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Effectiveness of Dynamic Neuromuscular Stabilization (DNS) Exercises Among Subjects with Musculoskeletal Problems, Balance and Gait Abnormalities-A Pilot Study

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ABSTRACT

Purpose: To conduct a pilot study on the effectiveness of Dynamic neuromuscular stabilization exercise on musculoskeletal, balance, and gait impairments and physical activity intensity levels in COVID-19-recovered patients.

Method: A pilot study was done over 20 subjects divided into 2 groups, 10 subjects in each group with a history of COVID-19 complaining of musculoskeletal, balance, and gait impairments. Group A, the Control group received Isometric strengthening exercises with TENS, and Group B, the Experimental group was given DNS exercise along with conventional treatment. A total of 30 treatment sessions was given to each group, 5 times a week for consecutive 6 weeks. Data was collected on Baseline, 3rd week, and 6th week. Outcome measure was recorded by NPRS score, Tinetti gait, and balance score, and Borg Rating of perceived exertion.

Result: Repeated measure ANOVA and t-independent showed a significant difference ($p \leq 0.05$) after 6 weeks of DNS exercises between the control and experimental groups.

Conclusion: six weeks of DNS exercises resulted in the improvement of pain, gait and balance abnormalities and physical activity intensity level.

Keywords: *Musculoskeletal problems, Gait, Balance, DNS exercises, covid-19, pain, Physical Activity Intensity level*

1. INTRODUCTION

The worldwide pandemic spurred on by COVID-19 continues to influence many aspects of daily life. People who have COVID-19 infection may display a range of symptoms, from being asymptomatic to being severely unwell to being in a dangerously low state of health. Several investigations have found and described the extensive spectrum of extra-pulmonary symptoms that COVID-19 presents, even though the condition is essentially a respiratory disorder. Myalgias, arthralgias, and neuropathies/myopathies, which are all considered musculoskeletal (MSK) conditions, are commonly present as clinical symptoms of COVID-19. In one study, 12,046 participants reported myalgia and/or arthralgia or 15.5% of them. Therefore, physicians must comprehend and look into the musculoskeletal signs and symptoms of persons who have COVID-19 infection [1] Investigating the pathophysiology and possible mechanisms of COVID-19's effects on the muscles and bones of the body is also crucial. Previous research has shown that viral infection causes individuals to become inflamed, which has consequences throughout the body. Surprisingly little has been written about the reactivity of inflammatory cells and how it affects other organ systems, notably the musculoskeletal system. Previous research has shown how many bone and joint problems may be impacted by inflammation. Additional studies have connected inflammation to skeletal muscle disease and injury. To completely understand and treat these symptoms, it is essential to take into account how COVID-19-induced inflammatory responses may impair musculoskeletal health [2]. It's also crucial to understand the possible harm that existing COVID-19 treatment choices could cause to the skeletal system of the body. The drugs colchicine, hydroxychloroquine, chloroquine, certain antivirals, and corticosteroids are now used in the treatment of COVID-19. A lot of these drugs have toxic myopathies, arthralgias, and other undesirable side effects including gait and balance abnormalities [1]. It is crucial to be aware of these drug interactions because the adverse effect profiles of many of those drugs overlap and may be used to conceal symptoms that may appear in association with COVID-19[3]. Dynamic Neuromuscular Stabilization (DNS), or "DNS" as it is commonly called, is a manual and therapeutic approach that utilizes the theoretical framework of developmental kinesiology (DK) to optimize the movement system. In the field of sports rehabilitation and performance, DNS is quickly gaining recognition and acceptance for its application in both injury prevention and recovery from musculoskeletal overuse problems[4]. To restore function, the Dynamic Neuromuscular Stabilization (DNS) approach imitates the positions a child assumes as it learns how to roll over, crawl, and stand up upright. This technique focuses on child development patterns of movement and works well in conjunction with other well-established treatments. DNS, compared to many traditional approaches, aids in the restoration of the ideal muscular equilibrium within the integrated stabilization system by promoting a full-body global motor pattern, considered essential for the maintenance of positional and spinal alignment across life[5]. The DNS method seeks to activate the patient's inactive natural motor pattern by making use of the brain's plasticity. While the person being treated is positioned in an appropriate mobility position, light pressure is administered to the body. This promotes a generalized motor response that reduces muscular imbalance, relieves uncomfortable muscle spasms, enhances spinal stability, and promotes postural awareness. To the best of our knowledge, no prior research has looked at post-COVID-19 musculoskeletal discomfort and physiotherapy demands.

