Q3D

Quantitative 3 Dot Test:
Detecting Visual Suppression,
Helping Kids See
Executive Summary

The University of Missouri–St. Louis is seeking a partner to license and commercialize the Q3D, a novel device that quantitatively measures the depth of visual suppression. This capability does not currently exist on the market and is critical to save the sight in children with conditions such as amblyopia (“lazy eye”).

> THE PROBLEM
Amblyopia (lazy eye)

- The loss of vision in an eye when the brain “suppresses” information from that eye.
- It’s the most common reason for vision impairment in children, young and middle-aged adults.
- The National Eye Institute (NEI) estimates 2% to 3% of all children have amblyopia worldwide (https://www.nei.nih.gov/amblyopia/backgrounder).
- If not detected, it can cause permanent vision loss.

> THE SOLUTION
The Q3D Screening Device

- Amblyopia can be prevented or reversed if detected early enough.
- However, current technology on the market doesn’t work well enough. It can detect visual suppression only qualitatively and only when significant suppression is already present, most often when it is too late to prevent or reverse the condition. The Q3D changes that.
- The Q3D is a valid, reliable, low-cost screening tool for the identification and quantification of vision disorders by optometrists, ophthalmologists, pediatricians, and other trained personnel. The Q3D test can be administered very rapidly (< 1 minute).
Overview

While many effective clinical therapies exist for such conditions (e.g. surgery, eye patching, corrective lenses, or optical penalization) many affected individuals do not receive timely interventions resulting in long-lasting functional impairment, lost productivity, and decreased quality of life. One of the primary causes for this global failure in vision care is the lack of accurate, low-cost screening tools widely accessible to vision care providers.

Early detection of visual suppression increases the likelihood of successful intervention and effective treatment, decreasing the likelihood of a child suffering negative outcomes from amblyopia. If treated before age 5, children can usually recover almost completely normal visual acuity in both eyes. Delaying treatment can result in permanent vision problems. Screening all children early is critical.

However, amblyopia can be difficult to recognize early because the weak, suppressed eye can appear normal. A sensitive testing device that can detect very small changes in visual suppression is necessary, but not available on the market. Current screening methods have been ineffective – the “gold standard” Worth 4 Dot Test is a “blunt instrument” that can only show whether significant suppression already exists, which may be too late for effective intervention.

The Quantitative Three Dot (Q3D) device addresses this need for a more sensitive instrument. The Q3D is able to detect extremely small changes in suppression and flag possible cases of amblyopia very early. In addition, its ability to quantitatively measure the depth of suppression allows healthcare providers to monitor the efficacy of therapies.

Market Potential

The worldwide ophthalmic products market exceeds $22 billion and is growing at more than 10% per year. The total global ophthalmology devices market is expected to be worth $16.2 billion by 2014, growing at a CAGR of 7.3% from 2009-2014.

The primary addressable market for the Q3D device consists of optometrists, ophthalmologists, and pediatricians in the United States and Europe. In the United

* The total number of children in the United States ages 0-5 was 24 million in 2013 (or 7.5% of the population) with a projected 28.8 million by 2049. Also in 2013, there were 48.6 million children under 12 years of age, accounting for nearly 15.5% of the population in the United States.
States alone, there are an estimated 40,000 practicing optometrists, 18,000 ophthalmologists, and 92,000 pediatricians (https://www.aap.org/en-us/professional-resources/Pediatrics-as-a-Profession/Pages/Frequently-Asked-Questions.aspx).

Approximately 20% of optometry and ophthalmology professionals have a major focus on pediatric issues, which commonly require screening and assessment of visual function. Optometrists serve as the sole primary eye care provider in more than 4,300 communities across the United States.

There are more than 400,000 combined eye care professionals (optometrists and ophthalmologists) worldwide (see links below):


**Applications**

- Test for and quantifying the depth of suppression in patients with conditions such as amblyopia.
- Measure the progress and outcome of treatments.
- Quantify afferent pupillary defects from optic nerve abnormalities (e.g. optic neuritis)

**Benefits**

- Currently, the Worth 4 Dot Test is commonly administered to determine the presence of suppression in patients. The Q3D is the first and only device that quantifies the depth of visual suppression.
- The Q3D detects small changes/impairments in visual suppression (0.1 log unit steps up to 3 log units); the Worth 4 Dot only detects dense suppression >2 log units.
- The test is fast to perform (< 1 minute) and easily administered by clinicians, nurses, technicians or other trained personnel. Quantifying depth of suppression allows for the selection of appropriate treatments and monitoring of outcomes over time.
• This current calibrated device is designed to be manufactured as a stand-alone device.

