite accidents occur because of inaccurate working length determination, iatrogenic widening of the apical foramen, lateral perforation, or wedging of the irrigation needle. Once irrigant is extruded beyond the apex, severe pain, uncontrollable bleeding, immediate swelling, and bone and tissue necrosis can occur (7&8). Standard endodontic treatment protocol includes irrigation with 5.25% sodium hypochlorite between each file used for cleaning and shaping with a final ultrasonic activation of the sodium hypochlorite for 30 seconds per canal. Lastly, there is a one minute soak of 17% EDTA to remove the layer of debris created from cleaning and shaping (5).

3. Study Endpoints/Events/Outcomes

3.1. Primary Endpoint/Event/Outcome: The primary outcome of this study is to determine whether treatment with the Gentlewave system will significantly decrease the occurrence of post-operative pain with endodontic treatment.

3.2. Secondary Endpoint(s)/Event(s)/Outcome(s): The secondary outcome is to determine the intensity of pain, should it occur, based on a NRS pain assessment.

4. Study Intervention(s)/Investigational Agent(s)

4.1. Description: The Gentlewave system is a FDA cleared root canal irrigation device that uses internally degassed distilled water, 3% NaOCl, and 8% EDTA to allow for a more thorough cleaning within the tooth (8). The system uses broad spectrum acoustic energy to create hydrodynamic cavitation and thousands of micro bubbles that create powerful shear forces. The fluids work to remove necrotic tissue, debris, biofilm, and bacteria while leaving dentin intact and preserving tooth structure. The cleaning and shaping protocol when using the Gentlewave system requires the clinician to prepare all canals within a tooth to a minimum of size 20 before using the Gentlewave system for irrigation. The Gentlewave irrigation replaces the NaOCl ultrasonic activation and EDTA steps of the standard endodontic protocol. Use of the Gentlewave system is contraindicated in teeth with immature apices, teeth with insufficient coronal structure, and teeth with root apices extending into the maxillary sinus.

4.2. Drug/Device Handling: The Gentlewave device will be stored in the Graduate Endodontics research laboratory and any treatment fluids specifically for research purposes will be locked and labeled for use at designated times. An inventory log of when and how much treatment fluids used will be kept and updated after each participant treatment.

4.3. Biosafety: *N/A*

4.4. Stem Cells: *N/A*

5. Procedures Involved

5.1. Study Design: Patients will be asked to indicate their peak pain level in the twenty-four hours prior to the appointment using a numeric rating scale (NRS). The NRS scale will consist of a 100mm line where 0 equals ‘no pain’ and 100 equals the ‘worst pain imaginable’. Patients will be divided into one of two treatment groups, either standard cleaning protocol or Gentlewave irrigation. Patient demographics, anesthesia, cleaning and shaping instruments, irrigation technique, and obturation method and material will be recorded, along with extent of treatment rendered, and the occurrence of over-instrumentation or overfill of obturation material.

Following the first appointment, patients will be given the same NRS assessment to take home and asked to record their level of pain at 6, 24, 72, and 168 hours post-treatment.

5.2. Study Procedures:

- Procedures that will be performed regardless of whether research were being conducted include diagnostic examination and radiographic examination/interpretation. Diagnostic examination includes sensibility testing of the tooth/teeth in question, determination of whether or not a crack, fracture, or non-endodontic pathology exists, and determination of the etiology of endodontic pathology. Diagnostic exam procedures include thermal testing using either Endo Ice Refrigerant spray or heated gutta-percha, electric pulp testing device if thermal testing is inconclusive, percussion testing using the handle of a mouth mirror and digital palpation of gingival area near the tooth/ teeth in question. Periodontal examination will also be performed for probing depths and mobility. Transillumination and methylene blue staining may be performed if a crack or fracture is suspected. Radiographic examination includes at least two periapical radiographs for posterior teeth and one periapical radiograph for anterior teeth. A limited field of view CBCT may be taken if necessary.
- Confirmation of pre-operative pain (symptomatic status) will be determined by having the patient record their pain level to percussion at the initial examination using the NRS scale. Additionally, the force required to cause pre-operative pain to biting will be recorded using a digital occlusal force meter.
- During the treatment portion of research, the tooth needing treatment will be sufficiently anesthetized with local anesthetic to undergo the procedure pain-free. A rubber dam will be placed isolating the tooth in question and one tooth adjacent to that tooth both mesially and distally. The pulp chamber will be accessed and prepared for straight line access to all canal orifices. During access, all caries and defective restorations will be removed. If there is a defective crown, it will be removed prior to rubber dam isolation. Hand files and electronic apex locators will be used to determine the working length of each files. Working length will be verified using a periapical radiograph. At this point is where the two treatment groups will diverge.
- For the standard protocol (control) group, following working length determination, all canals will be cleaned and shaped using rotary files to at least a size 20.04 canal size and to within 0.5 to 1 mm short of the apical terminus. Appropriate final canal size will be determined by the clinician treating the patient. Between each file, 5.25% NaOCl will be

