References and approvals

HEILBRON ANIMAL CLINIC

Dr. P.L. Van Zyl B.V.Sc.
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Regarding the RAU Animal Immobilizer

1. During my 20 years in large animal practice I have tested and used many different immobilizers. In my opinion none are as effective and easy to use as the RAU Immobilizer. I say so for the following reasons:
2. The probe inserts with ease into the rectum, and no clips attached to the lip that bothers the animal.
3. Total immobilization of the hind legs prevents the animal from kicking, even with stitching of teats.
4. Animals show no or very little stress. We use it when giving drips and blood to very sick animals, without detrimental effects.
5. The compulsory branding of animals is done without blotching and with less pain.
6. Even difficult to handle Brahman bulls calm down after a few minutes.

I can recommend this sturdy compact Immobilizer to any person working with cattle.
October 22, 1998

Neuclon Genetics

TO WHOM IT MAY CONCERN

I have been using the Animal Immobilizer extensively for the past twelve months at the Bethlehem Embryo Quarantine Centre.
The immobilizer was applied to assist in procedures like hoof trimming, eye treatment, lancing of abscesses, dehorning, minor surgery, clipping of animals for shows and various other procedures. The animals housed at the Quarantine Centre are either producing dairy cows or cows involved in embryo transfer programs and minimizing stress factors is very important to ensure sustainable milk or embryo production. I found the Animal Immobilizer indispensable in working with these animals. They showed very little signs of discomfort or stress and had no side effects. The Animal Immobilizer is an extremely helpful tool in large animal handling and management.
Yours sincerely,
Dr. C. J. van Zyl
October 22, 1998

University of Pretoria

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DEPARTMENT OF ANIMAL AND COMMUNITY HEALTH

IMMOBILIZER: EVALUATION

On your request I have evaluated a cattle immobilizer provided to me by yourself. Unlike other immobilizers, this one uses a rectal probe.
I found the instrument handy whilst performing sheath scrapings in adult bulls that were partly immobilized by the apparatus, making the collection much easier and safer. I can recommend this instrument for use in veterinarian practice as well as for responsible stockmen.
It must be noted that the effect of the immobilizer has no anesthetic properties, nor does it act as a tranquilizer. I would not replace the use of local or general anesthetic for painful procedures such as dehorning of adult cattle or major surgical procedures where pain is an issue.
The immobilizer does not replace good on farm handling facilities and good stockmanship where bovine behavior should constantly be taken into account. It should rather be seen as an aid to fluently completing a procedure, which a bovine would naturally resist, and if used correctly, it can prevent unnecessary injury to both handler and bovine.
Each bovine will respond differently to the immobilizer – as seen in the case of the adult bulls – an important fact to take into account by he operator.
Dr. W A Schultheiss

Agency Approvals

The RAU Animal Immobilizer meets the standards of the following agencies:

Federal Communications Commission:

Complies with FCC Rules and Regulations for, Part 15, Class A, Radiation and Conducted Emissions tests.

CE Compliance:

Verified to comply with CISPR 22/EN55022, Class A Rules and Regulations for Emissions and EN50082-1 (97), EN61000-4-2 (95) and EN61000-4-3 (96) for Generic Immunity as applicable.

Patent No's. RSA 99/3554, US 6901884 & US 7,111,587 granted to RAU.

These patents grant RAU the right to exclude others from making, using, offering for sale, importing or selling the invention throughout the United States of America and South Africa.

The invention provides for a device for use in partially or fully immobilizing animals such as cattle, sheep and the like. The device includes a probe for insertion in the anal canal of the animal, the probe comprising a pair of spaced electrodes connected by way of electrical conductors to a power source providing a pulsed electrical current at specified voltages and frequencies to the electrodes.

Effectively this means that other animal immobilization devices being sold in the USA or RSA which are using the same method and similar electronic frequencies may be in breach of these patents and may be infringing on RAU legal rights. This information is provided to potential animal immobilizer customers who are advised to satisfy themselves that any other products they may be considering are not in breach of these patent rights.

