Macquarie Research Ltd
ABN 59 003 849 198

A PRELIMINARY REPORT OF FINDINGS

A PILOT STUDY OF THE EFFECTIVENESS OF ENAR® OVER TENS THERAPY FOR THE TREATMENT OF CHRONIC NECK PAIN IN AN AUSTRALIAN ADULT POPULATION-PHASE 1 TREATMENT STAGE RESULTS

RESEARCH COMMISSIONED BY:
ENLIGHTENED THERAPIES PTY LIMITED

RESEARCH CONDUCTED BY
ANDREW L. VITIELLO BSC(ANAT)., MCHIRO., PHD(CAND)
ASSOCIATE PROFESSOR ROD BONELLO BSC(ANAT)., DC., DO., MHA, FICC
DR HENRY POLLARD BSC., GRAD DIP CHIRO., MSPORTSSC., PHD

DEPARTMENT OF HEALTH & CHIROPRACTIC
MACQUARIE UNIVERSITY
NORTH RYDE NSW 2109
AUSTRALIA

TABLE OF CONTENTS

Acknowledgments

We would like to extend our gratitude to the students of Macquarie University who kindly donated their time to participate in the study.

We would also like to acknowledge the invaluable services of Louis Petrin from Arrow Scientific Pty Limited whose statistical advice helped in the smooth transition between field data collection and final write up.

The authors would like to acknowledge the contribution of Dr Ramesh Manocha in this endeavour.

Disclaimer

The results of this study are part of a larger pilot study, the results of which are yet to be collected and statistically analysed. These results are prepared in response to the granting body (Enlightened Therapies Pty Limited) for a progress report. Phase 1 of this trial includes the 6 week treatment phase while Phase 2 involves studying the cohort over a 6 month post treatment period. Any claims made on the findings contained within this report, whether direct or implied should therefore also be considered progressive in nature and limited to the actual written conclusions.

It is important that any claims made of these progressive findings be stated as such, as the analysis of the data received from the project is currently being finalised. Whilst certain trends have emerged in this study that are of a very favourable nature, they are progressive trends that may change with the addition of further analysis of any other accompanying data.

The researchers (Vitiello, Bonello, & Pollard) and the institution they represent (Macquarie University) have no commercial stake in the research or its outcomes other than being recipients of a research grant. They do not benefit in any way from the potential success or otherwise that may result from the marketing of the therapy in question.

This should not reduce the message that the progressive data is providing, since there is promising evidence to suggest that the new ENAR therapy has a beneficial effect on the sufferer of chronic neck pain compared to using a similarly featured and commercially available therapy (TENS) or not receiving any treatment at all. This progressive status should alert the reader that the evidence for further analysis is not only warranted but is essential if we are to gain further evidence into the effects of such a therapy option.

Lay Summary

- **Project Description**

The aim of this phase of the pilot study was to collect pain feedback data, in the form of Visual Analogue Scale (VAS), both immediately before and after the administration of treatment to the randomly allocated cohort for a period of 6 weeks (12 treatment sessions).

- **Aim**

To test the hypothesis that receiving a newly developed electro-physical therapy (ENAR) was effective in reducing the intensity of chronic neck pain, as measured by VAS, when compared to both another established appropriate therapy (TENS) and no treatment in a randomly allocated control group.

- **Method**

To test the pre and post treatment VAS pain scores reported by subjects, in a randomised and controlled single-blinded clinical setting within 3 groups, being ENAR, TENS and SHAM (Control).

- **Results**

The newly tested ENAR therapy was successful in reducing chronic neck pain intensity immediately after its administration in its cohort significantly more than either the TENS or control groups.

- **Conclusion**

The authors conclude that the ENAR therapy was more successful in significantly reducing the intensity of neck pain when compared to either those patients receiving TENS or those where no tangible treatment was given (SHAM). Based on results of the Phase 1 (short term) study, the ENAR is superior to both TENS and no treatment in reducing the intensity of chronic neck pain within a short term period (2-7 days).

Introduction

This pilot study investigated the intensity of neck pain in a randomly chosen group of 18-50 year old of Australian adults within a randomised and controlled, single-blinded clinical setting. The aim of the project was to evaluate if the application of ENAR therapy gave statically superior reductions in chronic neck pain intensity compared to either the use of TENS or no therapy (control), using pre and post treatment VAS scores as an outcome measure. This study was an integral component of the overall investigation because it allowed the authors to assess the short term effects of ENAR on a randomly selected group of non-complicated chronic neck pain.