used to disinfect and wash the canals of debris. After the canal has been cleaned and shaped to 20.04, sodium hypochlorite will be passively activated using an ultrasonic instrument for 30 seconds per canal. Next, each canal will soak in 17% EDTA for 1 minute, will be rinsed in 5.25% NaOCl, and finally undergo a final rinse of 95% ethanol. Canals will be filled with $Ca(OH)_2$ and a temporary restoration will be placed with a cotton pellet and restorative material of the clinician's choice. All of these steps make up our standard protocol and would be performed whether research is being conducted or not.

- For the Gentlewave treatment group, the standard protocol will be followed until working lengths are determined. Each canal will be shaped to a canal size of 20.04 or 20.06 and to 1mm short of the apical terminus. An occlusal platform will be prepared to allow Gentlewave treatment of the tooth using the Kool-dam material recommended by Sonendo. The Gentlewave system will be held on the tooth by the clinician and will cycle through five minutes of 3% sodium hypochlorite, two minutes of 8% EDTA, and a final rinse of distilled water. Canals will be filled with $Ca(OH)_2$ and a temporary restoration will be placed with a cotton pellet and restorative material of the clinician's choice. If the research were not conducted, these patients would be treated using the standard protocol as above.
- Pain Management: As both arms include standard of care treatment, pain management will be the same recommendation as our standard, non-research related treatment. Recommendations for pain management include: 600mg Ibuprofen every 6 hours for pain. If additional pain relief is needed, patients are instructed to add 500-650mg Acetaminophen every 6 hours. If these medicines are necessary, participants will be instructed to record which medicines were taken, the amount, at which times, and how often. This will be returned along with the NRS pain assessment.
- Following the first and final appointment, regardless of procedure, participants will be given the same NRS pain assessment from pretreatment to take home and asked to record their level of pain at 6, 24, 72, and 168 hours post-treatment. Participants will be given an envelope with prepaid postage to return the pain assessment form to the graduate endodontics office.
- Should a participant's pain assessment form not be returned, a phone call will be placed to remind the participant to return the form.

- The Gentlewave system is a FDA cleared root canal irrigation device that is used to remove necrotic tissue, debris, biofilm, and bacteria while leaving dentin intact and preserving tooth structure. The Gentlewave irrigation replaces the NaOCl ultrasonic activation and EDTA steps of the standard protocol.
- The data to be collected include patient demographics, pretreatment/ posttreatment NRS pain assessment recordings, anesthetic technique/ amount, cleaning and shaping instruments, irrigation technique (standard vs Gentlewave), and obturation method/material will be recorded. The occurrence of over-instrumentation or overfill of obturation material will also be recorded.
- The total time commitment for all participants, regardless of arm assignment, will 4+ hours of treatment time and 5 minutes a day for 14 days to record pain levels.

5.3. Study Duration:

- The anticipated duration for enrolled participants is the amount of time to complete treatment (multiple visit treatment) and the 14 days (7 days after 1st visit and 7 days after final visit) following treatment during self-evaluation of post-operative pain.
- The anticipated time to complete all study procedures, follow-up, and data analysis is projected to be 12-15 months.

5.4. Individually Identifiable Health Information: The study will involve access to individually identifiable health information. The purpose of access is to ensure patients are treated safely and are not administered any medication/ anesthetic the patient may be allergic to or that may be contraindicated for use with any medication they may be currently taking.

5.5. Use of radiation*:* The study will involve the use of radiation in the completion of endodontic treatment. This involves taking multiple periapical radiographs and possibly limited field of view cone beam computed tomography.

5.6. Use of Center for Magnetic Resonance Research*:* N/A

6. Data and Specimen Banking N/A

7. Sharing of Results with Participants N/A

8. Study Population

8.1. Inclusion Criteria: The target population of the study includes patients needing endodontic treatment in the University of Minnesota Graduate Endodontics clinic, ages 18+. Those with an apical diagnosis of symptomatic apical periodontitis. Vulnerable populations that will be

included in the study are members of the military and those individuals from an undervalued or disenfranchised social group.