ELECTRONIC NEURAL STIMULATION for PHYSICAL RESTRAINT in BOS TAURUS

Aversiveness and Humaneness Contrasted with Squeeze Chute Methodology

Stephen M. Webb, Ph.D. Assistant Professor McNeese State University Department of Agriculture

Introduction This study demonstrates that physical restraint of cattle by direct, low voltage, electronic stimulation of the femoral neural branch is no more stressful in mature cows than industry-standard squeeze-chute methodology based on observable and measurable behaviors and measurable physiological parametrics. It is imperative to note that this particular technology is an improved embodiment of the work-of-art evaluated in the 1980's (see "Previous Work of Art" below). The veterinary medical technology used in this study was shown to produce a controllable state of motor tetany that effectively restrains an animal by electronically inducing a low-energy neural stimulation into the femoral nerve branch through a bipolar probe inserted in the rectum of the animal with physiological parametrics, stress levels and aversive responses remaining commensurate or better than that of the industry standard squeeze chute methodology. Device Under Test The Device Under Test (DUT) is the RAU Animal Immobilizer. This device provides a low voltage, low energy signal directly to the femoral nerve via a bipolar rectal probe that creates a very localized electronic stimulation at a prescribed frequency and waveform that tends to focus such stimuli on that neural branch. Consequently the stimulus is propagated into the spinal column without significant conduction through collateral tissue thereby eliminating any "shocking" sensation. Only two to four volts is normally required to achieve desired motor tetany. Test Protocol The Test Protocol was designed to apply the same handling stressors for each test subject other than the application of restraint methodology. Each test subject was selected at random and passed through five stations for five complete cycles. The five stations of the facility were: Pre-Process Pen, Isolation Pen with Feed Reward, Hydraulic Squeeze Chute, Exit Pen with Feed Reward, Post-Process Pen. The Post-Process and Pre-Process pens were adjacent to each other in order for the last subjects to experience similar communal herd presence as the first subjects. Four conditioning cycles were executed to provide sufficient experiential causation for development of amplified aversive response prior to a final record cycle. The first cycle was identical in restraint methodology for all subjects to establish baseline Electronic Neural Stimulation for Aversiveness and Humaneness vs Physical Restraint in Bos Tarus Squeeze Chute Methodology physiological and behavioral parametrics. Subsequently subjects were restrained according to the Test Method shown below while in the Squeeze Chute. Test Method Seventeen mature cows of genus Bos Tarus were divided into six test subjects and eleven control subjects. The six test subjects were placed into a

hydraulic squeeze chute but not into the head gate and no “squeeze” was applied. The Test Group (TG) was then restrained with the Device Under Test (DUT). Six control group animals were assigned to control-group one (CG1) and were restrained and “squeezed” in the hydraulic squeeze chute and the head gate. Control group two (CG2) consisted of the remaining five animals that were treated the same as the Test Group except that no stimulus was applied to the DUT. On the first cycle through the facility, all subjects were restrained the same as that for CG1 to establish a baseline score. Parametrics were recorded in the isolation pen with feed reward, during restraint, for exit response and at post-test feed reward with behavior graded on a predetermined scale. During restraint, physiological response for each subject was measured for heart rate, respiration and temperature. Subjects were restrained for two minutes and completed five cycles through the test facility. Subject’s responses were recorded only on the first, third and fifth cycle through the test facility.
The first cycle established a baseline, the fifth recorded final response and the third served as an intermediate correlation point. Each subject was scored at each record station by two observers. One observer remained at that record station and one accompanied each test subject through the entire cycle thus harmonizing inherent errors in single observer scoring. Animals were selected at random and observers were unaware of which group they belonged to other than at the squeeze chute where it was apparent which restraint methodology was being applied. Observers were drawn from a senior level animal science lab and were thoroughly briefed on duty, responsibilities and the scoring methods. This Table illustrates the process:

	Test Group Six cows	**Control Group 1 Six cows**	**Control Group 2 Five cows**
Station 1 Pre Process Pen	Holding Holding	Holding	
Station 2 Isolation w/ Feed Reward	Behavior & Feed Response Recorded	Behavior & Feed Response Recorded	Behavior & Feed Response Recorded
Station 3 Hydraulic Squeeze Chute	No Head Gate Used No Squeeze Applied Insert DUT Apply DUT Stimulus Record Phys Response	Head Gate Used Squeeze Applied No DUT Record Phys Response	No Head Gate Used No Squeeze Applied Insert DUT No DUT Stimulus Record Phys Response
Station 4 Exit Pen w/ Feed Reward	Behavior, Exit & Feed Response Recorded	Behavior, Exit & Feed Response Recorded	Behavior, Exit & Feed Response Recorded
Station 5 Post Process Pen	Holding	Holding	Holding