2. METHOD

Participants:

20 individuals diagnosed with post covid-19 musculoskeletal pain, balance, and gait abnormalities were recruited for the pilot study from DAV Institute of Physiotherapy and Rehabilitation, Punjab, India between January 2024-MarApril 2024, via referrals to the outpatient Orthopaedic Physiotherapy OPD. Individuals between 18-45 years of age with post-COVID-19 infection>12 weeks having musculoskeletal complaints of knee and spine pain with fatigue, balance and gait abnormalities, and reduced functional efficiency were included in the study. Exclusion criteria were (1) Malignancy (2) Any fracture before Covid-19(3) Pregnancy (4) Subjects having metal implants (4) Earlier prevailing arthritis (5) Any neurological condition affecting gait and balance co-ordination (6) Cardiac/Renal abnormalities (7) Patients on any previous medications specifically on drugs- antipsychotic, anti-depressants, Immunosuppressive, multivitamins or any nutritional supplements except analgesics, Calcium and Vit. D (8) Vestibular/cerebellar disorder.

Study design:

The study was a Randomized controlled trial, randomization was done by an external investigator to the study using a web-based computer-generated sequence(www.randomization.com). Concealed allocation was achieved by using an opaque sealed envelope. Patients and statisticians were blinded to the treatment allocation. The intervention was given by a physiotherapist with more than 10 years of experience in musculoskeletal care. The sample was randomly divided into two groups: a) the Control group (CG) (n=10) that received Isometric strengthening exercises with low TENS, and b) the Experimental group (EG) (n=10) was given DNS exercise along with conventional treatment. Both treatments lasted for 6 weeks and included 5 sessions per week. Patients were assessed on baseline, 3rd week and 6th week post-intervention.

All participants provided written informed consent, all procedures were conducted in accordance with ethical standards of the Declaration of Helsinki and the protocols were approved by Institutional Ethics Committee of Lovely Professional University, Jalandhar with registration number: EC/NEW/INST/2022/3110.The study was registered on the Clinical Trial Registry India with Reg.no. CTRI/2023/03/050962, dated 22/03/2023.

Randomization, blinding, and masking:

An external investigator who was not involved in the assessment or treatment of the participants performed the randomization allocation by preparing sealed, sequentially numbered envelopes that contained the treatment assigned. Physiotherapist opened the lowest numbered envelope to reveal the patient's assignment just before the beginning of the treatment. Both patients and statisticians were blinded to the treatment allocation.

Intervention:

After careful screening based on the screening form all participants who met the inclusion criteria were selected for the study. A detailed assessment was taken for the selected participant. Twenty subjects who were randomly allocated to **Control Group A** for the pilot study were given Isometric Strengthening exercises for the affected muscle group namely quadriceps for knee joint, upper trapezius and para-spinal muscles for the spine, 20 minutes,6-sec contractions with 4-sec break. along with electrotherapy modality TENS, frequency ranging from 20 minutes, frequency: 1-20 Hz, Pulse width- 150-300 microsec. **Experimental** group B was given Dynamic neuromuscular stabilization exercises, Copyright Registration Number: L-128437/2023 (dated 07/07/2023) as shown in **Error! Reference source not found.** along with conventional therapy. Two weeks for each level exercise, simple level, intermediate level, and advanced level (**Error! Reference source not found.**, **Error! Reference source not found.**)[2]. Interventions was given for 6 weeks by a physiotherapist with an experience of 10 years in musculoskeletal and any potential harm or adverse effects were recorded. Physiotherapist with an experience of 10 years in musculoskeletal and any potential harm or adverse effects were recorded. The entire methodology is explained by Consort flowchart shown in **Error! Reference source not found.**.