• Initial evaluation has determined that the device will likely be FDA Class I exempt (see Appendix)

Additional, Related Products

The Q3D also has a range of potential related hardware and software products expanding the commercial viability of this technology. It can serve as a launching point for development of related hardware to detect visual problems and software applications to enhance treatment of various visual disorders from those detected by the Q3D to optic nerve problems or trauma (e.g., traumatic brain injury).

The Technology

The Q3D is a simple, inexpensive, non-invasive device that provides an immediate and accurate measurement of visual suppression (in 0.1 to 3.0 log units) in patients as young as three years old. The first and only device that facilitates immediate, quantified assessment of visual suppression, the Q3D is a small, hand-held, battery powered electronic device that presents visual stimuli to a subject through the use of calibrated light emitting diodes (LEDs).

Visual stimuli of varying brightness are selectively presented to each of the subject’s eyes, which enable a direct comparison of the level of visual function in each eye. Q3D thereby identifies visual suppression and provides a quantitative measure of the severity of visual suppression, all in less than one minute.

The device is simple to use, does not involve any consumable components, and is accessible to all levels of vision care professionals (optometrists, ophthalmologists, technicians, volunteers, etc.). It has the potential to identify more cases of visual dysfunction much earlier, move visual screening into the hands of non-clinical personnel, and significantly improve rates of clinical intervention and overall patient outcomes worldwide.

The current version of the Q3D is designed to be manufactured inexpensively as a stand-alone device. Previous versions also were developed as possible add-on to fit standard power handles found in most clinics (e.g., Welch Allyn and Keeler).
The Test
The screening test is performed in a dimly lit room. The patient wears anaglyph (red/green) glasses and looks at the Q3D from three feet away. Three lights (one green, one yellow and one red) should be seen by the subject and should appear of equal brightness. However, visual suppression in the right eye (covered by the red filter) will cause the patient to see two green lights; suppression in the left eye (covered by the green filter) will cause the patient to see two red lights. The intensity of light being viewed by the suppressed eye is increased until it matches the brightness of the light as seen by the other eye. The suppression is quantified using log units, a numeric scale of the amount of suppression. The entire test takes less than a minute.

Clinical Trials
After an initial small study conducted at UMSL, a significant clinical trial of the Q3D was performed at Cardinal Glennon Children’s Hospital with more than 300 patients under the direction of Dr. Oscar A. Cruz, M.D., Chairman, Department of Ophthalmology, Anwar Shah Endowed Chair of Ophthalmology, and Professor of Ophthalmology at the Saint Louis University Eye Institute (SLU Medical Center), and Associate Professor of Pediatrics, Cardinal Glennon Children’s Hospital. Results from the clinical trial at Cardinal Glennon indicated that the Q3D is a significantly more sensitive predictor of visual suppression than current methods and can be used on patients as young as three years of age.

The Q3D detected 4x the number of impairments in patients with amblyopia as the existing screening tool. (See Appendix A for additional information and trial data.)

3rd Generation Prototype
The inventors were awarded a $50,000 University of Missouri System “FastTrack” award for the Q3D project to fund optimization of the device’s LED optics, improved form factor of the Q3D device, optimization of the Q3D schematics and design to improve reliability and reduce manufacturing cost per device.

Ten (10) working prototypes with hardware, software and circuit design documentation were produced.
Latest Q3D prototype pictured above (left: front of device; right: back of device). Ten working prototypes have been produced.

Based on feedback from clinical trials, the following changes were made in the 3rd generation prototype:

• The horizontal display orientation was changed to a vertical display to facilitate viewing in some patients with diplopia; and
• A feature to start at a brighter intensity was added to allow for testing at a distance and to facilitate demonstrating the device.

Also new in the 3rd generation prototype are the following:

• Refigured (reduced) form factor that is more ergonomic and that can be easily fit in a shirt/white coat pocket;
• White fixation light that potentially would mean the Q3D can be used as a “self-contained” device for the CPT 92060 billing code (Sensorimotor Examination);
• Modified design making the Q3D a two-piece, screw-together device to significantly simplify manufacturing and assembly;
• New design that utilizes readily available components and that is optimized for power consumption to allow for the rechargeable battery design;
• Simplified calibration with a newly designed calibration fixture;
• Power supplied by a rechargeable battery (note: the 1st generation was AC powered, and the 2nd generation was powered by a “standard” Welch Allyn ophthalmoscope handle); and

• SolidWorks model suitable for use with injection molds.

