Dinbeat UNO

Ethology Protocol

When can we use Dinbeat UNO?

Ethology protocol

Clinical ethology is the science that studies animal behavior. We can classify behavioral alterations based on existing ethological abnormalities related to a clinical pathology causing pain or behavioral problems associated with stress.

Broadly speaking, behavior problems in dogs can be divided into:

Generally, the behavioral problems that dogs have are divided into:

- **Aggressiveness problems**
- **Separation anxiety**
- **Elimination, vocalisation and destructiveness**
- **Fear problems and phobias**
- **Other behavior problems**
    - **Compulsive behaviors**
    - **Behavior problems in geriatric animals**
    - **Miscellany**

And in cats:
- **Aggressiveness problems**
- **Unwanted bowel movements**
- **Altered intake**
- **Scratch behavior**
- **Vocalization**
- **Fear problems and phobias**
- **Other behavior problems**
    - **Compulsive behaviors**
    - **Behavior problems in geriatric animals**

All the situations exposed above can be linked to behavioral problems associated with pain or stress and it is in these situations that Dinbeat UNO can help us both in their detection and treatment as well as in their follow-up.

Benchmarks for dogs and cats

Parameters	Dogs	Cats
Heart rate	Puppy: 70 - 220 bpm Adult: 70 - 160 bpm Toy breed: 70 - 180 bpm Large breeds: 60 - 140 bpm	140-220 bpm
Breathing frequency	10 -30	20 - 40
Rectal temperature	37.5 – 39 °C	37.7 - 39.2°C
Rythm	Respiratory sinus arrhythmia Sinus bradycardia (sport or working dogs)	Normal Sinus rhythm Sinus tachycardia (stress)

ECG	Suration(s)		
	P	≤0.04	≤0.04
	RP	0,06-0,13	0,05-0,09
	QRS	<20 kg : ≤0.05 >20kg : ≤ 0,06	≤0.04
	QT	0,15-0,25	0,12-0,18
	Amplitude (mV) Lead II		
	P	≤0.04	≤0.2
	R	<20 kg : ≤ 2,5 >20kg : ≤ 3,0	≤0.9
	J	≤ 25% of the R wave	≤0.3

Table 1 and 2: physiological ranges that can be monitored with Dinbeat UNO, modified Torrente and Bosh (2011) table.

When can we use Dinbeat UNO?

Behavioral problems associated with pain

Many situations of behavioral problems in animals are behavioral alterations due to the existence of an ailment, acute or chronic, due to an under-diagnosed pathology.

The pain can cause:

1. Aggressiveness:
Pain can cause aggressiveness in behavior because of a defensive reaction. In this way, the animal will defend itself by avoiding physical contact to avoid pain. As well as, of the situations that have caused him pain.

2. Fear-anxiety:
Animals can create associations of fear situations in which they have experienced pain, so when they are in similar conditions, they will have the memory of pain and may experience fear or anxiety.

3. Sleep disturbances:
Ailments that interfere with the animal's life can affect the quality and rhythm of the floor.

4. Inappropriate eliminations:
Especially in the feline species.

5. Repetitive behaviors:
The stress they may feel due to pain, whether chronic or acute, triggers compulsive compensatory behaviors. For example, behaviors that relieve pain (such as licking a painful area or getting the pet-mate's attention).

When can we use Dinbeat **UNO**?

Behavioral problems associated with pain

Differentiate behavioral disturbance from pain.

To differentiate whether it is a behavior problem or a situation that is causing pain, we must perform:

1. **Anamnesis.**
2. **Physical exam with Dinbeat UNO:**
   a. Assess physiological ranges as objectively as possible.
   b. Pain visualization scale (Table 3; Table 4).
   c. If the animal does not present any warning sign in which we must act urgently, the recommendation will be:
      i. Holter mode monitoring (24 hours) with movement filter on a routine day for the animal (Table 1 and 2).
   d. Blood analysis and imaging tests depending on the assessment and opinion of the clinician. Hormonal analysis if deemed appropriate (thyroid, cortisol...).
3. **Assessment of the results (depending on these we can find ourselves with):**
   a. Pre-existing pathology causing an alteration of behavior due to pain:
      i. Pathology diagnosis.
      ii. Treatment.
      iii. Tracing.
   b. Behavior problem due to non-pathological cause.