We would like to extend our gratitude to the students of Macquarie University who kindly donated their time to contribute in the study.

Aims

Evidence demonstrating the benefit of Electrotherapy (ET) for the treatment of chronic neck pain is at present unequivocal. Anecdotal evidence of a new ET (ENAR) suggests that it may be superior to conventional ET (TENS) for the treatment of chronic neck pain within an adult population.

It was the aim of this study to test the hypothesis that receiving a newly developed electro-physical therapy (ENAR) was effective in reducing the intensity of chronic neck pain, as measured by VAS, when compared to both another established appropriate therapy (TENS) and to a randomly allocated control group within the short term, i.e. within a 2 to 7 day period.

Methods

• Ethics

All subjects were required to read and sign a pre approved consent form and were advised that withdrawal form the project at any time would not impose any prejudicial influences. This study was granted approval by the Human Ethics Committee of Macquarie University prior to experimentation.

• Inclusions

Healthy adults were recruited form the local general population surrounding the Macquarie University outpatient clinics in Summer Hill, Epping and Eastwood.

• Exclusions

Certain conditions were deemed by the authors to be inconsistent with the testing parameters utilised in this project. These exclusion criteria included:

- *Red Flag Conditions*
  - Spinal Fractures
  - Spinal or other osseous infections such as Osteomyelitis
  - Inflammatory Arthritic conditions such as Rheumatoid Arthritis or Ankylosing Spondylitis
  - Malignant Neoplasms

- *Yellow Flag Conditions*
  - Any non-finalised Workers Compensation or Third Party Insurance Claim
  - Any other non-finalised compensatory litigation

- *WAD 1-4 whiplash injury within the last 6 months*

- *Presence of any vascular disease*

- *Severe or acute relapse of neck pain within the last 3 months*

- *Motor vehicle accident, serious falls or any other accident requiring medical/hospital treatment within the last 3 months*

- *Less than 18 years or greater 50 years of age*

- *Any current neurological signs or symptoms, e.g. muscle wasting or nerve root signs, epilepsy or paraplegia*

- *Pregnancy*

- *Spinal or orthopaedic surgery within the past 2 years*

- *Bowel, bladder or sexual dysfunction as a result of either prostate or lumbar spine dysfunction*

- *Currently undergoing a course of manual therapy or psychological intervention.*

- *Participants not prepared to attend 12 treatment sessions within the first 6 weeks and a further 3 assessment sessions over the next 18 weeks.*

- **Confidentiality**

All subjects were informed that only group results would be made subject to public and peer scrutiny. They were informed that no other person, apart from the chief investigators, would know of the identity of the individual subjects.

- **Subjects**

Healthy adults (18-50 years) were recruited by way of newspaper advertisements placed within community newspapers whose circulation was geographically similar to the locations of the university outpatient clinics in Sydney.

- **Recruitment Procedures**

All subjects were made aware of the project by way of public advertisements placed in local newspapers. Prospective subjects were given appropriate researcher contact details in order that particular enquires could be made regarding individual suitability. The total number of participants providing permission to participate was 30, of which 24 continued to the end of the Phase 1 stage of the pilot. Refer to Appendix 1.

- **Protocol**

Refer to Appendix 2.

- **Statistical Methods**

Results were tabulated and statistically analysed using the software package called SPSS® (SPSS Inc 1989-2001). Descriptive and interferential methods were applied to the data using a standard significance level (alpha) of 0.05. This level of significance allows the reader to expect that a significant finding be in fact not significant in 5% of cases. This is recognised as an acceptable margin of statistical error when stating results from any dataset.

Data/ Results

1. Data Frequency Analysis

Table 1 highlights the distribution of male to female participants within the project.

SEX

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	10	3.5	41.7	41.7
	Female	14	4.9	58.3	100.0
	Total	**24**	**8.3**	**100.0**	
Missing	System	264	91.7		
Total		**288**	**100.0**		