The current Q3D prototype will be validated via tests with human subjects at the College of Optometry at UMSL. Clinical testing will validate the sensitivity and usability of the device prior to large-scale release.

Regulatory Requirements
For the clinical trial at Cardinal Glennon, the Saint Louis University IRB committee designated the device as Low Risk, not requiring any FDA approval for use in their clinic during the trial. Based on FDA definitions, similar products and guidance from FDA consultants, the Q3D falls in the FDA Class I medical device category requiring only a “510(k) Exempt” submission type. (See Appendix B for a report from Nerac regarding regulatory classification.)

Intellectual Property

The Inventors

Carl Bassi, Ph.D.  
Associate Professor,  
Director of Research  
College of Optometry

Dr. Carl Bassi received his Ph.D. in psychology from Vanderbilt University. He did postdoctoral fellowships in psychology and cell biology at Vanderbilt University and in ophthalmology at the University of Southern California's Doheny Eye Institute. A faculty member at the UMSL College of Optometry since 1989, Dr. Bassi has published widely in the areas of new and better ways to assess the visual system in both clinical (macular degeneration, Alzheimer's, infant techniques) and applied (Air Force, Missouri Highway Patrol, and other industry applications) settings.

Michael Howe  
Senior Research Engineering Technician  
College of Optometry

Michael Howe has managed the research engineering machine shop at UMSL’s College of Optometry since 1991, supplying engineering support for optometric clinical level research including work in histology, electrophysiology and neurophysiology. He also works closely with graduate students in physiological optics. A machinist by trade, Howe came to UMSL from Central Microwave Company where he worked with a team to prototype microwave communications hardware for the defense and space industries.

Wayne Garver  
Adjunct Instructor  
Department of Physics

Wayne Garver received his master's degree in physics from Purdue University. After coming to UMSL in 1976, he has been active with several research groups including the Atomic Physics Laboratory and the Center for Neurodynamics; he also has published in several journals including Scientific American and Review of Scientific Instruments. Garver taught Modern Electronics and assisted in the Advanced Undergraduate Physics Laboratory at UMSL for more than 30 years.
Appendix A
Clinical Trials - Data

Summary of Clinical Data from the Q3D
DO NOT CITE

Background
Why did we make the Q3D? In the early 1990s our study team was involved with a study that assessed vision in patients with Alzheimer’s disease (See Bassi, CJ Solomon K, Young D Vision in aging and dementia. Optom Vis Sci 70: 809-13, 1990). As part of that study we measured stereoacuity in the subjects. We wanted to determine the binocular status of patients as part of the exclusionary criteria. We used modified pediatric techniques, cover test and the Worth 4 dot test, to assess binocular function. It was clear that the Worth 4 dot test was more of a “blunt instrument” for determining suppression status. The Worth 4 dot is only a qualitative test “normal” vs “abnormal” with a severe suppression > 2 log units needed to give a diagnosis of “abnormal”.

We (Michael Howe, Wayne Garver, Carl Bassi) devised a prototype device that used LEDs for target lights (stable, high luminance), with a calibrated light output where the luminance can be increased or decreased in intensity in 0.1 log unit steps over a 3 log unit range.

To date, 2 trials have been run with the Q3D. The first trial was a pilot study using 30 subjects (10 adult controls along with 20 patients from the UM St Louis College of Optometry). The purpose of the study was to determine the reliability of the test in adults and children and its use in a clinical population. The second trial was performed at Cardinal Glennon Children’s hospital in St Louis on a sample of 200 consecutive patients seen in the clinic. The purpose was to determine its utility in a large clinical (tertiary) practice.

Trial 1
This study was approved under the UMSL IRB. The subjects were 10 adults with normal binocular vision (age 28.7 ± 7.1 yrs) and 20 children (9.1 ± 2.6 yrs) were asked to match the red and green lights in brightness with the test being repeated
Subjects were classified into 6 categories: adults, convergence problems, alignment (exo- or esotropia), accommodation problems, amblyopia, and “others.”

