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NuCalm brainwave entrained masseter muscle relaxation compared with TENS transcutaneous electro-neural stimulation of fifth and seventh cranial motor nerves

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Introduction

This study undertaken at LVIADS was passed by the appointed Human Ethics Committee. In 1989 Norman Thomas and David Seiver demonstrated that repetitive *audio-visual (AVE) brain wave entrainment* (BWE) and TENS achieved rapid and effective relaxation of the masticatory musculature Figures 1 and 2 [1].

More recently *NuCalm* using *only audio* BWE duplicated the effects of AVE treatments raising the question how BWE compared with electroneutral stimulation TENS Figures 3 and 4 used in neuromuscular dentistry of CMD patients (Craniomandibular dysfunctional) who might find flashing visual images of AVE and electrical TENS stressful. It has been claimed that TENS reduces the voltage amplitude of painful masticatory musculature by relaxation. In 1981 Stulen, *et al.* [2] observed that although the change in electromyogram (EMG) voltage amplitude is dependent upon conduction velocity it is a second order effect and requires confirmation by correlation with frequency analysis. Thomas NR then showed by Fourier spectral analysis of masseter electromyogram that ultra-low frequency transcutaneous electrostimulation (TENS) of cranial motor nerves V and VII at the pre auricular mastoid notch was actually found to relax rather than fatigue the masticatory musculature resulting in the addition of scan 18 spectral analysis to the Myotronics protocol [3,4].

Figure 5 presents a graph of the sine wave of EMG Myotrajectories from a classical text. Fourier analysis of sine wave is depicted where Hz (m. sec)/uVx100 calculus is plotted along Y (volts) and X (degrees) axes. For a given phase dv of the sine wave signal corresponds to a unique minimum frequency called the instantaneous frequency Hz is given if dt is diminishing small which is true for mandibular movement TENS stimulation. The TENS procedure was used to derive a muscularly relaxed occlusal registration (bite) from which a Craniomandibular Orthotic (CMO) is constructed and worn 24/7 (Figures 6-10). When signs and symptoms of TMD are resolved or alleviated to maximal medical improvement definitive treatment was followed either by phase 1 Coronoplasty, 2 Full mouth fixed reconstruction or 3 Orthodontics performed dependent on severity of the occlusal change. This treatment was followed by an increasing cadre of neuromuscular dentists at ICCMO and at Las Vegas Institute of Advanced Dental Studies where Norman Thomas served as Director of Neuromuscular Research under the leadership of Dr W.G Dickerson.

In 2008 Cooper BC, *et al.* [5,6] published a position paper. Despite the publication criticism continued by Al-Saleh MA, *et al.* [7] in the Journal of the American Dental Association JADA 143:351-62 who stated that neuromuscular dentists only utilize EMG voltages. Jenkins D, *et al.* [8] published a rebuttal that Myotronics Kinesiography does include amplitude and spectral analysis. Cooper B and Oliver S also rightly pointed out that TMD Temporomandibular Disorder is a broad term of conditions and which no single testing device or procedure can exclusively diagnose. Al-Saleh, *et al.* [7] had obfuscated their logic by citing Okeson "the absolute association between muscular pain and high EMG amplitude must be considered in combination with the EMG frequency both of which are dependent on the degree of muscle fatigue". We will show here that scan 18 simply confirms what was evident in the actual EMG records comparing the habitual and relaxed muscle trajectories. For these reasons this study of the effects of NuCalm and TENS on both EMG amplitude and frequency will be followed throughout. In this connection one cannot over emphasize the importance of understanding the concept of application of trigonometric data of physiological relaxation of the masticatory muscles.

It has been pointed out above that recently NuCalm using only *audio* BWE has duplicated the effects of AVE treatments and both continue to be in vogue particularly in those patients who find the electrical TENS stimulation stressful. Furthermore no adverse effects of brain entrainment by audio or visual entrainment to date have neither been observed in general or in the potentially pregnant patient. Of course, in muscle relaxation by TENS should not be undertaken in cases of known pregnancy in keeping with FDA regulations. We should therefore critically consider the significance of calculus of amplitude and frequency in this study of muscle relaxation by TENS and NuCalm BWE.

NuCalm methodology

Males and females in total 12 subjects (10 completions) were assessed for baseline resting EMG amplitudes and frequencies of the bilateral masseter and temporal muscles on three sequential days. This establishes control levels for normalization in percentage EMG amplitude voltages and frequency. It was found that the subjects who were treated in the supine condition should be kept warm with blankets to reduce problematic postural changes and environmental cooling.

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Figure 1. Audio-visual Entrainment

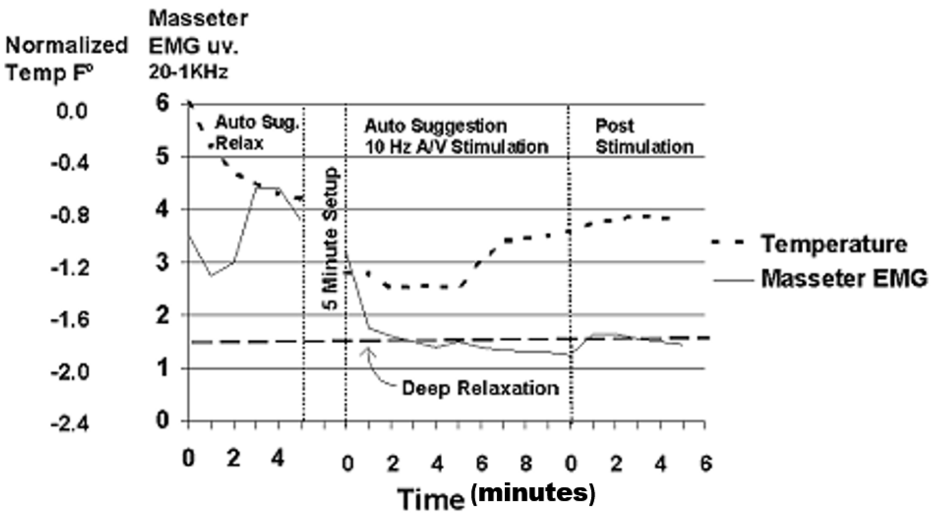


Figure 2. Change in electromyogram (EMG) voltage amplitude is dependent upon conduction velocity

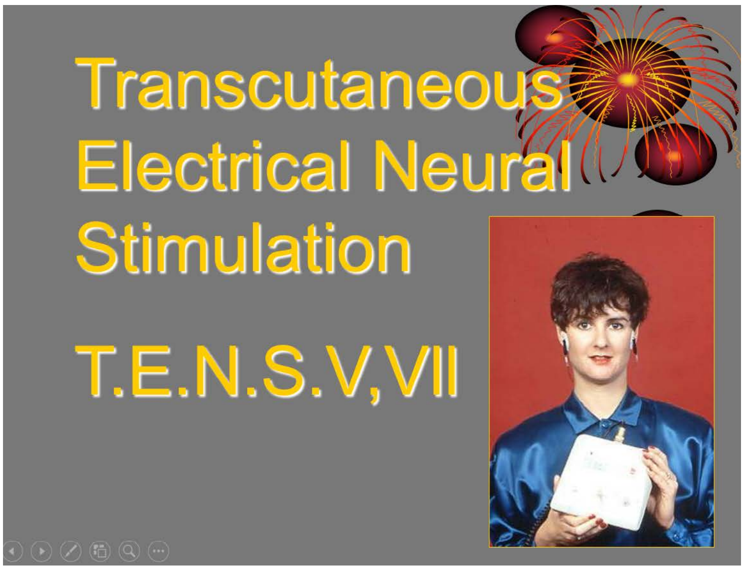


Figure 3. Electroneutral stimulation TENS used in neuromuscular dentistry of CMD patients