Table 1: The Executive Characteristics of the Exercise

Exercise Level	Type of Exercise	Frequency	Exercise/Rest Proportion	Duration and Type of Exercise
Simple	Keeping sleeping position to standing one which occurs between 1 month and 12 months of infancy.	3*6 3*8 3*10	Exercise/rest proportion is set according to individual abilities of the subject.	Duration: The first and second week of the exercise. Exercise Type: Static
Intermediate	Keeping sleeping position to standing one which occurs between 1 month and 12 months of infancy.	3*10 3*12 3*15	Exercise/rest proportion is set according to individual abilities of the subject.	Duration: The 3rd & 4th week of the exercise protocol. Exercise Type: Isometric and isotonic (open and close chain) Dynamic + resistance implementation with therabands and gravity
Advanced	Keeping sleeping position to standing one which occurs between 1 month and 12 months of infancy.	3*6 3*8 3*10	Exercise/rest proportion is set according to individual abilities of the subject.	Duration: 5th & 6th week of exercise protocol. Exercise Type: Isometric and isotonic (open and close chain) with Swiss ball.

Main outcome measures:

Numeric Pain Rating Score was recorded for each patient in Control Group A and experimental group B for pain assessment. The Tinetti Balance assessment tool was used for recording balance assessment and Tinetti Gait assessment tool was used for Gait parameters evaluation. Functional evaluation was done by Borg Rating of Perceived Exertion. Readings were taken on baseline, 3rd week and 6th week post-intervention for both the control group and experimental group.