8.2. Exclusion Criteria: Patients with teeth that have root apices in the maxillary sinus, teeth with immature root apices, and teeth with insufficient coronal tooth structure will be excluded. For the purposes of this study children, pregnant women, prisoners, and adults lacking the capacity to consent will be excluded.

8.3. Screening: Screening will be completed during the participant's consultation appointment for endodontic treatment.

9. Vulnerable Populations

9.1. Vulnerable Populations:

□ Children

□ Pregnant women/Fetuses/Neonates
□ Prisoners
□ Adults lacking capacity to consent and/or adults with diminished capacity to consent, including, but not limited to, those with acute medical conditions, psychiatric disorders, neurologic disorders, developmental disorders, and behavioral disorders
□ Approached for participation in research during a stressful situation such as emergency room setting, childbirth (labor), etc.
□ Disadvantaged in the distribution of social goods and services such as income, housing, or healthcare
□ Serious health condition for which there are no satisfactory standard treatments
□ Fear of negative consequences for not participating in the research (e.g. institutionalization, deportation, disclosure of stigmatizing behavior)
□ Any other circumstance/dynamic that could increase vulnerability to coercion or exploitation that might influence consent to research or decision to continue in research
☒ Undervalued or disenfranchised social group
☒ Members of the military
☒ Non-English speakers
□ Those unable to read (illiterate)
□ Employees of the researcher
□ Students of the researcher
□ None of the above

9.2. Additional Safeguards: Inclusion of these selected groups does not represent any additional safety issues. There would be no medical or dental safety issue that would warrant their exclusion. The safeguard in place to protect

their rights includes nondiscriminatory practices and equal presentation of study participation and treatment options.

10. Local Number of Participants

10.1. Local Number of Participants to be Consented: The approximate number of participants requested is 150. 34, or 17 per treatment group, is the lowest number that will give an 80% power to detect a mean difference between the two groups of 1 standard deviation. (Dr Heyse and Dr Dale will each analyze a subcategory of symptomatic patients: Necrotic symptomatic teeth or Vital symptomatic teeth). Requesting 150 participants allows for greater clinical meaningfulness and accounts for possible dropouts. Randomization order for each arm of the study will be 1 to 1.

11. Local Recruitment Methods

11.1. Recruitment Process: Participants will be recruited during their consultation appoint at the University of Minnesota Graduate Endodontics clinic. Advertisements will not be publicly posted.

11.2. Identification of Potential Participants: Potential participants will be recruited from the Graduate Endodontics patient population and will be identified on their consultation exam and rightness of fit based on their demographics and tooth morphology and anatomy. Supplemental investigators will make the initial contact and upon participant signage of consent forms will be made known to the primary investigator. Confirmation of participation will be known when the patient signs a consent form.

11.3. Recruitment Materials: After being identified by a member of the research team, the potential participant will be given recruitment material which is a FAQ sheet that they can take home and read should they need more time to consider the invitation to participate.

11.4. Payment: No gifts, payments, compensation, reimbursement, or services without charge will be provided to the participants for participating in the research.

12. Withdrawal of Participants

12.1. Withdrawal Circumstances: Should patients have an occurrence that will eliminate their eligibility for root canal therapy, i.e. an unforeseen crack or fracture.

12.2. Withdrawal Procedures: For research in which it is determined to be appropriate to document the withdrawal of a subject, such documentation could specify:

- Documentation of whether the withdrawal of the participant resulted from a decision by the participant or by the investigator, and the reasons for the withdrawal, if known.
- Whether the withdrawal was from all components of the research study or just the primary interventional component.
- Should any participant want to withdraw from procedures, the participant will be debriefed on which arm of the procedure they were assigned to. An offer to complete treatment via other standard treatment options will be extended. Also, following treatment the participant will not be asked to complete the pain scale assessment, but will have the standard 6 month recall to assess healing. The Office of Human Research Protections also recommends that the investigator explain to the participant the importance of obtaining follow-up safety data about the participant. If the participant agrees, research activities involving these other types of participation for which the participant previously gave consent will continue. Should a participant wish to seek treatment elsewhere, a list of possible endodontists will be furnished. Data collection will terminate at the point of withdrawal.