Dog Pain Assessment scale

Category	Description	Numérotation
Physiological parameters	In range	0
	Dilated pupils	2
	Increase in HR over baseline:	
	> 20 %	1
	> 50%	2
	> 100%	3
	Increase in RF over baseline:	
	>20 %	1
	>50 %	2
	>100 %	3
Response to palpation	No behavior change	0
	Defense reactions when touched	2
	Defense reactions without touching him	3
Activity	Rested, semi-conscious, sleeping	0
	Resting, sleeping	1
	Eating	0
	Agitated, restless	2
	Twisting, rolling, bumping	3

Dog Pain Assessment scale

Category	Description	Numérotation
State of mind	Submissive	0
	Friendly	1
	Scared	2
	Aggressive	3
Position	Lateral decubitus	0
	Sternal decubitus	1
	Sitting, lying, in station with head up	1
	Moving	1
	In station, crestfallen	2
	Abnormal posture (prayer, kyphosis)	2
	Guarding protection of the affected area	2
Vocalisation	Does not vocalize	0
	Vocalizes when touched	2
	Intermittent vocalization	2
	Continuous vocalization	3

Table 3: includes a combination of specific physiological and behavioral responses divided into categories based on behaviors related to suffering from pain for the score for its classification (Table 4) according to Firth, and Haldane; 1999.

When can we use Dinbeat **UNO**?

Dog Pain Assessment scale

Pain	Score
Mild	1 -5
Moderate	6 – 11
Serious	12 – 17
Unbearable	18 – 24

Table 4: pain classification based on the score obtained according to Firth and Haldane; 1999.

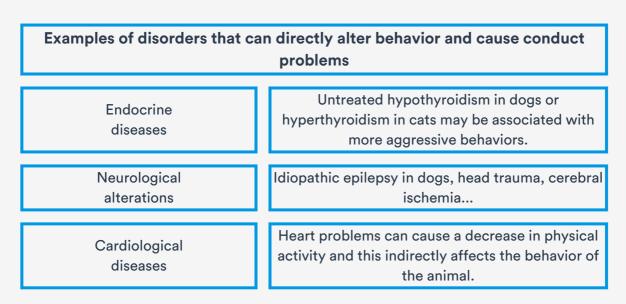***There are diseases that may or may not cause pain, but influence the behavior of animals (Table 5).**

Examples of disorders that can directly alter behavior and cause conduct problems	
Endocrine diseases	Untreated hypothyroidism in dogs or hyperthyroidism in cats may be associated with more aggressive behaviors.
Neurological alterations	Idiopathic epilepsy in dogs, head trauma, cerebral ischemia...
Cardiological diseases	Heart problems can cause a decrease in physical activity and this indirectly affects the behavior of the animal.

Table 5: example of disorders that can directly alter behavior and cause conduct problems.

When can we use Dinbeat UNO?
Behavioral problems associated with stress

Stress is a physiological response of the organism that leads to the activation of the Hypothalamus-Pituitary-Adrenal axis and is initiated by the release of corticotropin-releasing hormone (CRH).

This hormonal release causes a physiological response resulting from the release of catecholamines (Table 6).

It must be taken into account that many behavior problems derive from stressful situations that, if prolonged over time, can cause chronic stress, triggering aggressiveness, fear, phobias, anxiety... For example, stress in cats can pose a risk to the animal if it manifests itself acutely with anorexia.

Chronic stress in this species can cause lower urinary tract problems, which may require urgent treatment (urinary obstruction and elevated creatinine) or non-urgent, but require treatment (idiopathic cystitis).

The physiological parameters used to assess stress, such as the measurement of hormones, HR, temperature, blood pressure... have always had the drawback of being able to give false results as a result of our interference with the animal, that is, the influence of our presence and handling. about his constants (especially at the vet).

When can we use Dinbeat UNO?

Behavioral problems associated with stress

Consequences of stress	
Physiological	**Physical indicators**
Tachycardia Tachypnea Peripheral vasoconstriction hypertension bronchial dilatation hyperglycemia hyperthermia	hypersalivation Urine/faeces elimination tremors Panting Agitation Nervousness

Table 6: Physiological consequences and physical indicators of stress due to the release of catecholamines.