Table 1. Frequency analysis of participant gender

Figure 1 demonstrates a graphical re-interpretation of the results of Table 1

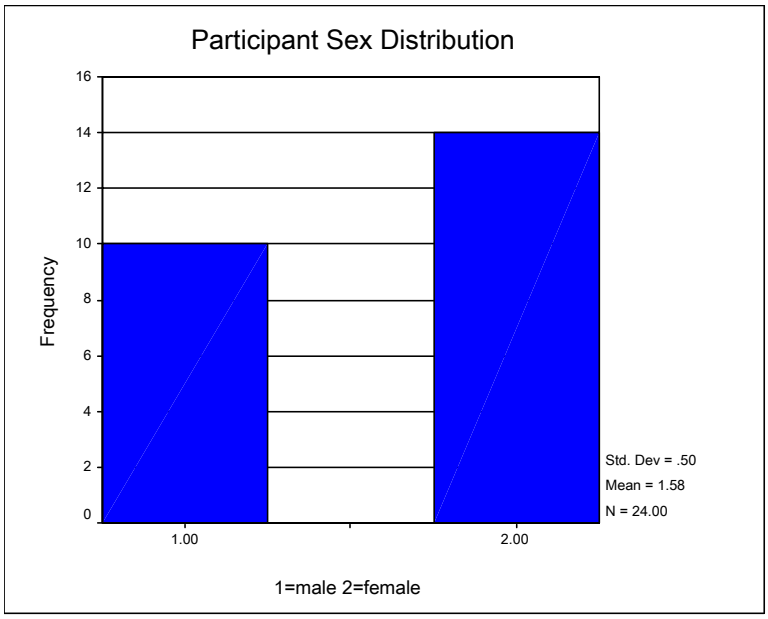


Figure1. Frequency analysis of participant gender in a graphical format

Table 2 demonstrates the breakdown of participant race within the project cohort

RACE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Caucasian	19	6.6	79.2	79.2
	Asian	5	1.7	20.8	100.0
	Total	**24**	**8.3**	**100.0**	
Missing	System	264	91.7		
Total		**288**	**100.0**		

Table 1. Frequency analysis of participant race

Figure 2 shows a graphical interpretation of Table 2

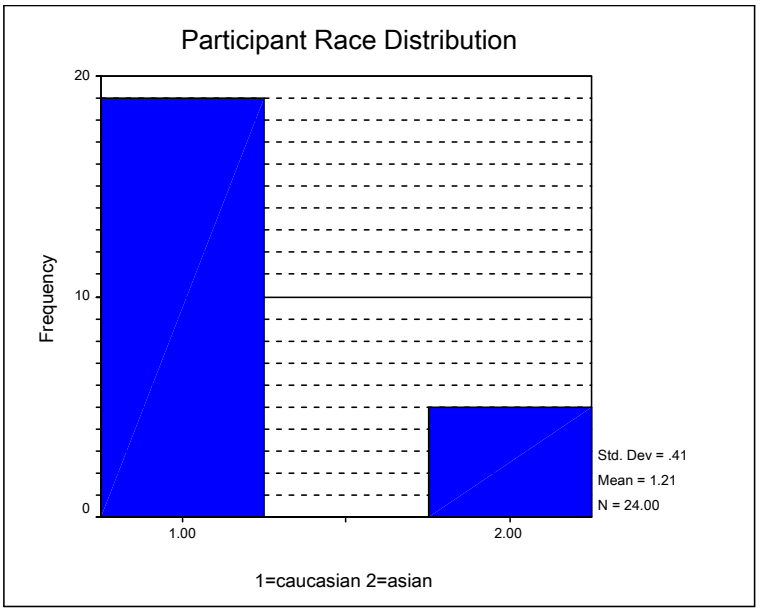


Figure 2. Frequency analysis of participant race in a graphical format

Table 3 demonstrates the age distribution of the cohort

AGE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	25	1	.3	4.2	4.2
	28	1	.3	4.2	8.3
	29	2	.7	8.3	16.7
	33	1	.3	4.2	20.8
	34	1	.3	4.2	25.0
	36	1	.3	4.2	29.2
	38	2	.7	8.3	37.5
	39	1	.3	4.2	41.7
	40	2	.7	8.3	50.0
	41	1	.3	4.2	54.2
	43	2	.7	8.3	62.5
	46	1	.3	4.2	66.7
	47	2	.7	8.3	75.0
	48	1	.3	4.2	79.2
	49	2	.7	8.3	87.5
	50	3	1.0	12.5	100.0
	Total	**24**	**8.3**	**100.0**	
Missing	System	264	91.7		
Total		**288**	**100.0**		