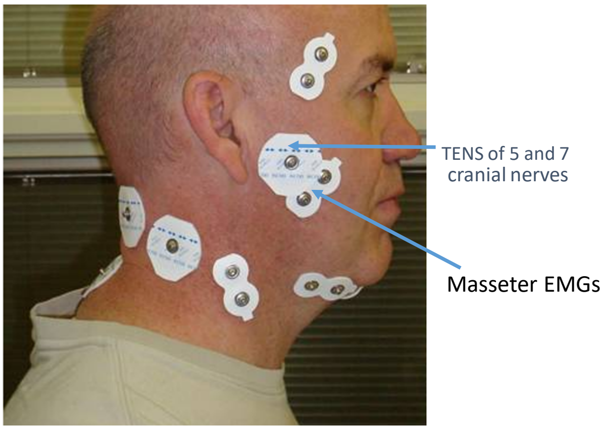


Figure 4. Electroneutral stimulation TENS used in neuromuscular dentistry of CMD patients

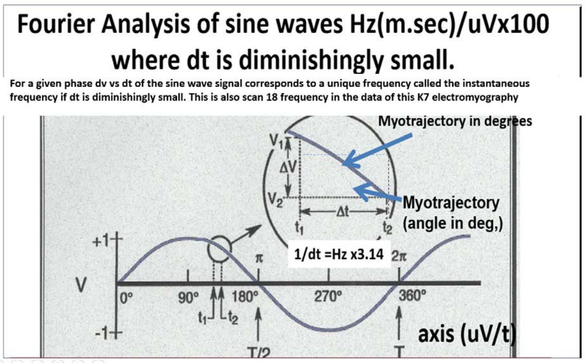


Figure 5. Graph of the sine wave of EMG Myotrajectories from a classical text

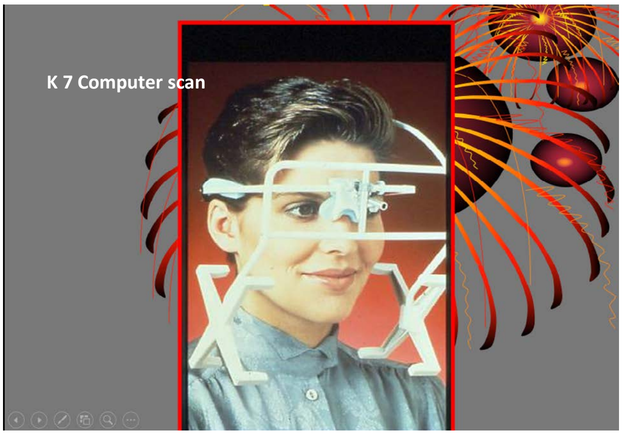


Figure 6. Phase dv of the sine wave signalA

Figure 7. TENS procedure to derive a muscularly relaxed occlusal registration

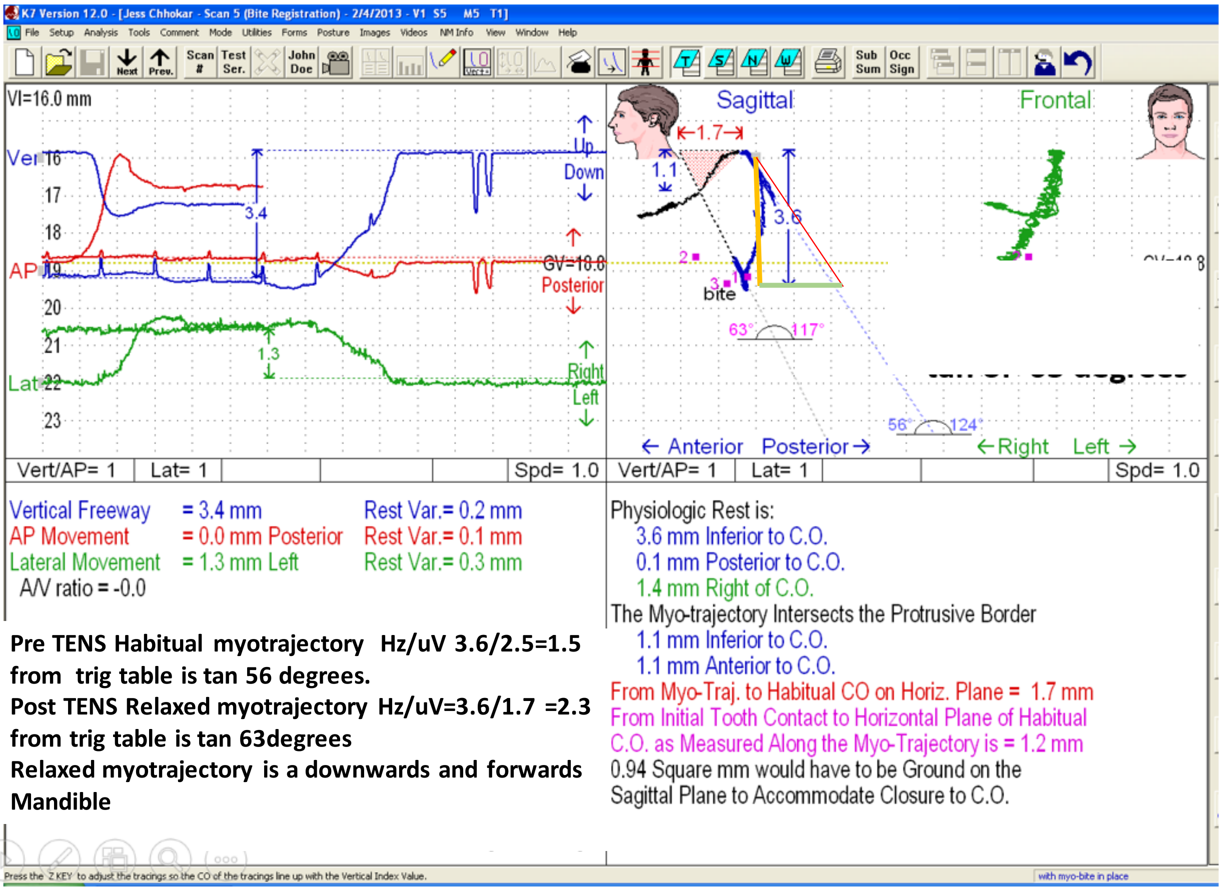


Figure 8. Phase dv of the sine wave signal

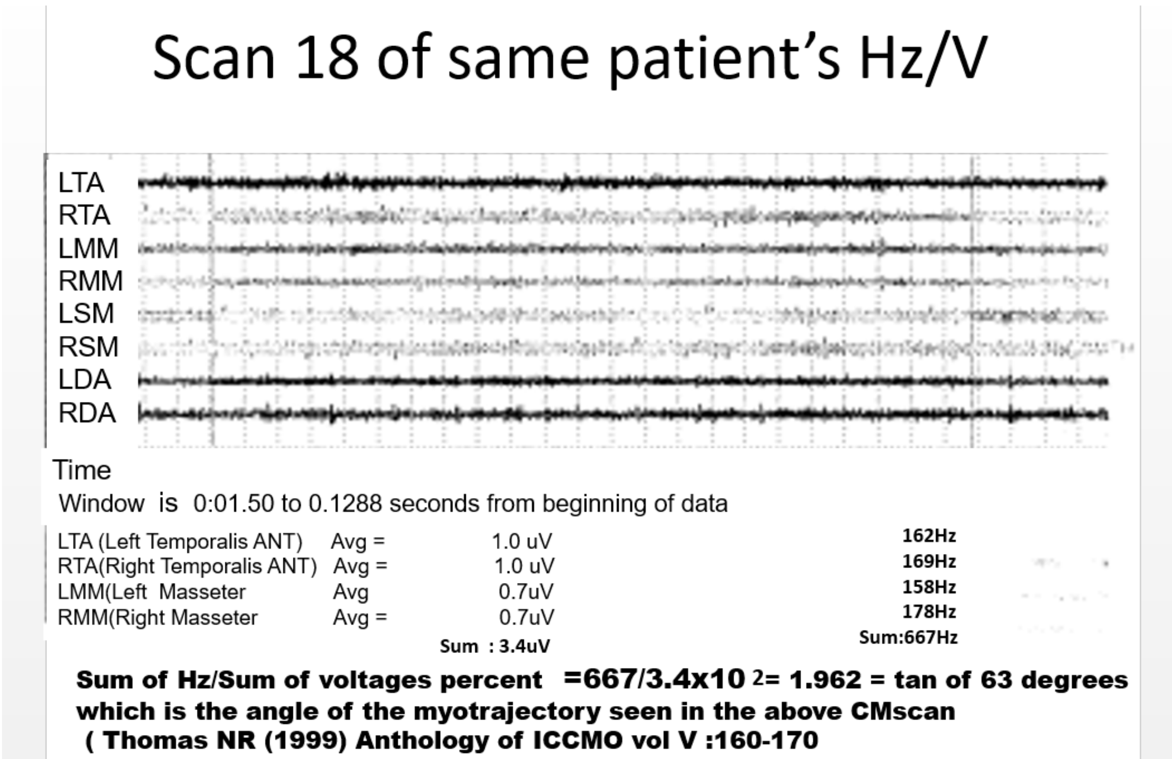


Figure 9. Phase dv of the sine wave signal

Angle	Sine	Cosine	Tangent
1°	.0175	.9998	.0175
2°	.0349	.9994	.0349
3°	.0523	.9986	.0524
4°	.0698	.9976	.0699
5°	.0872	.9962	.0875
6°	.1045	.9945	.1051
7°	.1219	.9925	.1228
8°	.1392	.9903	.1405
9°	.1564	.9877	.1584
10°	.1736	.9848	.1763
11°	.1908	.9816	.1944
12°	.2079	.9781	.2126
13°	.2250	.9744	.2309
14°	.2419	.9703	.2493
15°	.2588	.9659	.2679
16°	.2756	.9613	.2867
17°	.2924	.9563	.3057
18°	.3090	.9511	.3249
19°	.3256	.9455	.3443
20°	.3420	.9397	.3640
21°	.3584	.9336	.3839
22°	.3746	.9272	.4040
23°	.3907	.9205	.4245
24°	.4067	.9135	.4452
25°	.4226	.9063	.4663
26°	.4384	.8988	.4877
27°	.4540	.8910	.5095
28°	.4695	.8829	.5317
29°	.4848	.8746	.5543
30°	.5000	.8660	.5774
31°	.5150	.8572	.6009
32°	.5299	.8480	.6249
33°	.5446	.8387	.6494
34°	.5592	.8290	.6745
35°	.5736	.8192	.7002
36°	.5878	.8090	.7265