When can we use Dinbeat UNO?

Behavioral problems associated with stress

How will Dinbeat UNO help us detect this stress?

À travers de :
1. **Heart rate**
2. **Breath rate**
3. **Temperature**
4. **Heart rate variability**
5. **Vocalisation and activity**

1. Heart rate:

Cardiac function is influenced by the balance of the sympathetic and parasympathetic nervous systems, components of the Autonomic Nervous System. These can be activated in a generalized or selective way.

- The sympathetic nervous system acts by accelerating the depolarization of the sinus node and can be activated by a painful or emotional stimulus and produce an alarm or stress reaction. The consequence of this generalized sympathetic discharge produces, among other things, an increase in heart rate, muscle activity, blood pressure, and blood glucose concentration. While a selective activation can occur, for example, in thermal regulation. And volume of blood that passes through the affected skin and organs without affecting the others (Table 7).

- The parasympathetic nervous system is related to rest processes and its activation is related to energy savings. It produces a decrease in heart rate, with generalized discharge that will produce symptoms such as vomiting, nausea, increased secretions, increased intestinal peristalsis, enuresis... or selectively; bladder and rectal emptying.

When can we use Dinbeat UNO?

Behavioral problems associated with stress

Heart rate fluctuation

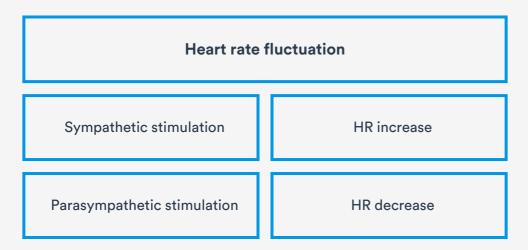| Sympathetic stimulation	HR increase
Parasympathetic stimulation	HR decrease

Table 7: Heart rate fluctuation as a function of the Autonomic Nervous System.

Keep in mind that HR increases during inspiration and decreases during expiration. Negative thoracic pressure causes reduced vagal tone and increased HR during inspiration. On expiration, the positive pressure of the vagal tone decreases the HR. Respiratory sinus arrhythmia is directly influenced by vasovagal tone, which can be estimated by variations of the RR intervals on the ECG.

In this way, we will be able to detect increases or decreases in HR by using Dinbeat UNO.

When can we use Dinbeat UNO?

Behavioral problems associated with stress

2.Breath rate:

Respiratory rate is also, in part, controlled by autonomic innervation.
In stressful situations, HR increases, as mentioned above, and to supply the demand for blood oxygenation flow, RR rises. Sympathetic innervation produces bronchodilation and pulmonary vasoconstriction.
On the contrary, the parasympathetic system modulated by the vagus nerve regulates breathing to decrease HR and relax the body, it can produce bronchoconstriction and increase bronchial secretions.

3.Temperature:

Temperature can also be an indicator of a stress situation, with hyperthermia appearing especially in acute stress. However, in chronic stress where the body has undergone a physiological adaptation it may not be such a good indicator.

When can we use Dinbeat UNO?

Behavioral problems associated with stress

3. Heart rate variability (ECG):

We can obtain information from the Autonomic Nervous System through HRV and it correlates with physiological adaptations to changes in the internal and external environment and the presence of diseases.

HRV has been used in the investigation of changes in the sympathovagal balance related to pathological conditions, stress, behavioral changes, temperament and emotional states. It is a good objective indicator of the activity of the autonomic nervous system in response to psychological and physiological stress. HRV is a non-invasive method for characterizing the response to stress, resulting from the rhythmic disorganization of the autonomic nervous system.

Vagal tone reflects the heart rate associated with spontaneous RF, and is measured by heart rate and its variability. An increased vagal tone has been linked to efficient autonomic regulatory activity that allows an organism to improve its sensitivity and response to physiological and environmental challenges. In situations of stress, it will result in a decrease in HRV.

HR and HRV are inversely proportional, when sympathetic stimulation is activated, HR will increase and HRV will decrease, if parasympathetic stimulation is activated, the opposite will happen (Table 8).

When can we use Dinbeat UNO?