Results
With the adults, 22/30 tests (10 subjects tested three times) found that the lights matched upon initial presentation and six more were matched with the addition of 1.1 log unit to one light. The mean log suppression across the three trials for the adult observers was 0.04 ± .01 log units.

There was also good reliability found with the pediatric patients. The following table shows the intercorrelations among the three tests. There were strong significant correlations among all the tests.

**Correlations Among the Repeated Measures For the Children**

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<th>Q3D2</th>
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<td>Q3D1 Pearson Correlation</td>
<td>1.000</td>
<td>.895**</td>
<td>.987**</td>
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<tr>
<td>Sig. (2-tailed)</td>
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<td>20</td>
<td>11</td>
<td>6</td>
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<tr>
<td>Q3D2 Pearson Correlation</td>
<td>.895**</td>
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<td>.995**</td>
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<tr>
<td>Q3D3 Pearson Correlation</td>
<td>.987**</td>
<td>.995**</td>
<td>1.000</td>
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<td>Sig. (2-tailed)</td>
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**Correlation is significant at the 0.01 level (2-tailed).**

This data is consistent with a highly reliable measure of visual suppression.
The next comparison was done across the groups. The following figure shows the mean level of suppression for the different groups.

ANOVA found a significant difference across groups. Paired comparisons, using the Tukey-Kramer multiple comparisons correction, found a significant difference (p<.001) of the amblyopia group compared to each of the other groups.

This data was presented at the 2008 AAPOS meeting and juried as among the “best presentations.”

Conclusions from Study 1:
1. The Q3D provides a way to reliably measure suppression in both adult and pediatric patients.
2. The test was relatively simple for patients to perform even in children as young as 5 years of age.
3. The Q3D can be used to quantify even mild suppression in a variety of patient populations.
**Trial 2**

This study was conducted at Cardinal Glennon Children's Hospital-St. Louis University with Brad Davitt, M.D., Oscar Cruz, M.D. (chair), and Eric Behrman (medical student). It was done with approval from the UMSL and Saint Louis University IRBs.

The study examined 200 consecutive patients, ages 3-18 (mean age 7.6 ± 3.9 years) with any condition. The following information was collected from each subject: diagnoses, Worth 4 dot results, refraction, acuities (monocular), stereoacuity, and results of the Q3D (three times). The experimental questions were:

1. Can the Q3D be used in a busy clinical practice?
2. Can the Q3D be done/understood by all age?
3. Is the Q3D more sensitive to detect suppression than the Worth 4 dot?

**Results**

The Q3D was easily incorporated into the clinical exams and was understood by the subjects.

**Is the Q3D more sensitive to suppression than the Worth 4 dot? Overall analysis:**

Standard sensitivity and specificity tests are not useful here because there is no "gold standard" for determining when there is suppression. Our hypothesis is that the Q3D is more sensitive than the Worth 4 dot because it is quantitative and can measure much smaller differences in sensitivity between eyes. Indeed we found that overall, 20.8% of patients identified as having deficit with Worth 4 dot, 44.4% of patients with the Q3D. While this number may seem high it is important to note that Cardinal Glennon is a tertiary care referral center with a high percentage of amblyopes referred and in this population (n=122).

**Patients diagnosed as amblyopic**

Further analyses were performed with only those subjects diagnosed with amblyopia. It is important to note here that subjects with the diagnoses of "amblyopia" were in various stages of treatment from newly diagnosed to long term
follow up from patching and or surgical intervention. This complicates comparing subjects with “amblyopia” from those without because some subjects classified as “amblyopia” who were treated would be expected to have less suppression than those without treatment (assuming that treatment was begun at a point where there is still plasticity of the visual system). We recruited Paul Thompson, PhD professor in Biostatistics at Washington University to assist with our analyses.

Logistic analyses were used to find the optimum “cut point” for declaring a subject “abnormal” with the Q3D test. A value of 0.3 log unit was determined to be optimal cut point for an abnormal test. The Q3D found an abnormal result in 68% if the patients with the diagnosis of amblyopia while 18% of amblyopes had an abnormal Worth 4 dot finding. Again, we would not expect that 100% of the patients should have a “normal” Q3D result here because subjects were in various stages of treatment. The important point here is that the Q3D is much more sensitive in finding abnormal suppression.