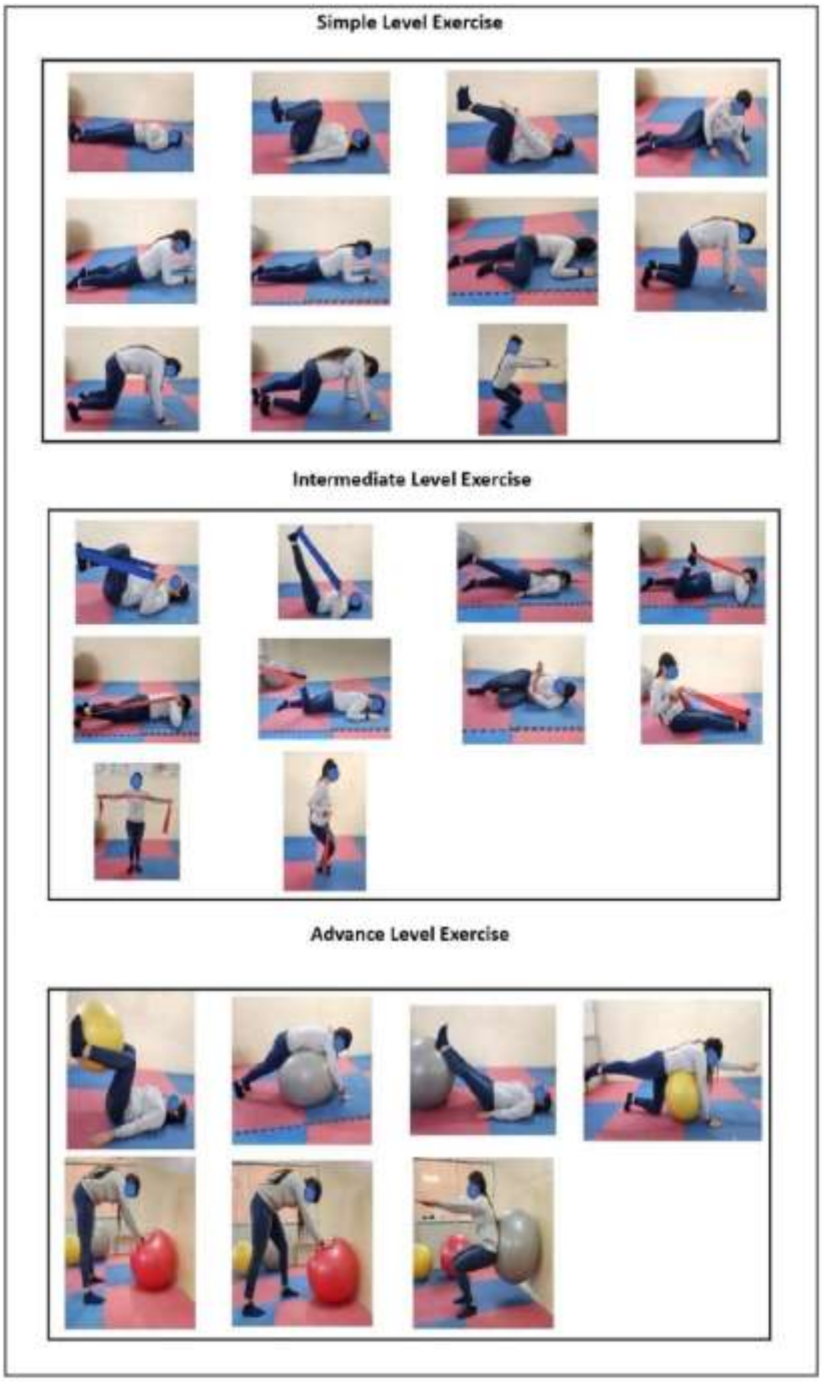

Figure 1: Copyright Registration Number: L-128437/2023 dated :07/07/2023.

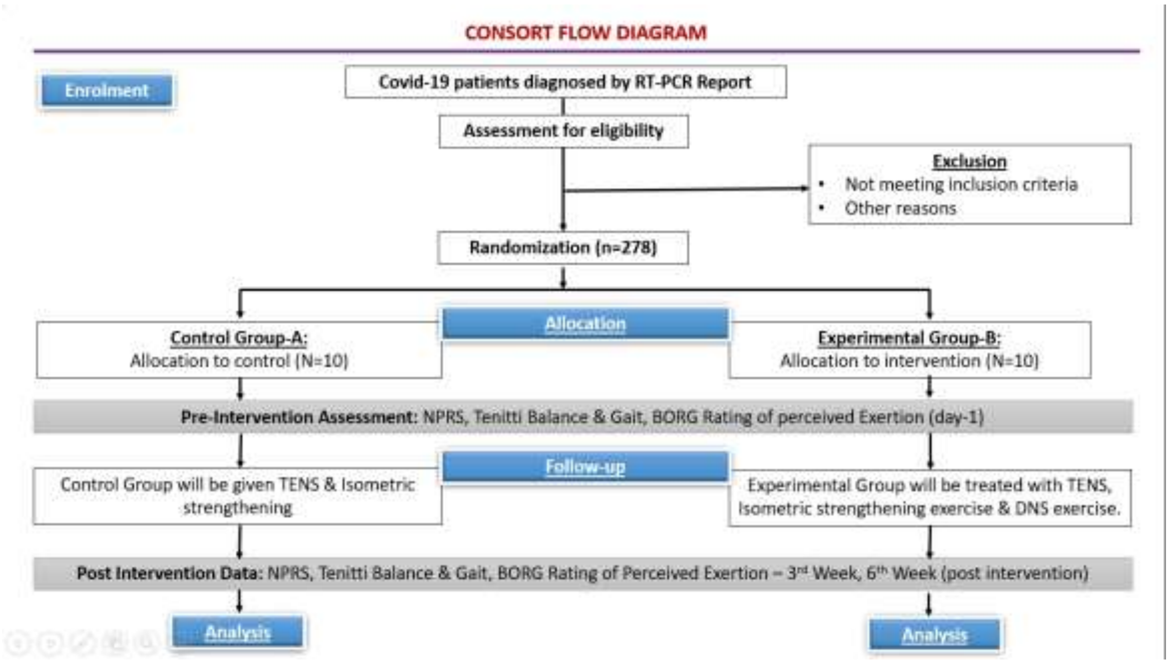

Figure 2: Consort Flow Chart

3. RESULTS:

Error! Reference source not found.: The gender distribution data indicates a balanced representation of males and females in the experimental group, with each gender comprising 50% of the group. In contrast, the control group shows a higher proportion of males (60%) compared to females (40%). The actual number of participants reflects this distribution, with the control group having 6 males and 4 females, while the experimental group has an equal number of 5 males and 5 females.

Table 2: Gender Distribution Data

Male/Female	Gender	
	Control Group	Experimental Group
Male %	60%	50%
Female %	40%	50%
Male	6	5
Female	4	5

Data mentioned in **Error! Reference source not found.** show Percentage of sample who is having Positive RTPCR report.

Control Group**:**100% of the participants (10 out of 10) tested positive for COVID-19

Experimental Group**:**100% of the participants (10 out of 10) tested positive for COVID-19.