Table 3. Frequency analysis of participant age

Figure 3 demonstrates participant ages in a graphical format

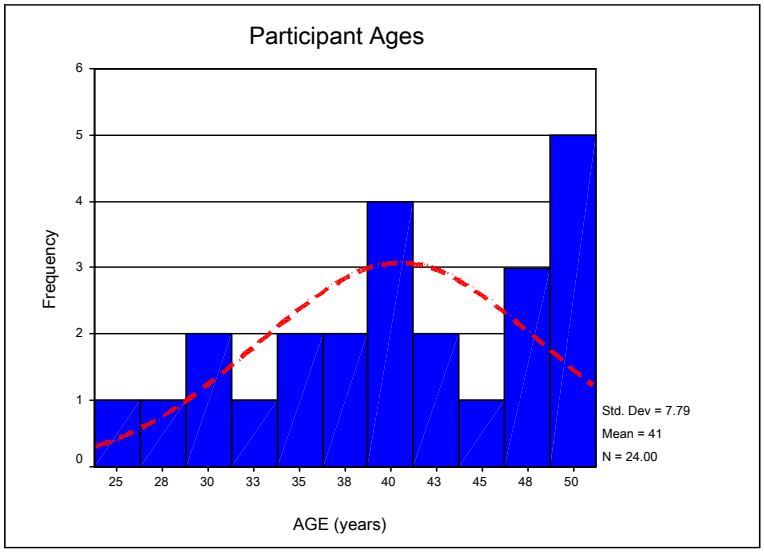


Figure 3. Frequency analysis of participant age in a graphical format

Table 4 highlights the random allocation of participants to the individual treatment group

TREATMENT GROUP

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	ENAR	9	3.1	37.5	37.5
	TENS	7	2.4	29.2	66.7
	Sham	8	2.8	33.3	100.0
	Total	**24**	**8.3**	**100.0**	
Missing	System	264	91.7		
Total		**288**	**100.0**		

Table 4. Frequency analysis of participant allocation to each treatment group

2. Descriptive Analysis

Table 5 highlights the mean VAS scores for each treatment group before and after the administration of the individual intervention.

Descriptives

							95% Confidence Interval for Mean				
			N	Mean	Std. Deviation	Std. Error	Lower Bound	Upper Bound	Minimum	Maximum	Between-Component Variance
PREVAS	ENAR		108	2.444	2.1051	.2026	2.043	2.846	.0	10.0	
	TENS		84	3.338	1.9723	.2152	2.910	3.766	.5	7.0	
	SHAM		95	3.147	2.0497	.2103	2.730	3.565	.0	7.0	
	Total		287	2.939	2.0788	.1227	2.697	3.180	.0	10.0	
	Model	Fixed Effects			2.0487	.1209	2.701	3.177			
		Random Effects				.2784	1.741	4.136			.1867
POSTVAS	ENAR		108	1.102	1.3922	.1340	.836	1.367	.0	7.0	
	TENS		84	3.083	2.0252	.2210	2.644	3.523	.0	7.5	
	SHAM		95	2.679	1.9336	.1984	2.285	3.073	.0	6.5	
	Total		287	2.204	1.9761	.1166	1.974	2.433	.0	7.5	
	Model	Fixed Effects			1.7794	.1050	1.997	2.411			
		Random Effects				.6204	-.465	4.873			1.1099

Table 5. Descriptive Statistics of VAS Pain scores

3. t-Test Analysis

Table 6 demonstrates the Paired Sample t-test which shows that statistically significant changes occurred in VAS pain scores before and after treatment.

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	PREVAS - POSTVAS	.735	1.0883	.0642	.608	.861	11.439	286	.000

Table 6. Paired Sample t-test of Pre and Post Treatment VAS Pain scores

4. One-way Analysis of Variance Analysis (ANOVA)

The analysis of variance clearly shows statistical differences between treatment groups before and after treatment with the greatest difference occurring as a result of the ENAR intervention (F=34.356). At this stage we cannot determine which intervention is responsible for the significant difference.

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
PREVAS	Between Groups	43.919	2	21.960	5.232	.006
	Within Groups	1191.962	284	4.197		
	Total	1235.881	286			
POSTVAS	Between Groups	217.572	2	108.786	34.356	.000
	Within Groups	899.254	284	3.166		
	Total	1116.826	286			

Table 7. One way ANOVA of PRE and Post Treatment VAS Pain scores

5. Post-hoc Analysis

The Sheffe Post Hoc Analysis was performed to determine where the post treatment difference originated. The greatest difference in VAS scores occurred when comparisons between the post treatment ENAR and TENS and ENAR and Sham groups were made.