**Conclusions from the two trials:**

1. The Q3D is a reliable, valid quantitative measure of visual suppression
2. The Q3D is more sensitive that Worth 4 dot in finding suppression
3. The Q3D is an easy test both for patient and clinician. The test may be even further simplified with larger steps. This trial suggests that 0.3 log unit steps may be sufficient for testing. This would simplify the testing procedure even more.
Appendix B

Nerac Regulatory Report for Q3D

05UMS031: Q3D - REGULATORY

May 28, 2013

Prepared for:
Tamara Wilgers, Director

University of Missouri, St. Louis

Written by:
Donna Mitchell-Magaldi, Nerac Analyst
Tina Rideout, Nerac Analyst
Objective

The University of Missouri has designed the Quantitative Three Dot Test (Q3D) to detect visual suppression. This is a hand-held, portable device that quantitatively measures the amount of visual suppression in either eye of the patient in less than one minute. The device has the ability to measure the depth of suppression allowing for the ability to track the progress of treatment over time in patients.

The University of Missouri has requested Nerac provide an opinion as to the proper FDA classification of this device. The St. Louis IRB has indicated that the device should qualify as a class I exempt (no premarket approval necessary) and Nerac has been asked to verify this and provide rationale.

Approach

Nerac conducted a thorough investigation into the FDA regulations pertaining to device classification. First, Nerac analyst consulted FDA’s definition of a medical device to determine if this device is considered a medical device.

Once it was determined that the device did meet the definition of a medical device, the device classification panel was searched to identify the code of federal regulations that match the device description.

After looking through the list of ophthalmic devices already classified by the FDA, it was noted that although many employed similar technologies for different intended use, most were classified as class I exempt under 21 CFR part 807 subpart E. This regulation was consulted to further determine if the Q3D was indeed exempt.

The FDA 510K process and exemptions was then researched to determine if, Q3D was not equivalent to any of the already exempted devices listed by the FDA, to determine additional 510K exemption. Other considerations were power supply.

Next, the 510K De Novo process was consulted because this device is the first device to quantify the depth of visual suppression.

Definition of a Medical Device

If a product is labeled, promoted, or used in a manner that meets the following definition in
section 201(h) of the Federal Food Drug & Cosmetic (FD&C) Act it will be regulated by the Food and Drug Administration (FDA) as a medical device and is subject to premarketing and post-marketing regulatory controls. A device is:

- "an instrument, apparatus, implement, machine, contrivance, implant, in vitro reagent, or other similar or related article, including a component part, or accessory which is:
  - recognized in the official National Formulary, or the United States Pharmacopoeia, or any supplement to them,
  - intended for use in the diagnosis of disease or other conditions, or in the cure, mitigation, treatment, or prevention of disease, in man or other animals, or
  - intended to affect the structure or any function of the body of man or other animals, and which does not achieve its primary intended purposes through chemical action within or on the body of man or other animals and which is not dependent upon being metabolized for the achievement of any of its primary intended purposes." (FDA, 2013)

The Q3D is an instrument used to detect/diagnose visual suppression and therefore satisfies the FDA’s definition of a medical device.

**Device Classification Panel**

[http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/Overview/ClassifyYourDevice/ucm051530.htm](http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/Overview/ClassifyYourDevice/ucm051530.htm)

Ophthalmic devices are found under 21 CFR Part 886


This provided a list of devices already categorized by the FDA. Devices that appeared to be similar, but not a direct match, are listed below:

- Sec. 886.1050 **Adaptometer (biophotometer).**

(a)**Identification.** An adaptometer (biophotometer) is an AC-powered device that provides a stimulating light source which has various controlled intensities intended to measure the time required for retinal adaptation (regeneration of the visual purple) and the minimum light threshold.

(b)**Classification.** Class I (general controls). The device is exempt from the premarket notification procedures in subpart E of part 807 of this chapter, subject to the limitations in 886.9. [55 FR 48441, Nov. 20, 1990, as amended at 59 FR 63012, Dec. 7, 1994; 66 FR 38809, July 25, 2001]
Sec. 886.1070 Anomaloscope.

(a) **Identification.** An anomaloscope is an AC-powered device intended to test for anomalies of color vision by displaying mixed spectral lines to be matched by the patient.
(b) **Classification.** Class I (general controls). The device is exempt from the premarket notification procedures in subpart E of part 807 of this chapter, subject to the limitations in 886.9.


Sec. 886.1340 Haploscope.