37°	.6018	.7986	.7536
38°	.6157	.7880	.7813
39°	.6293	.7771	.8098
40°	.6428	.7660	.8391
41°	.6561	.7547	.8693
42°	.6691	.7431	.9004
43°	.6820	.7314	.9325
44°	.6947	.7193	.9657
45°	.7071	.7071	1.0000

Angle	Sine	Cosine	Tangent
46°	.7193	.6947	1.0355
47°	.7314	.6820	1.0724
48°	.7431	.6691	1.1106
49°	.7547	.6561	1.1504
50°	.7660	.6428	1.1918
51°	.7771	.6293	1.2349
52°	.7880	.6157	1.2799
53°	.7986	.6018	1.3270
54°	.8090	.5878	1.3764
55°	.8192	.5736	1.4281
56°	.8290	.5592	1.4826
57°	.8387	.5446	1.5399
58°	.8480	.5299	1.6003
59°	.8572	.5150	1.6643
60°	.8660	.5000	1.7321
61°	.8746	.4848	1.8040
62°	.8829	.4695	1.8807
63°	.8910	.4540	1.9626
64°	.8988	.4384	2.0503
65°	.9063	.4226	2.1445
66°	.9135	.4067	2.2460
67°	.9205	.3907	2.3559
68°	.9272	.3746	2.4751
69°	.9336	.3584	2.6051
70°	.9397	.3420	2.7475
71°	.9455	.3256	2.9042
72°	.9511	.3090	3.0777
73°	.9563	.2924	3.2709
74°	.9613	.2756	3.4874
75°	.9659	.2588	3.7321
76°	.9703	.2419	4.0108
77°	.9744	.2250	4.3315
78°	.9781	.2079	4.7046
79°	.9816	.1908	5.1446
80°	.9848	.1736	5.6713
81°	.9877	.1564	6.3138
82°	.9903	.1392	7.1154
83°	.9925	.1219	8.1443
84°	.9945	.1045	9.5144
85°	.9962	.0872	11.4301
86°	.9976	.0698	14.3007
87°	.9986	.0523	19.0811
88°	.9994	.0349	28.6363
89°	.9998	.0175	57.2900

Figure 10. Standard Trigonometrical Tables

The supine findings were seen to compare well with the upright posture results normally obtained in NM treatment using TENS.