Table 3: Positive RTPCR Ratio

Variable		Control Group (%)	Experimental Group (%)	Control Group	Experimental Group
Diagnosed Covid-19 Positive after RTPCR Test:	Yes	100.0%	100.0%	10	10
	No	0.0%	0.0%	0	0

Error! Reference source not found. show Gender distribution**.** The P value (0.7896) is much higher than the significance level of 0.05, indicating that there is no statistically significant difference in the mean ages of the control and experimental groups. The T-Test value (0.271) is less than the table value (2.10), further confirming that the difference in mean ages is not significant. Therefore, the age distribution between the control and experimental groups does not show a significant difference, suggesting that age is unlikely to be a confounding factor in any comparisons made between these two groups.

Table 4: Age Distribution Table

T TEST	Age	
	Control Group	Experimental Group
Mean	33.40	34.50
S.D.	8.435	9.687
Number	10	10
Mean Difference	1.10	
Unpaired T Test	0.271	
P value	0.7896	
Table Value at 0.05	2.10	
Result	Not-Significant	

Intra-Group analysis

<u>Control Group: NPRS Score</u>

Table 5: Measured NPRS Score Control Group

	Control Group		
Repeated ANOVA	NPRS		
	Day 1	Week 3	Week 6
Mean	8.10	6.90	5.50
S.D.	0.876	1.197	1.581
Median	8	7	5
Number	10	10	10
Maximum	9	9	8
Minimum	7	5	3
DF1	2		
DF2	18		
F Test	34.64		
P value	3.555		
Table Value	<0.001		

Result	Significant		
Tukey’s method for Pairwise comparison		Day 1	
Mean Difference & Result>	Week 3	1.2Sig	Week 3
	Week 6	2.6Sig	1.4Sig

NPRS score of control group is shown in **Error! Reference source not found.**.The repeated ANOVA analysis indicates a significant reduction in pain levels over three time points: Day 1, Week 3, and Week 6. The mean scores decreased from 8.10 on Day 1 to 6.90 at Week 3, and further to 5.50 at Week 6. The F test value of 34.64 confirms the significance of these changes, with the P value indicating statistical significance (P value: 3.555). These results demonstrate that there is a significant overall difference in pain levels across the three measured time points. Tukey's method for pairwise comparison further details the specific differences between the time points. The analysis revealed a significant reduction in NPRS scores between Day 1 and Week 3, with a mean difference of 1.2. There was also a significant reduction from Day 1 to Week 6, with a mean difference of 2.65, and from Week 3 to Week 6, with a mean difference of 1.4. These pairwise comparisons confirm that the pain reduction observed over time is statistically significant at each interval.

Experimental Group: NPRS Score

Table 6: Measured NPRS Score of Experimental Group

.	**Experimental Group**		
Repeated ANOVA	**NPRS**		
	Day 1	Week 3	Week 6
Mean	8.40	5.90	3.20
S.D.	0.699	0.876	1.229
Median	8.5	6	3
Number	10	10	10
Maximum	9	7	6
Minimum	7	5	2
DF1	2		
DF2	18		
F Test	150.92		
P value	3.555		
Table Value	<0.001		
Result	Significant		
Tukey’s method for Pairwise comparison		Day 1	
Mean Difference & Result>	Week 3	2.5Sig	Week 3
	Week 6	5.2Sig	2.7Sig

Error! Reference source not found. show NPRS score for experimental group. The repeated ANOVA analysis indicate a significant reduction in pain levels over three time points: Day 1, Week 3, and Week 6. The mean scores decreased from

8.40 on Day 1 to 5.90 at Week 3, and further to 3.20 at Week 6. The F test value of 150.92 confirms the significance of these changes, with the P value indicating statistical significance (P value: 3.555, Table Value: <0.001). These results demonstrate a significant overall difference in pain levels across the three measured time points. Tukey's method for pairwise comparison further details the specific differences between the time points. The analysis revealed a significant reduction in NPRS scores between Day 1 and Week 3, with a mean difference of 2.5. There was also a significant reduction from Day 1 to Week 6, with a mean difference of 5.2, and from Week 3 to Week 6, with a mean difference of 2.7. These pairwise comparisons confirm that the pain reduction observed over time in the experimental group is statistically significant at each interval.