Test Results

While the relatively small subject size and small test size produced variability in the test results, there were no areas that caused concern regarding the comparative assessment of the two methodologies. For the sake of brevity in this summary paper, only the relationship between the test group and the first control group will be discussed at the last station.
Behavior Levels -In all but one case we see the behavior observations improving both from cycle to cycle and from station to station with the first station exhibiting the higher observed stress behavior. The Test Group (TG) demonstrated similar or better performance than the Control Group 1 (CG1). The one exception occurred on the third cycle in the fourth station (the squeeze chute) where the behavior scores were worse than the first and fifth cycle. However, examination of the third cycle showed significant reduction of stress scores as the subjects passed from station to station with the Test Group (TG) being equal or better than the Control Group 1 (CG1) and thereby indicating normal progression as observed in the other test cycles.
Feed Response – Upon exit from the restraint station the average feed response remained similar from cycle-to-cycle. No stress or aversive development is perceived here. From the first baseline cycle to the

last test cycle results fell off only 8% and 7% respectively for the Test Group (TG) and Control Group (CG1). The feed response is a subjective measure of the test animal's eagerness in consuming the feed reward. As stated above in the Behavior Levels, the first station was the most stressful when the test subject was removed from the herd and isolated. In the Isolation Pen the feed response fell from the first pass to the last cycle by 60% and 81% respectively for the Test Group (TG) and Control Group (CG1). In fact only three animals fed at all in the fifth cycle in the Isolation Pen. Remarkably, all but one subject fed eagerly upon final release from the final restraint station demonstrating that the removal from the herd is worse than all of the handling and restraint methodologies and yet the cattle acclimated quickly and were eager to feed upon completion of the test. The one animal that did not take feed never did take feed except very lethargically at the end of the very first cycle.

Time to Feed -As with the Feed Response above, the average time taken to begin taking feed is similar for the Test Group (TG) and the Control Group (CG1), varying from each other by only 4 %. While the time to take feed did worsen when contrasted with the Feed Response, it could also be attributed to a slower exit speed which would also demonstrate lower stress levels. Most important is that the restraint methods demonstrate no significant difference.

Measured Data -Includes Temperature, Heart Rate and Respiration. All of these objective parameters were better in the Test Group (TG) than for the Control

Group (CG1). From the first baseline cycle to the last cycle Temperature rose an average of 0.6 degrees F for the Control Group (CG1) but only 0.4 degrees for the Test Group (TG). For Heart Rate we find the heart rate for the Test Group (TG) actually fell 0.9 beats per minute versus the average rise for the heart rate in the Control Group (CG1) of 6.3 beats per minute. Similarly, the respiration improved for the Test Group (TG) by falling 0.3 breaths per minute average while the Control Group (CG1) worsened by 5.2 breaths per minute. Heart rate was determined with a stethoscope and no arrhythmia was detected and no abnormal respiration was noted.

Data Summary -While assessing data of this nature can become very complex, no convolution or permutation of this data results in reason at this point for concern regarding this restraint methodology. While the test data and the test methodology may warrant criticism in various areas, the result clearly demonstrates reason for optimism and a need for further, more extensive and comprehensive studies in the hope of providing cattle handlers and operators an effective, less costly and possibly better restraint alternative to the industry standard squeeze chute restraint methodologies.

Previous Work of Art Since the 1980's the electronics industry has witnessed an explosion of atomic proportions in the development and commercialization of data processing, communications, audio and video technologies as well as a virtual plethora of discoveries in every field and discipline. It should, therefore, be no surprise that the electronic restraint technology for medium to large mammals would also experience some improvement at the same time. A search of studies conducted in the 80's on so-called "immobilizer" technologies by Grandin, Lambooy, Rushen, Pacoe, et al finds distressing results for electro-immobilization at this particular time in history. The actual effect of these early products was actually far worse than these studies ever demonstrated as the world is full of bovine practitioners with horror stories of broken bones and mortalities relating to these identifiable "two wire" systems then employed. However, please note, the embodiment of the work-of-art as presented in this paper is an improvement that has overcome the faults and shortsightedness of the past and has proven worthy of further consideration and examination. Conclusion This study clearly showed no adverse effects related to repeated neural stimuli from the rectal probe with our measurements and observations of demeanor, feed acceptance, vocalization, respiratory rate, pulse rate, and body temperature, all of which are accurate indicators of pain, discomfort, and stress.

While some studies related to stress tend to focus only on elevated levels of circulating glucocorticoid hormones, the uncertainty and unpredictability of using blood analysis to isolate specific stress indicators related only to a change in a specific stimuli did not fit this initial study.

I feel this study is an accurate representation and a good indicator of the results one can expect when using the RAU immobilizer technology. Additional and more comprehensive studies are clearly indicated and recommended.