In the NuCalm treated subjects two tablets of amino acid supplements including neurotransmitters GABA and 5HTP were orally administered with Theanine relaxant from green tea all of which are known to pass the blood brain barrier when given sublingually. Centro electrical stimulation was applied behind the auricle along known acupuncture stimulation. Neuroacoustic brain entrainment at 10Hz was applied binaurally via earphones and ostensibly consists of relaxing music with hidden entrainment beats in each auditory channel. Light blocking glasses were worn throughout the process. Surface EMGs (SEMGs) were recorded from alcohol cleansed skin over the masticatory and facial muscles at 0, 5, 10, 30, 40, 50 and 60 minutes. All ten subjects were recorded by bipolar electrodes placed at controlled interelectrode intervals by standard Myotronics electrodes. The three studies included rest alone, TENS alone, NuCalm alone and NuCalm and TENS together.

Figure 5 presents a graph of the sine wave of EMG Myotrajectories from a classical text. Fourier analysis of sine wave is depicted where Hz (m. sec)/uV calculus is plotted along Y (volts) and X (degrees) axes. For a given phase dv of the sine wave signal corresponds to a unique minimum frequency called the instantaneous frequency Hz is given if dt is diminishing small which is true for mandibular movement TENS stimulation The Myotrajectories for a given phase and trajectory angles further depicted in scans 4/5 (of jaw movements) and scan 18 which directly calculate masticatory muscle EMGs and frequency in the Myotronics program to which the trigonometric tables of sine, cosine and tan apply. With reference to the calculus property of unit *circle* where the radius is by definition 1 it will be seen that it is necessary to convert 1/t from decimal milliseconds (time) to cycles per second (Hz) for frequency and the EMG microvolts (uV) recorded. Thus Hz/Volts is frequency per volt as demonstrated in Thomas NR (1999) Anth. ICCMO (1999): vol V 159-170.

The caption of Figure 5 states that "For a given phase, dv *vs* dt of the sine wave signal corresponds to a unique minimum frequency called the instantaneous frequency if dt is diminishingly small"

Figure 8 is a kinesiograph (K7 version) scan 4/5 pre and post TENS scans of the sagittal and frontal view of jaw motion from physiological rest to the occlusal plane of a patient in an upright posture. On the left side of the figure is the pre and post treatment scans of the myotrajectory from clinical rest and physiological rest. The TENS evoked jaw motion extends from *physiological* rest to the centric occlusal plane (CO) and compared with the patient's voluntary pre-existing *habitual* jaw motion from aberrant *clinical* rest in sweep mode. On the right the data is represented in non-sweep mode. The pre TENS habitual closures post TENS pulses are overwritten on the right trace and correspond to the pulses shown on the left side in the sweep mode. For mathematical ease the reader may assume that in this scan 4/5 the vertical scale represents the amplitude in microvolts while the horizontal scale is in hundreds of Hz in scan 18 due to the fact that the scans are similar triangles to the unit triangle of the sine wave.

Thus Figure 8 scan 4/5 compares the habitual trajectory of 56 degrees for a Pre TENS un- relaxed patient while relaxed myotrajectory is 63 degrees representing the post TENS condition of mandible downwards and forward of the clinical occlusion that requires relaxation because of presenting pain and abnormal mandibular motion.The scan 4/5 gives a tan of 1.5 (actual 1.4826) for the habitual trajectory with sine of .8290 and cosine of .5592 which from the trigonometric table is 56 degrees while that for the relaxed myotrajectory gives a tan of 2.03 (actual 1.9626 for a relaxed trajectory with sine of .8910 and cosine .4540 which from the trigonometric table is close to 63degrees Thus Scan 4/5 for the habitual and relaxed myotrajectories provide pre relaxed and post TENS relaxed conditions [9]. For a TMD patient habitual and relaxed myotrajectories for the pre and post TENS conditions are shown as the scan 18 data of 56 and 63 degrees respectively Figure 9 6.67/3.4=1.962=tan63degrees relaxed frequency of 6.67X100=667Hz 3.60/2.4=1.48=tan56degrees habitual trajectories with frequency of 3.60x100 =360Hz calculated from the trig tables Figure 10.

Thus given any two of the parameters of frequency, voltage, angle of trajectory and time taken from physiological rest to CO in decimals of milliseconds it is possible to provide the calculation of the degree of fatigue or of relaxation produced by the treatment within scientific error of measurement from the kinesiograph

Figure 9 is the scan 18 derived from a Fourier analysis of the same data exhibited in scan 4/5 and shows how voltage and frequency for the various states or sample points of relaxation are coordinate with each other.

Finally if the habitual trajectory is accompanied by signs and symptoms then it is most important that the calculated myotrajectory angle be larger than the initial or habitual trajectory angle so that the trajectories should not cross or interact. This is because when the trajectories cross the treated myotrajectory assumes the voltage and frequency of the pre-existing trajectory and can thus be a source of continuing symptoms and signs of the original condition including postural anomaly and obstructive sleep apnea with all the accompanying co- morbidities. But it is imperative that one understands that the frequency is a first order resultant of fatigue and relaxation and the voltage is a second order effect as the above calculations show. A priori consideration is that frequency is a primary resultant of changes in velocity of conduction of the muscle while the voltages are action potentials.

Figure 11 is an example of the NuCalm derived post NuCalm resting EMG scan 9 (amplitude in volts) of a subject resting in the supine state for 30 minutes. The resting voltage is 4.1uV which increases with light tooth contact (Rest CO) to 9.8uV (Figure 12). Both data indicate rest which requires confirmation by accompanying frequency analysis. The increased voltage on light occlusal contact is the raison d'être why bite correction is necessary.

Figure 11 reveals an amazing reduction in uV with NuCalm in just 5 minutes and concurs with the AVE findings of Thomas, *et al.* [1]. Figure 12 shows the EMG data for subject 1 in light centric occlusion (CO) indicating that the habitual occlusion ideally requires coronoplasty or other phase of treatment mentioned above. Figure 13 provides another example of the remarkable muscle relaxation by NuCalm by just 20minutes relaxation and so it continues for all ten subjects.

Figures 14-16 give the mean EMG voltages compared with the baselines for NuCalm alone, TENS alone and NuCalm and TENS together over 60 minutes treatment. Figure 17 is a table comparing the change in per cent frequency (Hz cycles per second)per amplitude voltages for 60 minutes treatment by NuCalm+TENS treatment. The comparison of relaxing effects of the different modalities in the table shown in Figure 17 clearly indicate that Nu Calm is superior relaxant to TENS alone and that NuCalm and TENS improves relaxation best.