Multiple Comparisons

Scheffe

Dependent Variable	Treatment Group	Treatment Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
PREVAS	ENAR	TENS	-.894*	.2980	.012	-1.627	-.160
		SHAM	-.703	.2882	.053	-1.412	.006
	TENS	ENAR	.894*	.2980	.012	.160	1.627
		SHAM	.191	.3068	.824	-.564	.946
	SHAM	ENAR	.703	.2882	.053	-.006	1.412
		TENS	-.191	.3068	.824	-.946	.564
POSTVAS	ENAR	TENS	-1.981*	.2589	.000	-2.618	-1.344
		SHAM	-1.577*	.2503	.000	-2.193	-.961
	TENS	ENAR	1.981*	.2589	.000	1.344	2.618
		SHAM	.404	.2665	.318	-.251	1.060
	SHAM	ENAR	1.577*	.2503	.000	.961	2.193
		TENS	-.404	.2665	.318	-1.060	.251

*. The mean difference is significant at the .05 level.

Table 8. Scheffe post hoc analysis of inter group VAS Pain scores

6. Pre Treatment VAS Means Plot

Figure 1 represents the post-hoc analysis in a graphical format. This graph demonstrates no significant difference in the VAS scores before the administration of treatment in either the TENS or Sham group, or between the Sham and ENAR group but marginal statistical significance (p=0.012) has been demonstrated between the ENAR and TENS groups.

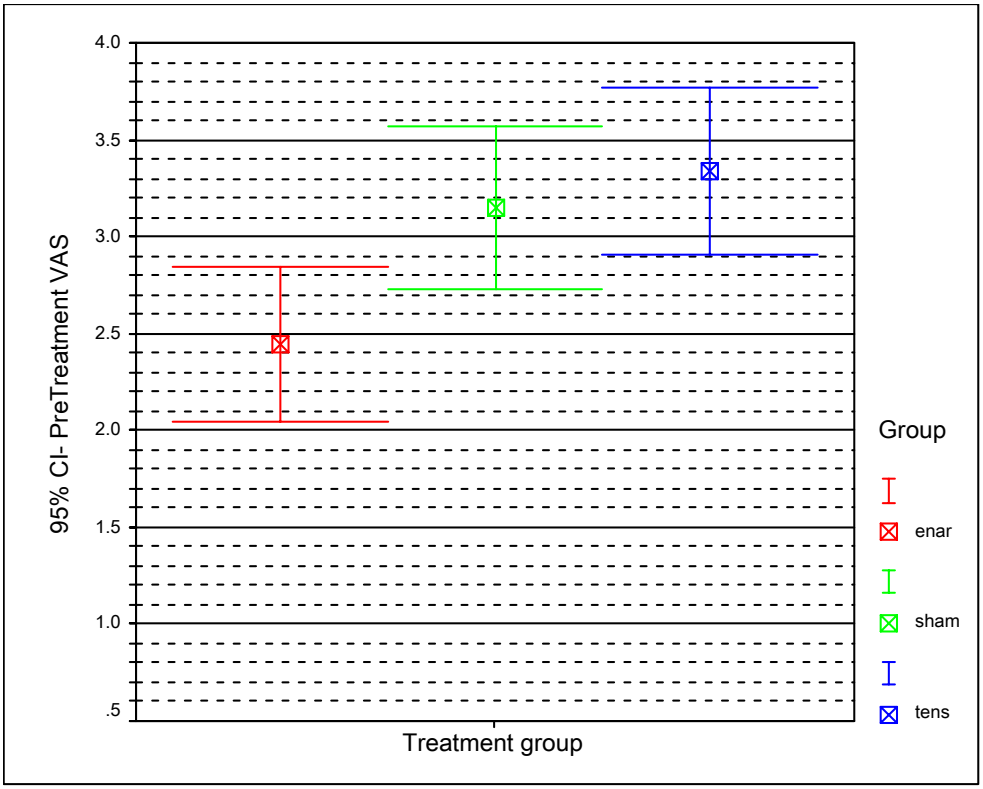


Figure 4. Means plot of group pre-treatment VAS pain scores

7. Post-Treatment VAS Means Plot

After individual treatments had been received, the participants VAS pain scores were again measured. In this graphical interpretation of the post-hoc analysis treatment VAS scores there was no significant difference in pain intensity (VAS) between the TENS or Sham groups. In contrast there was a significant reduction in the intensity of pain felt by the recipients of the ENAR treatment immediately after its administration which compared to either the TENS or Sham treatment groups.