12.3. Termination Procedures: Procedures will be terminated should the patient want to withdraw or if there is a pathological discovery that would deem the tooth in question non-restorable, after treatment has begun. Should a participant wish to seek treatment elsewhere, a list of possible endodontists will be furnished. Should the tooth be deemed non-restorable, referral to the University's Oral & Maxillofacial Surgery graduate clinic will be provided. Data will not be used following termination.

13. Risks to Participants

13.1. Foreseeable Risks:

<u>All risks listed below are associated with both arms of the study.</u>

- **Post-operative discomfort or sensitivity:** Recommendation of 600mg ibuprofen or a combination of 600mg ibuprofen plus 1000mg acetaminophen every 6 hours (Menhinick)
- **Restrictive mouth opening:** Recommendation of home remedies for limited mouth opening and trismus following extended periods of mouth opening.
- **Jaw muscle spasm or cramps:** This risk can be lessened by using post-procedure massages, heat and ice packs, as well as anti-inflammatory analgesics.

- **Temporomandibular joint difficulty:** This risk can be lessened by using post-operative massages, heat and ice packs, as well as anti-inflammatory medicines.
- **Non-healing of the tooth:** Following treatment, the tooth and symptomatology will be monitored for resolution. Should symptoms not resolve, the next phase of treatment (i.e. root end resection) will be discussed with the participant.
- **Damage to restorations:** If a restoration is damaged beyond the investigator's ability to repair, the proper referral will be made.
- **Reaction to local anesthetic:** Correct administration technique and continual evaluation
- **Uncontrollable Bleeding:** All attempts will be made to arrest bleeding. If bleeding cannot be controlled then a $Ca(OH)_2$ medicament can be placed in the tooth and temporary restoration material placed. A subsequent appointment will be scheduled.
- **Separation of instruments within root canals:** Every attempt will be made to remove the separated instrument. If it cannot be removed then an attempt will be made to disinfect and obturate beyond it. The participant will be monitored for healing.
- **Over-instrumentation or over-obturation of root canals:** The working length of the canals will be determined by electronic apex locators and verified using periapical radiographs.
- **Numbness or paresthesia:** The local anesthetic agents used to gain anesthesia have relatively low risk of causing numbness or paresthesia.

<u>Risk specific to Gentlewave treatment</u>

- **Increased sensitivity due to backpressure during machine operation:** Profound anesthesia, and adequate access opening preparation to eliminate possible back pressure during operation.

13.2. Reproduction Risks: N/A

13.3. Risks to Others: N/A

14. Potential Benefits to Participants

14.1. Potential Benefits: No direct benefit to individual participants, other than necessary root canal treatment

15. Statistical Considerations

15.1. Data Analysis: To examine the research question, a two-sample t test will be conducted to determine if mean differences exist on post-operative pain

following treatment with the Gentlewave system and post-operative pain following standard endodontic treatment. Two-sample t test, with a significance level of 0.05, is an appropriate statistical analysis if each of the two samples can be matched on the pain measurements at 6, 24, 72, and 168 hours following the completion of treatment. A linear mixed effects model will be used to compare the groups across time. Also, descriptive statistics will be used for patient demographics and characteristics.

15.2. Power Analysis: A sample size of 17 per group will give an 80% power to detect a mean difference between the two groups of 1 standard deviation. This sample size selection and power analysis is based off of previous studies

15.3. Statistical Analysis: A two-sample t-test will be used with a significance level of 0.05 for pain measurements recorded at 6, 24, 72, and 168 hours. A linear mixed effects model will be used to compare the groups across time. Also, descriptive statistics will be used for patient demographics and characteristics.

15.4. Quality control of the collected data will be overseen by the principal investigator.

16. Confidentiality

16.1. Data Security:

- Data access will be limited to the principal and additional investigators. Data will be de-identified including names, geographic subdivisions, all elements of dates (except the year), telephone numbers, fax numbers, electronic mail addresses, social security numbers, medical record numbers, health plan beneficiary numbers, account numbers, certificate/ license numbers, and any other unique identifying number, characteristic, or code. Data will be secured on password protected computer consoles and AHC-IS servers and an AHC-IS supported desktop computer.
- AHC-IS Supported Desktop Device #: 20130133

17. Provisions to Monitor the Data to Ensure the Safety of Participants

Although the procedures included within this study is of minimal risk, the program director/ principal investigator will monitor the data integrity and safety of the participants. The principal investigator will ensure that study is conducted, recorded, and reported in accordance with the protocol, standard operating procedures, and applicable regulatory requirements.