Clearly the relaxation procedures of NuCalm alone and TENS alone are seen to represent different physiological mechanisms of

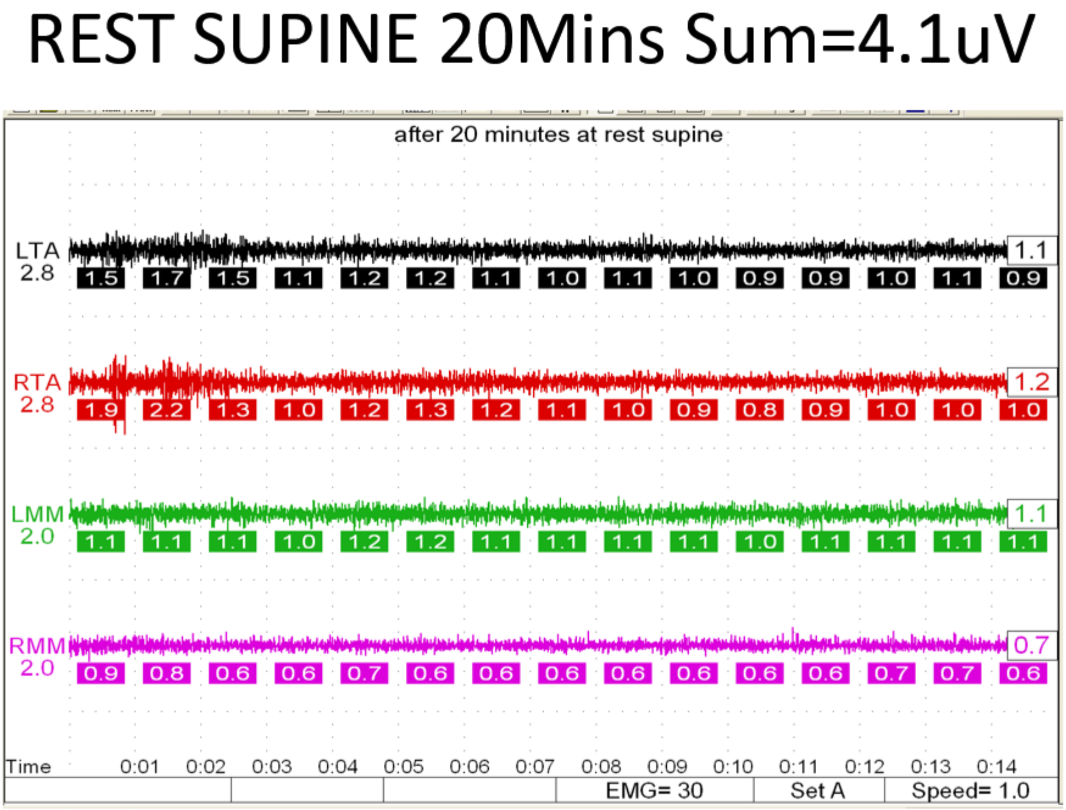


Figure 11. example of the NuCalm derived post NuCalm resting EMG scan 9

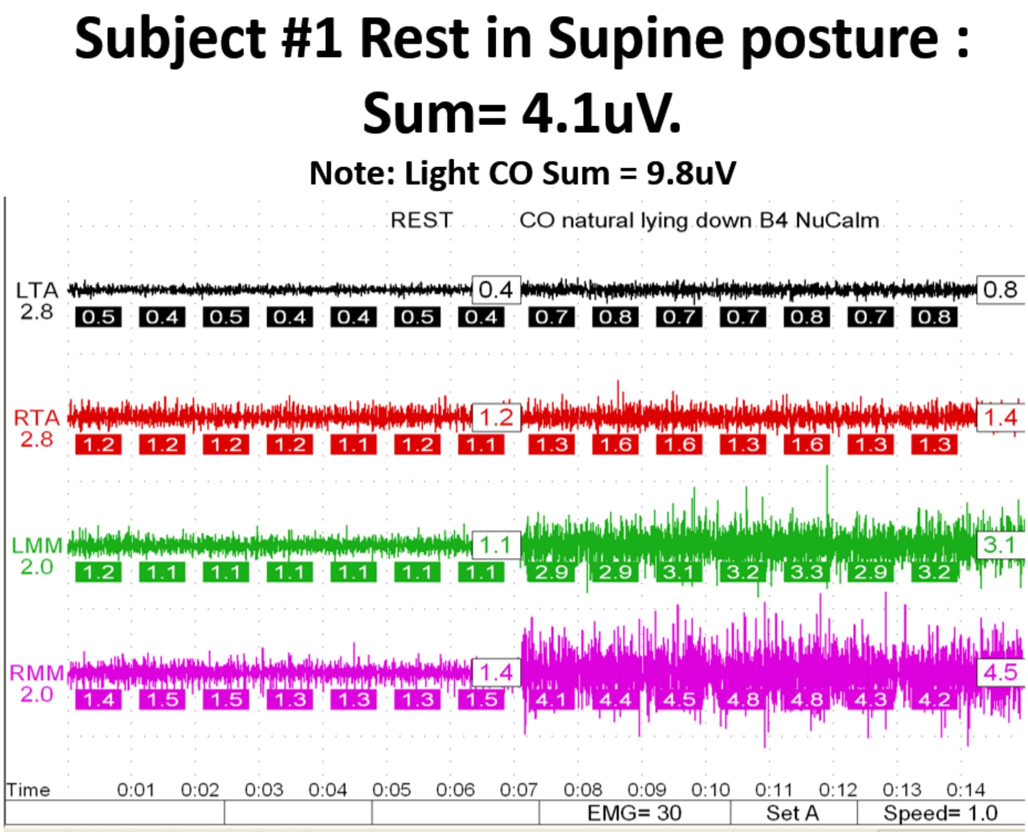


Figure 12. EMG data for subject 1 in light centric occlusion

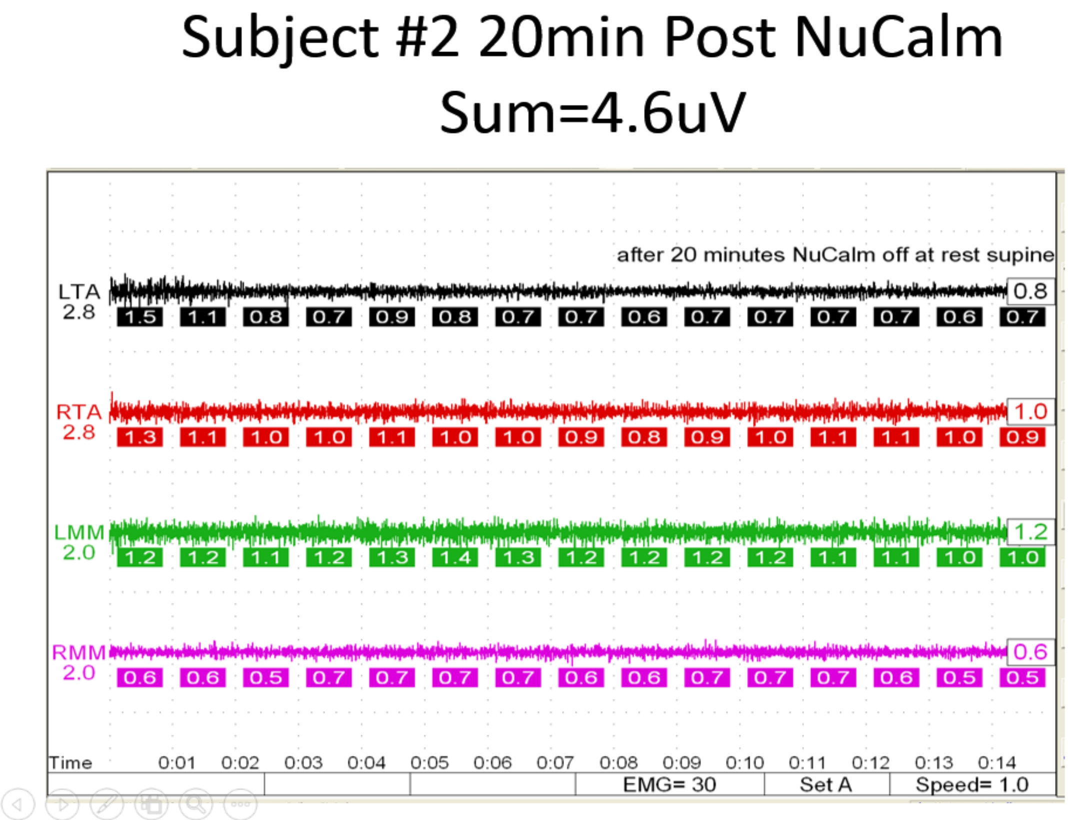
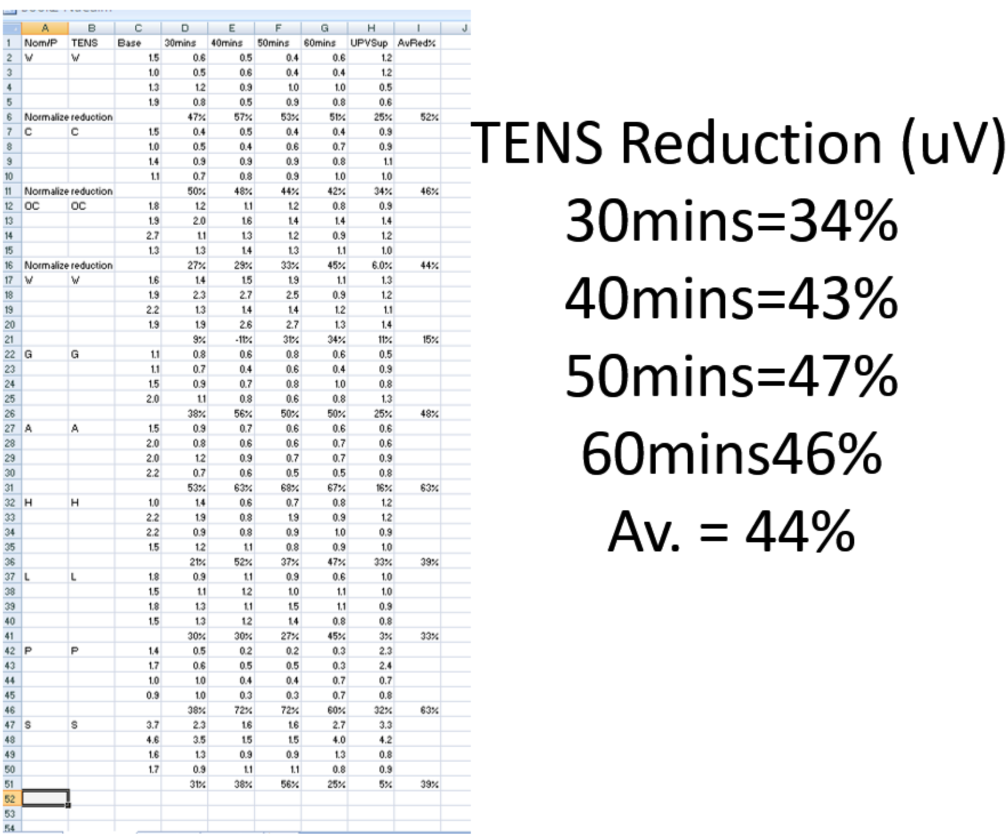


Figure 13. Remarkable muscle relaxation by NuCalm



	A	B	C	D	E	F	G	H	I
1	Nom/P	TENS	Base	30mins	40mins	50mins	60mins	UPVSup	AvRed%
2	W	W	1.5	0.6	0.5	0.4	0.6	1.2	
3			1.0	0.5	0.6	0.4	0.4	1.2	
4			1.3	1.2	0.9	1.0	1.0	0.5	
5			1.9	0.8	0.5	0.9	0.8	0.6	
6	Normalize reduction			47%	57%	53%	51%	25%	52%
7	C	C	1.5	0.4	0.5	0.4	0.4	0.9	
8			1.0	0.5	0.4	0.6	0.7	0.9	
9			1.4	0.9	0.9	0.9	0.8	1.1	
10			1.1	0.7	0.8	0.9	1.0	1.0	
11	Normalize reduction			50%	48%	44%	42%	34%	46%
12	OC	OC	1.8	1.2	1.1	1.2	0.8	0.9	
13			1.9	2.0	1.6	1.4	1.4	1.4	
14			2.7	1.1	1.3	1.2	0.9	1.2	
15			1.3	1.3	1.4	1.3	1.1	1.0	
16	Normalize reduction			27%	29%	33%	45%	6.0%	44%