(a) **Identification.** A haploscope is an AC-powered device that consists of two movable viewing tubes, each containing a slide carrier, a low-intensity light source for the illumination of the slides, and a high-intensity light source for creating afterimages. The device is intended to measure strabismus (eye muscle imbalance), apparent disease of the eye, to assess binocular vision (use of both eyes to see), and to treat suppression and amblyopia (dimness of vision without any
(b) **Classification.** Class I (general controls). The device is exempt from the premarket notification procedures in subpart E of part 807 of this chapter, subject to the limitations in 886.9.


Sec. 886.1605 Perimeter.

(a) **Identification.** A perimeter is an AC-powered or manual device intended to determine the extent of the peripheral visual field of a patient. The device projects light on various points of a curved surface, and the patient indicates whether he or she sees the light.
(b) **Classification.** Class I (general controls). The device is exempt from the premarket notification procedures in subpart E of part 807 of this chapter, subject to the limitations in 886.9. The device is also exempt from the current good manufacturing practice requirements of the quality system regulation in part 820 of this chapter, with the exception of 820.180, with respect to general requirements concerning records, and 820.198, with respect to complaint files.
21 CFR Part 807 Subpart E-Premarket Notification Procedures
wFR=1&subpartNode=21:8.0.1.1.5.5

Sec. 807.85 Exemption from premarket notification.

(a) A device is exempt from the premarket notification requirements of this subpart if the device intended for introduction into commercial distribution is not generally available in finished form for purchase and is not offered through labeling or advertising by the manufacturer, importer, or distributor thereof for commercial distribution, and the device meets one of the following conditions:
(1) It is intended for use by a patient named in the order of the physician or dentist (or other specially qualified person); or
(2) It is intended solely for use by a physician or dentist (or other specially qualified person) and is not generally available to, or generally used by, other physicians or dentists (or other specially qualified persons).

(b) A distributor who places a device into commercial distribution for the first time under his own name and a repackager who places his own name on a device and does not change any other labeling or otherwise affect the device shall be exempted from the premarket notification requirements of this subpart if:
(1) The device was in commercial distribution before May 28, 1976; or
(2) A premarket notification submission was filed by another person.

If the University can prove equivalence of the Q3D to any of the devices listed above, then it would qualify as class I exempt. However, if equivalence cannot be proven the Q3D is not considered exempt and would have to apply for 510K clearance.

Class I/II Devices Exempt from 510(k) and class I Devices Exempt from GMPs
Devices exempt from 510(k) are:
• Preamendment devices not significantly changed or modified; or
• Class I/II devices specifically exempted by regulation
If the Q3D is not substantially equivalent to an already marketed device, then it is recommended that the University pursue a De Novo 510K.

De Novo 510K

This process provides a route to market for medical devices that are low to moderate risk, but that have been classified in class III because FDA has found them to be “not substantially equivalent” (NSE) to legally marketed predicate devices.

If a new device that does not have a substantially equivalent device in which to offer as predicate as required by the 510K, the FDA issues a No Substantial Equivalent letter and automatically classifies the device as a class III.

“novel type of device may be eligible for the de novo process if it has received an NSE determination as a result of a 510(k) submission. In this case, in accordance with section 513(f)(2), the submitter of a 510(k) may, within thirty (30) days of receipt of an NSE determination for that 510(k), submit a de novo petition requesting FDA to make a risk-based classification determination for the device under section 513(a)(1) of the FD&C Act. The de novo petition must include a description of the device and detailed information and reasons for any recommended classification. FDA must make a classification determination for the device that is the subject of the petition by written order within sixty (60) days of the request”

If the FDA grants the de novo petition, the device is reclassified from class III into class I or class II. The device may then be marketed immediately and serve as a predicate device. Thereafter, we will also publish a notice in the Federal Register announcing the classification, the accompanying regulation, and the controls necessary to provide reasonable assurance of safety and effectiveness. If the petition is denied, the device remains in class III and may not be marketed”

Conclusion

Based on the information provided for the Q3D by University of Missouri and the FDA regarding product classification and exemptions it is concluded that the Q3D is minimal risk device. As such it should qualify for class I. However, Nerac cannot determine if the Q3D is substantially equivalent to any of the devices listed as FDA exempted devices. If the University of Missouri inventors can qualify substantial equivalence to any of the already exempted devices, then it should qualify for class I exempt. If the Q3D is not substantially equivalent to the exempted
devices and has no predicate device, Nerac recommends University of Missouri consider the De Novo 510K.