17.1. Data Integrity Monitoring.

- Because the procedures included within this study are of minimal risk, the program director/ principal investigator will monitor the data integrity, study design, study milestones and study endpoints and outcomes.
- The principal investigator will ensure that study is conducted, recorded, and reported in accordance with the protocol, standard operating procedures, and applicable regulatory requirements.

17.2. Data Safety Monitoring.

- Oversight of the trial is provided by the Principal Investigator, Dr. Ronald Ordinola-Zapata. Confidentiality throughout the trial will be maintained by the Graduate Endodontics residents.
- A cumulative review of data will be conducted monthly throughout the entirety of the study and data collection. During the review safety data, efficacy data, data accuracy and untoward events will be discussed.
- Safety information will be collected with case report forms and via monthly in-person meetings with the principal investigator.
- Dr. Ronald Ordinola-Zapata, the principal investigator and Dr. Jeffrey Heyse will monitor the data.
- The only condition that should warrant immediate suspension of the study is if the department Gentlewave machine stops functioning properly and is in need of service.

18. Provisions to Protect the Privacy Interests of Participants

18.1. Protecting Privacy: Participant privacy will be protected by removing any identifiable information from the research data

18.2. Access to Participants*:* The research team is permitted to access private information about participants if they are patients of record at the University of Minnesota School of Dentistry. This information may be needed to determine if any treatment or medication precautions need to be followed to safely treat the participant.

19. Compensation for Research-Related Injury

19.1. Compensation for Research-Related Injury: Compensation for Research-Related Injury: In the event that this research activity results in an injury, treatment will be available, including first aid, emergency treatment and follow-up care as needed. Care for such injuries will be billed in the ordinary manner to you or your insurance company. If you think that you have suffered a research related injury, let the study doctors know right away.

20. Consent Process

20.1. Consent Process (when consent will be obtained):

- Consent will take place during the consultation appointment, after the research participation offer has been extended.
- If the potential participant needs time to consider the research invitation, a time period of half the time until their treatment initiation appointment will be given for the participant to consider the offer. This time frame allows the participant to make an informed decision and allows the clinic staff time to schedule and plan treatment with the Gentlewave system should it be necessary.
- It will be the duty of the treating clinician to make sure the participant understands the information provided.

20.2. Waiver or Alteration of Consent Process (when consent will not be obtained): N/A

20.3. Non-English speaking Participants:

- The University of Minnesota School of Dentistry Graduate Endodontics clinic sees a diverse population of patients whom speak a variety of languages other than English. Oral information will be provided through the use of an interpreter, and written information will be provided once it is determined which specific language translations are needed.
- Interpreters are required by the University of Minnesota to be present for any patient interaction for patients who do not speak English. If a patient qualifies for recruitment, the interpreter will be available at the time of consult and recruitment to present the research opportunity and obtain consent. HRP-507 Short form for consent will be used. The interpreter is also required to be present during any treatment and follow-up visits as well.

20.4. Participants Who Are Not Yet Adults (infants, children, teenagers under 18 years of age):

- Only adults ages 18 years or older will be recruited for research participation

20.5. Adults Unable to Consent:

- Adults unable to consent will not be recruited for the study.

21. Setting

21.1. The site of the research will be the University of Minnesota School of Dentistry Graduate Endodontics clinic. Research procedures will be

performed by resident dentists who will be overseen by certified endodontists on faculty at the school of dentistry.

21.2. International Research: N/A

22. Multi-Site Research

N/A

23. Resources Available

23.1. Resources Available:

- The study will be conducted by a student investigator and co-residents, the faculty advisor will be available for assistance should there be any needed. There are also faculty clinicians trained on the usage of the Gentlewave device should any issues arise.
- Patient consultations for treatment occur daily, either through normal treatment scheduling, or through emergency scheduling. These patient pools should contain more than a sufficient number of necessary participants.
- The research treatment, data collection, and data analysis should require no more than 12-15 months.
- The facilities include 9 dental operatories and a surgical suite equipped with all necessary equipment and instruments to perform standard root canal treatment, including dental operating microscopes. There is one Gentlewave machine, with necessary treatment fluids and hand pieces for all research patient cases.
- Should participants have a medical emergency, we have a first aid kit, ambu bag, oxygen, and AED available. As well as a nearby hospital and fast access to emergency responders.
- All Graduate endodontics faculty, residents, and assistants have been trained on how to properly operate and troubleshoot the Gentlewave device. Prior to starting the research, each participating resident will be given verbal and written instruction on the consent process, the protocol for conducting treatment, and which information needs to be collected from each participant.

24. References

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