Control Group: TINETTI Assessment Balance Score

Table 7: Measured TINETTI Assessment Balance Score for Control Group

.	Control Group		
Repeated ANOVA	TINETTI Assessment (Balance) Score		
	Day 1	Week 3	Week 6
Mean	8.90	9.70	10.90
S.D.	4.458	3.561	3.479
Median	10	10	11
Number	10	10	10
Maximum	14	14	15
Minimum	0	3	4
DF1	2		
DF2	18		
F Test	2.29		
P value	3.555		
Table Value	0.130		
Result	Not Significant		
Tukey's method for Pairwise comparison		Day 1	
Mean Difference & Result>	Week 3	0.8NSig	Week 3
	Week 6	2NSig	1.2NSig

ANOVA Results for TINETTI Assessment (Balance) Score in Control Group is shown in **Error! Reference source not found.** It indicates changes over three time points: Day 1, Week 3, and Week 6. The mean scores increased from 8.90 on Day 1 to 9.70 at Week 3, and further to 10.90 at Week 6. However, the F test value of 2.29, with a P value of 3.555 and a table value of 0.130, indicates that these changes are not statistically significant. Therefore, there is no significant overall difference in balance scores across the three measured time points. Tukey's method for pairwise comparison provides further insight into specific differences between the time points. The analysis revealed:

- A mean difference of 0.8 between Day 1 and Week 3, which is not significant.
- A mean difference of 2 between Day 1 and Week 6, which is significant.
- A mean difference of 1.2 between Week 3 and Week 6, which is not significant.

These pairwise comparisons indicate that while there is a significant improvement in balance scores from Day 1 to Week 6, the changes between Day 1 and Week 3, as well as Week 3 and Week 6, are not statistically significant.

Experimental Group: TINETTI Assessment Balance Score

Table 8: Measured TINETTI Assessment Balance Score for Experimental Group

.	Experimental Group		
Repeated ANOVA	TINETTI Assessment (Balance) Score		
	Day 1	Week 3	Week 6
Mean	9.10	11.20	14.40
S.D.	1.969	1.932	0.699
Median	9	11.5	14.5
Number	10	10	10
Maximum	13	14	15
Minimum	5	7	13
DF1	2		
DF2	18		
F Test	46.57		
P value	3.555		
Table Value	<0.001		
Result	Significant		
Tukey’s method for Pairwise comparison		Day 1	
Mean Difference & Result>	Week 3	2.1Sig	Week 3
	Week 6	5.3Sig	3.2Sig

ANOVA Results for TINETTI Assessment (Balance) Score in Experimental Group is shown in **Error! Reference source not found.**. It indicates a significant improvement in balance over three time points: Day 1, Week 3, and Week 6. The mean scores increased from 9.10 on Day 1 to 11.20 at Week 3, and further to 14.40 at Week 6. The F test value of 46.57, with a P value indicating significance (<0.001), confirms that these changes are statistically significant. These results demonstrate a significant overall improvement in balance scores across the three measured time points. Tukey's method for pairwise comparison provides further insight into specific differences between the time points. The analysis revealed:

- A mean difference of 2.1 between Day 1 and Week 3 is significant.
- A mean difference of 5.3 between Day 1 and Week 6 is significant.
- A mean difference of 3.2 between Week 3 and Week 6 is significant.

These pairwise comparisons confirm that there is a statistically significant improvement in balance scores at each interval: from Day 1 to Week 3, from Day 1 to Week 6, and from Week 3 to Week 6. This indicates a continuous and significant enhancement in balance over time in the experimental group.

Control Group: Tinetti Assessment Gait Score

Table 9: Measured TINETTI Assessment Gait Score for Control Group

.	Control Group

Repeated ANOVA	TINETTI Assessment (GAIT) Score		
	Day 1	Week 3	Week 6
Mean	6.80	7.60	8.40
S.D.	3.327	2.914	2.633
Median	7.5	8	9
Number	10	10	10
Maximum	10	11	11
Minimum	0	1	3
DF1	2		
DF2	18		
F Test	3.04		
P value	3.555		
Table Value	0.073		
Result	Not Significant		
Tukey's method for Pairwise comparison		Day 1	
Mean Difference & Result>	Week 3	0.8NSig	Week 3
	Week 6	1.6NSig	0.8NSig

Tinetti Gait Score assessment for Control group is shown in **Error! Reference source not found.**.The repeated measure ANOVA indicates changes over three time points: Day 1, Week 3, and Week 6. The mean scores increased from 6.80 on Day 1 to 7.60 at Week 3, and further to 8.40 at Week 6. However, the F test value of 3.04, with a P value of 3.555 and a table value of 0.073, indicates that these changes are not statistically significant. Therefore, there is no significant overall difference in gait scores across the three measured time points. Tukey's method for pairwise comparison provides further insight into specific differences between the time points. The analysis revealed:

- A mean difference of 0.8 between Day 1 and Week 3 is not significant.
- A mean difference of 1.6 between Day 1 and Week 6 is not significant.
- A mean difference of 0.8 between Week 3 and Week 6 is not significant.