The De Novo 510K process is for those new innovative low to moderate risk devices that do not have a predicate in which to satisfy safety and performance. The process is redundant in that you must first file for a traditional 510K and have the FDA issue a No Significant Equivalent (NSE) letter. Then, you can file for the 510K de Novo using the information in the NSE letter. There are two advantages to using the De Novo process, once cleared, the device (1) can be marketed immediately, and (2) can be used as a predicate device.

As discussed in our previous conversations, the FDA does have a process by which you can obtain their opinion as to the proper classification and regulatory pathway. This process is called a 513 (g) and is subject to user fees. The FDA is also very clear that an opinion via the 513 (g), it is not an official designation and is only based on the information the submitter provides to the FDA. http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/ucm209841.htm

Please note that the opinions provided by Nerac are technical opinions based on information and experience and do not constitute a legal opinion.

Works Cited

About the Analysts
Donna Mitchell-Magaldi
Analyst Donna Mitchell-Magaldi has been with Nerac for over 12 years and partners with medical device companies, serving them in many capacities. Donna’s particular expertise is within the dental field where she was involved all areas of dental hygiene, radiation, and restorative dentistry, oral surgery including implants, extractions, and periodontal treatments, prosthetics and orthodontics. As an Analyst at Nerac, Donna has been exposed to a variety of other medical device disciplines such as cardiovascular, medical imaging, endodontics, biomonitoring and medical sensors, orthopedics, gastrointestinal and more. Over the course of the last several years, Donna has been assisting our medical device clients with meeting the MedDev 2.7.1 Rev 3 “Guideline on Medical Devices Clinical Evaluation: A Guide for Manufacturers and Notified Bodies” and other regulatory issues, market analysis, prior art
research, research to support R&D initiatives, patient landscape, FDA clinical literature support, and much more. Ms. Mitchell-Magaldi has wide-ranging expertise, encompassing medical device regulatory; dentistry (devices, equipment, procedures, dentifrices, hygiene, impressions, prosthetics, implants, orthodontics, periodontals); medical devices (including imaging diagnostics, catheters, shunts, and syringes); radiography; environmental topics (the effects on wildlife and habitation, strategies to protect endangered ecosystems, species, and food-chain effects); ecology (population dynamics, animal behavior and organismal biology); and laboratory analysis (trace metal analysis, IACUC, lab safety, inductive couple plasma and atomic absorption).

**Key areas of expertise**
- Medical devices
- CE Mark compliance
- Regulatory issues
- Dentistry
- Medical Technology
- Radiography, Biomedical Imaging
- Environment, Ecology
- Animal Behavior, Organismal Biology

**Industries**
- Medical Devices
- Dentistry
- Regulatory-Medical Devices

**Credentials**
- B.S., Biology, Eastern Connecticut State University

**Professional Memberships**
- Regulatory Affairs Professional Society (RAPS)
- MedTech

**Publications**
- Mitchell-Magaldi, D “The Importance of Article Selection for Meeting the MedDev 2.7.1 Rev 3 Requirements” Nerac Strategist March 2013


**Tina Rideout**

Tina has worked in Research and Technology Development as well as Regulatory Affairs for a top tier company involved with implants, wound healing, medical devices, and surgical instrumentation research. With this experience, she is well versed in the total product development cycle, from product concept to launch. She has conducted technology landscapes and devised strategic plans as to how to incorporate new technologies into the company’s portfolio. She has developed test protocols for validating new surgical stapling products during
the development process. Moreover, Tina has experience in identifying global thought leaders and potential partners in the clinical and technical arenas in order to validate design concepts and assess clinical applicability. She understands what is fully involved in bringing the latest innovative concept to a viable product in a global marketplace.

**Areas of Expertise**
- Medical Devices
- CE Mark compliance
- Medical/Surgical Instrumentation
- R&D, Product Development
- Regulatory
- Physiology
- Medical Diagnostics, Imaging
- Reimbursement

**Industries**
- Medical Device
- Biology and Biotechnology

**Credentials**
- M.B.A., International Business, University of Connecticut
- M.S., Biomedical Engineering, University of Connecticut
- B.S., Engineering with a concentration in Biomedical, Trinity College, Hartford, CT

**Published**
Tina has co-authored posters that have been presented at clinical congresses. She has filed applications with United States’ and European patent authority.

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