17	W	W	1.6	1.4	1.5	1.9	1.1	1.3	
18			1.9	2.3	2.7	2.5	0.9	1.2	
19			2.2	1.3	1.4	1.4	1.2	1.1	
20			1.9	1.9	2.6	2.7	1.3	1.4	
21				9%	-11%	31%	34%	11%	15%
22	G	G	1.1	0.8	0.6	0.8	0.6	0.5	
23			1.1	0.7	0.4	0.6	0.4	0.9	
24			1.5	0.9	0.7	0.8	1.0	0.8	
25			2.0	1.1	0.8	0.6	0.8	1.3	
26				38%	56%	50%	50%	25%	48%
27	A	A	1.5	0.9	0.7	0.6	0.6	0.6	
28			2.0	0.8	0.6	0.6	0.7	0.6	
29			2.0	1.2	0.9	0.7	0.7	0.9	
30			2.2	0.7	0.6	0.5	0.5	0.8	
31				53%	63%	68%	67%	16%	63%
32	H	H	1.0	1.4	0.6	0.7	0.8	1.2	
33			2.2	1.9	0.8	1.9	0.9	1.2	
34			2.2	0.9	0.8	0.9	1.0	0.9	
35			1.5	1.2	1.1	0.8	0.9	1.0	
36				21%	52%	37%	47%	33%	39%
37	L	L	1.8	0.9	1.1	0.9	0.6	1.0	
38			1.5	1.1	1.2	1.0	1.1	1.0	
39			1.8	1.3	1.1	1.5	1.1	0.9	
40			1.5	1.3	1.2	1.4	0.8	0.8	
41				30%	30%	27%	45%	3%	33%
42	P	P	1.4	0.5	0.2	0.2	0.3	2.3	
43			1.7	0.6	0.5	0.5	0.3	2.4	
44			1.0	1.0	0.4	0.4	0.7	0.7	
45			0.9	1.0	0.3	0.3	0.7	0.8	
46				38%	72%	72%	60%	32%	63%
47	S	S	3.7	2.3	1.6	1.6	2.7	3.3	
48			4.6	3.5	1.5	1.5	4.0	4.2	
49			1.6	1.3	0.9	0.9	1.3	0.8	
50			1.7	0.9	1.1	1.1	0.8	0.9	
51				31%	38%	56%	25%	5%	39%