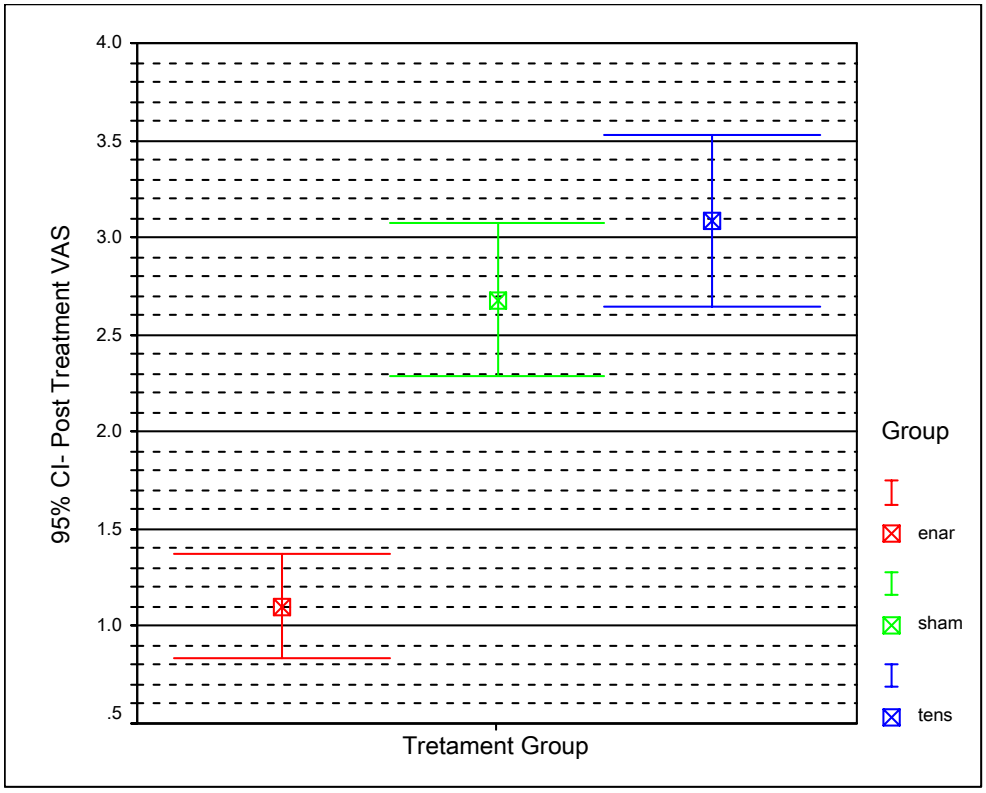


Figure 5. Means plot of group post-treatment VAS pain scores

8. Combined VAS Means Plot

Figure 6 combines the previous two charts to highlight the differences in VAS scores before and after treatment in all three groups simultaneously.