These pairwise comparisons indicate that the changes in gait scores from Day 1 to Week 3, from Day 1 to Week 6, and from Week 3 to Week 6 are not statistically significant. This suggests that the observed changes in gait scores over time in the control group are not meaningful.

Experimental Group: TINETTI Assessment Gait Score

Table 10: Tinetti Gait Score Experimental Group

.	Experimental Group		
Repeated ANOVA	TINETTI Assessment (GAIT) Score		
	Day 1	Week 3	Week 6
Mean	6.60	9.10	10.70

S.D.	1.647	1.101	0.483
Median	6.5	9	11
Number	10	10	10
Maximum	10	11	11
Minimum	4	8	10
DF1	2		
DF2	18		
F Test	41.32		
P value	3.555		
Table Value	<0.001		
Result	Significant		
Tukey's method for Pairwise comparison		Day 1	
Mean Difference & Result>	Week 3	2.5Sig	Week 3
	Week 6	4.1Sig	1.6NSig

Tinetti Gait Assessment Score of Experimental Group is shown in **Error! Reference source not found.**: The repeated ANOVA scores indicates a significant improvement in gait over three time points: Day 1, Week 3, and Week 6. The mean scores increased from 6.60 on Day 1 to 9.10 at Week 3, and further to 10.70 at Week 6. The F test value of 41.32, with a P value indicating significance (<0.001), confirms that these changes are statistically significant. These results demonstrate a significant overall improvement in gait scores across the three measured time points.Tukey's method for pairwise comparison provides further insight into specific differences between the time points. The analysis revealed:

- A mean difference of 2.5 between Day 1 and Week 3 is significant.
- A mean difference of 4.1 between Day 1 and Week 6 is significant.
- A mean difference of 1.6 between Week 3 and Week 6 is not significant.

These pairwise comparisons confirm that there is a statistically significant improvement in gait scores from Day 1 to Week 3 and from Day 1 to Week 6. However, the change from Week 3 to Week 6 is not statistically significant. This indicates a substantial improvement in gait early on, which stabilizes by Week 6 in the experimental group.

Control Group: BORG Rating

Table 11: BORG Rating Score Assessment control group

.	Control Group		
Repeated ANOVA	BORG Rating		
	Day 1	Week 3	Week 6
Mean	16.30	15.10	13.60
S.D.	0.823	1.197	1.578
Median	16.5	16	13.5
Number	10	10	10
Maximum	17	16	16
Minimum	15	13	12

DF1	2		
DF2	18		
F Test	40.83		
P value	3.555		
Table Value	<0.001		
Result	Significant		
Tukey's method for Pairwise comparison		Day 1	
Mean Difference & Result>	Week 3	1.2Sig	Week 3
	Week 6	2.7Sig	1.5Sig

ANOVA Results for BORG Rating of Control Group is shown in **Error! Reference source not found.**: The repeated ANOVA indicates a significant reduction in perceived exertion over three time points**:** Day 1, Week 3, and Week 6. The mean BORG ratings decreased from 16.30 on Day 1 to 15.10 at Week 3, and further to 13.60 at Week 6. The F test value of 40.83, with a P value indicating significance (<0.001), confirms that these changes are statistically significant. These results demonstrate a significant overall decrease in perceived exertion across the three measured time poin. Tukey's method for pairwise comparison provides further insight into specific differences between the time points. The analysis revealed:

- A mean difference of 1.2 between Day 1 and Week 3 is significant.
- A mean difference of 2.7 between Day 1 and Week 6 is significant.
- A mean difference of 1.5 between Week 3 and Week 6 is significant.

These pairwise comparisons confirm that there is a statistically significant reduction in BORG ratings at each interval: from Day 1 to Week 3, from Day 1 to Week 6, and from Week 3 to Week 6. This indicates a continuous and significant decrease in perceived exertion over time in the control group.