Behavioral problems associated with stress

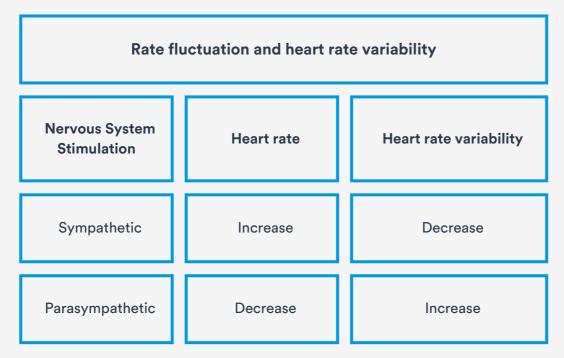| Rate fluctuation and heart rate variability		
Nervous System Stimulation	**Heart rate**	**Heart rate variability**
Sympathetic	Increase	Decrease
Parasympathetic	Decrease	Increase

Table 8: fluctuation of HR and HRV, sympathetic stimulation acts to accelerate the depolarization of the sinus node, producing tachycardia and decreasing HRV. Parasympathetic stimulation results in the release of acetylcholine, which decreases the discharge rate of the sinus node, producing bradycardia and increasing HRV.

For the display of HRV, monitoring with Dinbeat UNO for 24 hours is recommended. The HRV is obtained from the analysis of the time of the R – R intervals. We can acquire the ECG recording or the HRV tool that provides us with graphs in tachogram, histogram or Poincaré.

Through the graphs we can break down the data for analysis, with its components. Depending on the branch of the Autonomic NS (Sympathetic or Parasympathetic) that we want to assess, we must monitor the electrocardiographic activity for a minimum of time (Table 9).

When can we use Dinbeat UNO?

Behavioral problems associated with stress

There are different ways to analyze HRV data, among them, it is based on the time domain or frequency domain, ideally, we should analyze them in both ways.

- Time domain: We define time variables as the different statistical parameters that result from the electrocardiographic measurement of normal RR intervals. These normal RR intervals are statistically and mathematically analyzed to obtain the different parameters. It is done using tachograms, and these in turn can be represented as histograms. The parameters obtained in the time domain are influenced by changes in the activity of the SNS and the PNS, a circumstance that makes these measurements not specific to calculate the sympathetic-vagal balance in a concrete way. They are useful parameters to detect abnormalities in the activity of the Autonomic Nervous System but cannot be used to quantify specific changes in the activity of the relationship between the two systems.

- Frequency domain: the measurement of the HRV spectrum is obtained through a mathematical transformation and the energy (power) of the RR signal is broken down according to the frequency domains, better separating the sympathetic and parasympathetic influences. These various spectral components correlate with the different components of the autonomic nervous system. most of the power of the signal is in a range from 0 to 0.4 Hz. One of the advantages that this type of analysis provides us is the ratio of low frequency / high frequency , and it is used to estimate the balance sympatho-vagal, being normal in the dog <0.2.

When can we use Dinbeat UNO?

Behavioral problems associated with stress

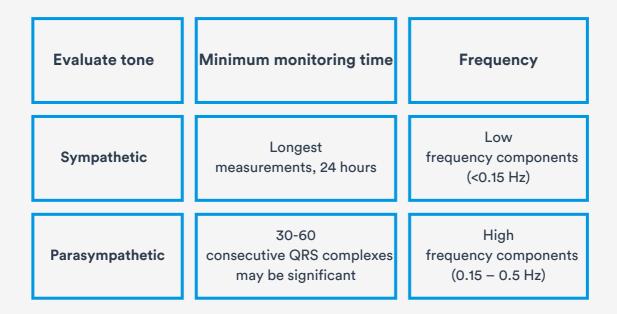| Evaluate tone	Minimum monitoring time	Frequency
Sympathetic	Longest measurements, 24 hours	Low frequency components (<0.15 Hz)
Parasympathetic	30-60 consecutive QRS complexes may be significant	High frequency components (0.15 – 0.5 Hz)

Table 9: differences in HRV based on the assessment of sympathetic and parasympathetic tone.

6. Vocalisation and activity:

The vocalization and activity will allow us to control the level of movement of our patient and his frequency of vocalization. In addition to associations for the analysis of clinical parameters with non-clinical ones without the need to be present (example: moment of increase in HR, RR and decrease in HRV with time of vocalization or activity).

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