Figure 14. Mean EMG voltages compared with the baselines for NuCalm

Nom/P	NUCALM	Base	30 mins	40mins	50mins	60mins	UPvSup	Av Red
W		1.2	0.6	0.5	1.2	0.5	1.1	
		1.9	0.8	0.6	2.2	0.8	1.3	
		0.9	1.2	1.2	1.0	0.5	0.5	
		0.8	0.4	0.5	0.6	0.3	0.4	
Normalized Red		100%	37%	41%	-4%	56%	48%	32
C		1.9	0.3	0.3	0.3	0.3		
		1.5	0.5	0.4	0.4	0.8		
		0.6	0.5	0.5	0.4	0.4		
		0.8	0.4	0.4	0.5	0.4		
Normalize Red		100%	65%	66%	66%	65%	65%	
OC		1.3	0.8	0.7	0.6	0.6		
		1.0	0.8	0.7	0.6	0.6		
		2.3	1.5	1.0	0.9	0.8		
		1.0	0.9	0.7	0.7	0.6		
		100%	28%	44%	50%	53%	53%	
W		1.8	1.8	0.9	3.4	1.1		
		2.4	1.2	0.4	1.6	0.5		
		1.0	2.1	1.1	1.9	0.9		
		1.3	2.0	1.5	1.8	1.5		
			9%	40%	18%	33%	25%	
G		1.5	0.6	0.5	0.4	0.5		
		1.5	0.6	0.5	0.4	0.6		
		4.6	2.6	2.6	2.6	1.2		
		1.8	0.9	1.0	1.0	0.9		
			50%	51%	53%	66%	55%	
A		1.9	0.9	0.7	0.6	0.6		
		1.5	0.9	0.7	0.7	0.6		
		1.3	2.2	1.8	1.9	1.3		
		1.3	1.0	1.0	0.8	1.0		
			33%	50%	50%	41%	43%	
H		3.1	1.2	5.4	0.6	0.7		
		2.3	1.8	2.7	0.7	0.8		
		2.0	2.0	2.0	1.1	1.3		
		2.8	1.2	1.0	0.9	0.7		
			6%	-83%	50%	46%	19%	
L		0.6	0.4	0.3	0.4	0.3		
		1.1	0.6	0.6	0.6	0.5		
		2.2	1.4	1.2	1.2	1.3		
		2.1	0.9	0.9	0.8	0.8		
			45%	50%	50%	51%	49%	
P		1.1	0.4	0.8	1.2	0.3		
		1.3	0.6	0.4	0.3	0.3		
		1.1	2.7	3.0	3.0	0.4		
		0.9	2.6	1.2	1.0	0.3		
			6.3	5.4	5.5	1.3		
			-47%	-22%	-25%	70%	-24%	
S		2.3	0.5	0.3	0.4	0.2		
		2.6	0.8	0.7	0.5	0.2		
		1.6	0.6	0.4	0.5	0.4		
		1.0	0.7	0.4	0.4	0.4		
			34%	24%	24%	16%	24%	

NuCalm Reduction (uV)

30mins = 26%

40mins= 26%

50mins=33%

60mins=49%

Av=33%

Figure 15. Mean EMG voltages compared with the baselines for NuCalm

	30 min	40 min	50min	60min
NuCalm	26%	26%	33%	49%
TENS	34%	43%	47%	44%
NC +TENS	34%	49%	56%	58%

Figure 16. Table od results of Reduced EMGs(uv) according to treatment

muscle relaxation. NuCalm relaxes muscle via brain wave entrainment whereas TENS relaxation occurs via antidromic hyperpolarization of midbrain motor efferents demonstrated in Figures 18-20 developed from findings of Fujii H, *et al.* [10]. TENS motor V nerve increases the inhibitory 1a afferents from muscle spindles of the H wave allowing the direct M action potential to the masticatory muscle to become facilitated as a relaxation phenomenon. Figure 21 is a summary graph of the effects of NuCalm alone, TENS alone and NuCalm+ TENS relaxation on frequency of masseter EMG over time. While NuCalm plus TENS continues to be the best methodology to relax the musculature when assessed by voltage amperes uV. But the graphs are nonlinear. Figure 22 shows that all frequencies are equivalent to tans of angles which are linear to trigonometrical points.

Conclusion

The positive effect of NuCalm versus TENS is very clear when combining frequency and voltage. TENS appears a lesser procedure when voltage alone is followed but when combined with the first order of fatigue which is frequency the effect of TENS is more positive. While so called neuromuscular dentists know from following a patient that a TENS orthotic is effective one readily sees why those who oppose the technique only see voltage amplitude and erroneously remain

Results: NuCalm+TENS Hz/V

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	W		NuC+TENS		Bare V:H	MPF/V	30m V:H	MPF/V	40m V:H	MPF/V	50 V:MP	MPF/V	60 V:MPI	MPF/V	60mUp	MPF/V	
2			MPF/uV		1.4 121		0.6 156		0.5 153		0.6 142		0.4 149		1.0 155		
3					1.5 103		0.6 153		0.6 182		0.8 152		0.6 163		1.1 159		
4					2.5 91		0.7 180		0.6 180		0.5 174		0.6 177		0.4 150		
5					1.9 95		0.8 155		0.6 154		0.6 156		0.7 162		0.5 146		
6			Sum Hz/V		7.3 41	56.16	2.7 64	238.5	2.3 66	290.8	2.5 62	249.6	2.3 651	283	3.0 61	203.3	
7			Normalize Reduction			100%		324%		416%		342%		416%		270%	
8																	
9	C		SumHz/V		7.1 421	59.2	5.1 614	120.3	2.3 610	265	3.4 70	207	3.8 555	146			
10			NormRed			100%		203%		448%		350%		246%			
11	OC																
12			Sum Hz/V		10.8 54	50.7	4.8 47	98.7	5.1 440	86	4.7 47	101	5.9 571	96.7	4.1		
13			Norm Red			100%		96%		69%		99.20%		90.70%			
14	W		Sum Hz/V		7.4 533	72	9.1 710	78	5.0 721	144	3.3 71	216	3.5 730	208.5	3.4 61	181.4	
15			Norm Red			100%		8%		100%		200%		188%		151%	
16	G		Sum Hz/V		9.7 34	35.4	1.5 623	415	1.5 599	399	1.5 640	426	1.3 626	481	2.0 62	313	
17						100%		1172%		1027%		1103%		1258%		784%	
18	H																
19			Sum Hz/V		6.5 329	50.6	4.2 509	121	3.6 46	122	3.9 54	139	3.2 517	161.5	3.7 54	147.0	
20			Norm Red			100%		239%		241%		247%		133%		121%	
21	H																
22			Sum Hz/V		10.9 639	58.6	8.2 55	67.3	4.4 682	155	3.4 63	185	4.8 504	105	6.0 510	85	
23			Norm Red			100%		114%		378%		315%		179%		145%	
24																	
25	L		Sum Hz/V		8.3 39	46.9	5.3 62	117.5	5.3 62	117	4.3 57	133	3.9 598	153	2.9 581	200	
26						100%		250%		249%		284%		326%		426%	
27																	
28	P		Sum Hz/V		7.5 546	72.8	7.5 79	105	9.2 80	86.9	3.9 694	177.9	6.0 773	128	7.0 68	97.8	
29						100%		144%		119%		244%		175%		134%	
30	S		Sum Hz/V		7.5 402	53.6	2.6 569	218	1.8 568	315.5	1.8 557	309	1.2 560	466	3.6 52	145	
31						100%		406%		588%		576%		869%		270%	
32						100%		295%		353%		341%		388%		262%	
33					Bare		5min										
34	T		SumHz/V		4.3 693	161	2.3 653	283									
35						100%		175%									
36																	