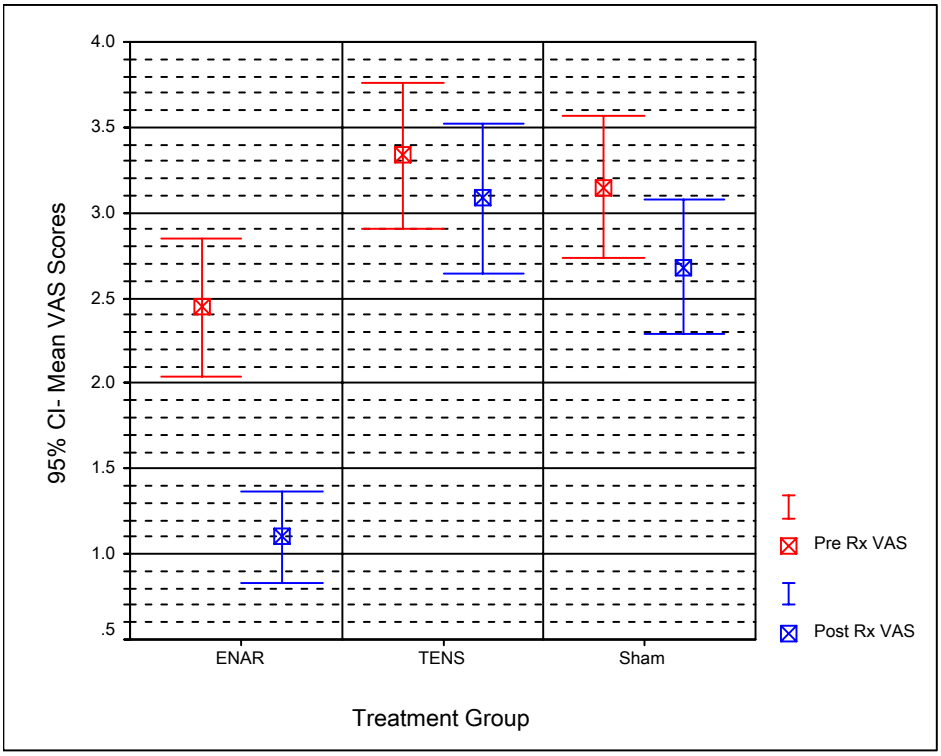


Figure 6. Combined Pre & Post Treatment VAS Means Plot

Discussion

From the results the initial breakdown of the cohort data reveals that the study recruited more females than males (F:M=14:10). At this early stage of the study the authors cannot be certain whether or not this reflects the prevalence of chronic neck pain within the local community or as a result of the randomization process within a limited sample size (N=24). Table 2 also highlights a skewing of successful participants within the Caucasian racial group when compared to the Asian. We should also note a lack of participants from the Negroid racial group. The authors believe that this inequality within participant racial groups is a function of subject recruitment rather than a reflection of the prevalence of neck pain within any one race. Participants were targeted from the immediate geographical regions surrounding the Macquarie University outpatient clinics by way of local newspaper advertisements. Figure 3 demonstrates the distribution of participant ages and it can be seen that the median age of the sample group was 41 years. This result is consistent with anecdotal evidence that suggests that chronic musculoskeletal conditions, such as chronic neck pain, are more prevalent in the later decades of life[2].

Table 4 demonstrates the random allocation of participant within each treatment group. At the beginning of the trial each group had attracted 10 subjects but by the end of phase 1 a total of 6 participants had withdrawn from the trial. It should be noted that all but 1 of the participants had withdrawn either due to the increasing of neck pain or the non abatement of symptoms, these subjects were either in the sham or TENS group. The single withdrawal from the ENAR group was a result of non compatible scheduling times and the participants changed work status.

The paired sample t-tests (Figure 6) demonstrate statistically significant differences in all three groups between the pre and post treatment stages. When further analysed with analysis of variance (ANOVA), it can be demonstrated that the statistical differences occurred between the individual groups both before and after treatment. These differences can be best appreciated when figures 4, 5 and 6 are viewed. From these diagrams it can be seen that after the administration of individual treatments the greatest reduction in pain was within the ENAR group. By comparison, participants who either received the TENS or no treatment had no significant differences in pain intensity ($p=0.318$)

Prior to the application of any treatment the subjects exhibited different pain profiles in each group. From Figure 5 we can see that those participants within the ENAR group had starting VAS scores that were significantly different (2.043-2.846 95%CI) than those in the TENS group (2.910-3.766 95%CI). Kelly[1] had found that the minimum clinically significant difference (MCSD) of VAS pain scores for people with moderate pain was between 4-14 mm (95%CI) with a mean of 11mm, when measures on a 100 mm scale. Using this result we note that the previously significant difference in VAS scores between the ENAR and TENS groups prior to the application of treatment was unlikely to be of a difference that could be detected by a clinician. However, when the post treatment VAS scores were taken into account the VAS scores of the ENAR group were both clinically and statistically significant, in contrast the Post Treatment TENS and Sham were neither.

Scheffe Post hoc analysis revealed that the significant differences in VAS scores were not as a result of a Type 1 error thereby not requiring further analysis.

Conclusion

The use of ENAR therapy in patients with non-complicated chronic neck pain has shown initial short term benefits (0-6 weeks) when compared to both TENS therapy and the use of a sham therapy.

This pilot study has successfully demonstrated that benefits (lasting from 0-6 weeks) in VAS scores were possible within this limited cohort. Further analysis of the 6 week to 6 month follow up periods are needed to assess the longer term effects of the ENAR therapy on the VAS scores reported by the participants

These results clearly demonstrate that a short term benefit in reducing chronic neck pain intensity, as measured by a VAS scale, is possible when receiving ENAR therapy, compared to both the use of the TENS therapy or no therapy for the same treatment period.

References

1. Kelly AM The minimum clinically significant difference in visual analogue scale pain score does not differ with severity of pain. Emerg. Med J. 2001 May;18(3):205-7.

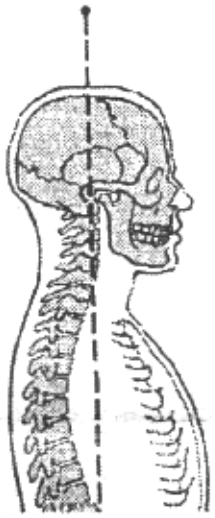
2. Guez M, Hildingsson C, et al. The Prevalence of Neck Pain- A population-based study from northern Sweden. Acta Orthop Scand 2002;73(4):455-9.

Appendix 1 Public Advertisement

Research Study

MACQUARIE UNIVERSITY~SYDNEY

Would you like free treatment for your neck pain?