Figure 17. Comparing the change in per cent frequency

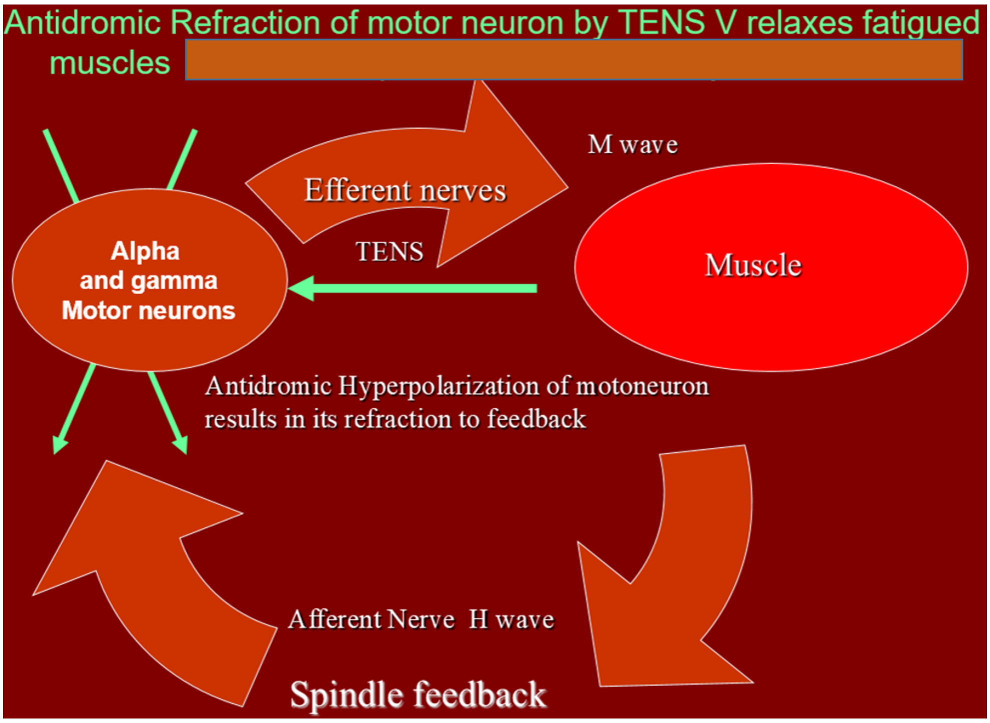


Figure 18. Antidromic refraction of motor neuron by TENS V relaxes fatigued muscles

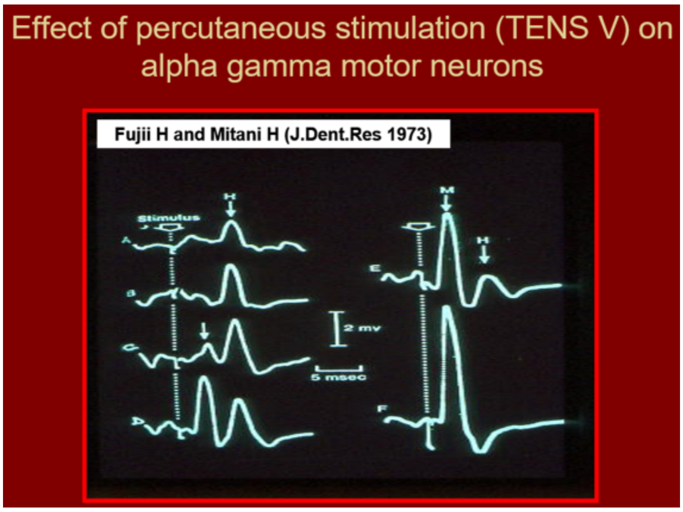


Figure 19. Effect of percutaneous stimulation (TENS V) on alpha gamma motor neurons

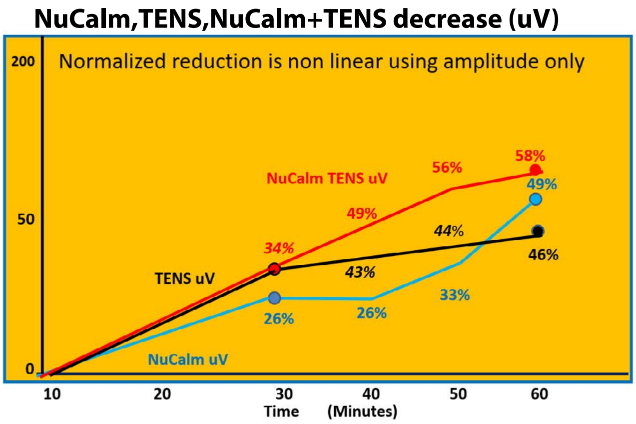


Figure 20. Antidromic hyperpolarization of midbrain motor efferents

Comparison of the relaxation effects of NuCalm + TENS using Hz/uV frequencies

Base	10	30	40	50	60
54.5	161	195	253	241	288

Figure 21. Summary graph of the effects of NuCalmA

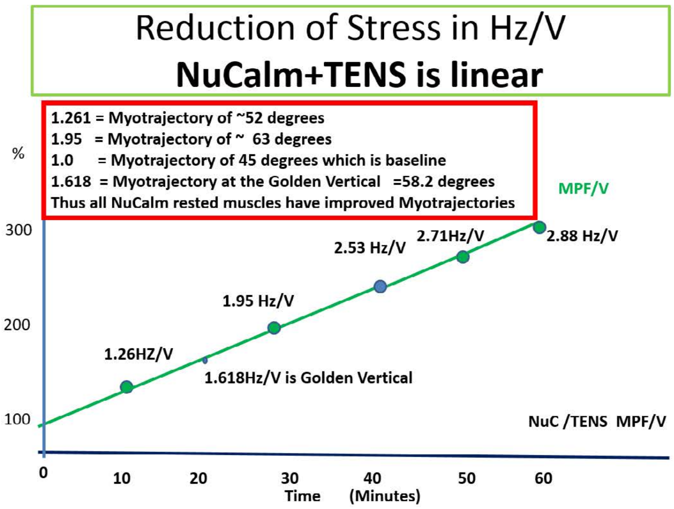


Figure 22. Frequencies are equivalent to tans of angles which are linear to trigonometrical points

unconvinced by the data including sensitivity, specificity and reliability because when calculated from frequency Hz/uV they are all linear falling along trigonometrical points.

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