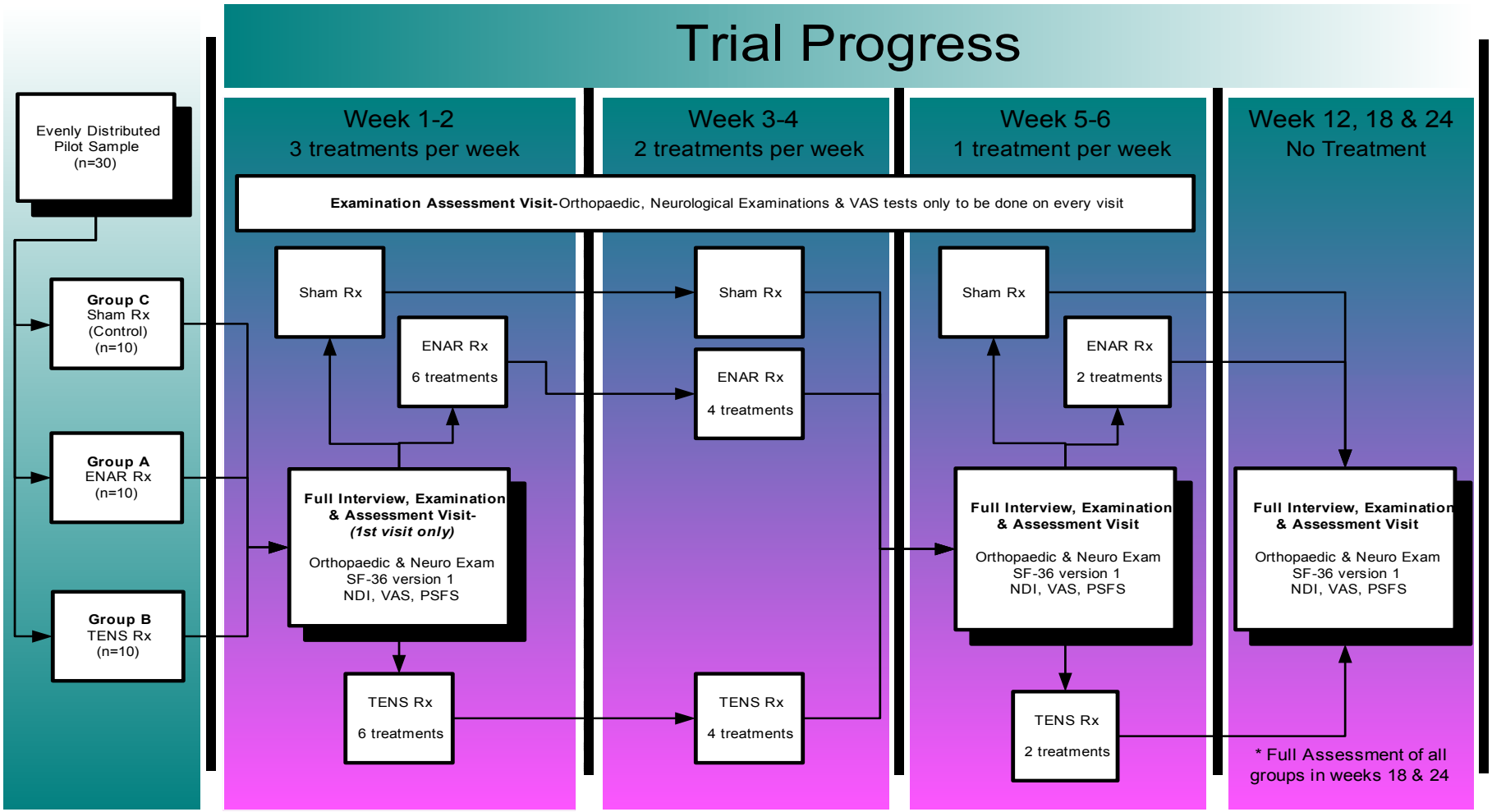


Macquarie University are conducting an investigation into a new, non-invasive treatment option for people suffering from chronic neck pain. If you have had neck pain for more than 3 weeks, are between 18-50 years and would like to participate in this 6 month trial **contact Andrew Vitello on the ENAR Hotline on 1300 137 849** for more information on your suitability.

AUSTRALIA'S INNOVATIVE UNIVERSITY

Appendix 2 Pilot Study Protocol

ENAR Pilot Study Protocol



Treatment: Phase 1. 5 min at site of pain either side of spine
Phase 2. 2 min at each "Sticky Point" at either side of spine (max of five)

Page 1