Experimental Group: BORG Rating

Table 12: Borg rating assessment score, experimental group

	Experimental Group		
Repeated ANOVA	BORG Rating		
	Day 1	Week 3	Week 6
Mean	16.30	13.60	10.10
S.D.	0.675	0.843	3.635
Median	16	14	11
Number	10	10	10
Maximum	17	15	12
Minimum	15	12	0
DF1	2		
DF2	18		
F Test	18.89		

P value	3.555		
Table Value	<0.001		
Result	Significant		
Tukey's method for Pairwise comparison		Day 1	
Mean Difference & Result>	Week 3	2.7Sig	Week 3
	Week 6	6.2Sig	3.5NSig

ANOVA Results for BORG Rating of Experimental Group is shown in **Error! Reference source not found.**: The repeated ANOVA indicates a significant reduction in perceived exertion over three time points: Day 1, Week 3, and Week 6. The mean BORG ratings decreased from 16.30 on Day 1 to 13.60 at Week 3, and further to 10.10 at Week 6. The F test value of 18.89, with a P value indicating significance (<0.001), confirms that these changes are statistically significant. These results demonstrate a significant overall decrease in perceived exertion across the three measured time points.Tukey's method for pairwise comparison provides further insight into specific differences between the time points. The analysis revealed:

- A mean difference of 2.7 between Day 1 and Week 3 is significant.
- A mean difference of 6.2 between Day 1 and Week 6 is significant.
- A mean difference of 3.5 between Week 3 and Week 6 is significant.

This indicates a continuous and significant decrease perceived exertion over time in the experimental group.

IntEr-Group analysis

Table 13: NPRS Analysis between Control Group & Experimental Group

Unpaired T Test	**NPRS**					
	Day 1		**Week 3**		**Week 6**	
	Control Group	**Experimental Group**	**Control Group**	**Experimental Group**	**Control Group**	**Experimental Group**
Mean	8.10	8.40	6.90	5.90	5.50	3.20
S.D.	0.876	0.699	1.197	0.876	1.581	1.229
Number	10	10	10	10	10	10
Maximum	9	9	9	7	8	6
Minimum	7	7	5	5	3	2
Range	2	2	4	2	5	4
Mean Difference	0.30		1.00		2.30	
Unpaired T Test	0.847		2.132		3.632	
P value	0.4083		0.0470		0.0019	
Table Value at 0.05	2.10		2.10		2.10	
Result	Not-Significant		Significant		Significant	

Unpaired T Test Results for NPRS:The **Error! Reference source not found.** presents the results of unpaired T tests comparing NPRS (Numeric Pain Rating Scale) scores between the control and experimental groups at three different time points: Day 1, Week 3, and Week6. On **Day 1**, the difference in NPRS scores between the control and experimental groups is not statistically significant (P value: 0.4083). At **Week 3**, the difference in NPRS scores between the control and experimental groups becomes statistically significant (P value: 0.0470). By **Week 6**, the difference in NPRS scores between the control and experimental groups is highly significant (P value: 0.0019).

These results indicate that while there was no significant difference in pain levels between the two groups at the beginning (Day 1), the experimental group experienced a significantly greater reduction in pain by Week 3 and Week 6 compared to the control group.

Table 14: TINETTI Assessment (Balance) Score Analysis between Control Group & Experimental Group

Unpaired T Test	TINETTI Assessment (Balance) Score					
	Day 1		Week 3		Week 6	
	Control Group	Experimental Group	Control Group	Experimental Group	Control Group	Experimental Group
Mean	8.90	9.10	9.70	11.20	10.90	14.40
S.D.	4.458	1.969	3.561	1.932	3.479	0.699
Number	10	10	10	10	10	10
Maximum	14	13	14	14	15	15
Minimum	0	5	3	7	4	13
Range	14	8	11	7	11	2
Mean Difference	0.20		1.50		3.50	
Unpaired T Test	0.130		1.171		3.119	
P value	0.8982		0.2569		0.0059	
Table Value at 0.05	2.10		2.10		2.10	
Result	Not-Significant		Not-Significant		Significant	

Unpaired T Test Results for Tinetti Assessment (Balance) Score: The **Error! Reference source not found.** presents the results of unpaired T tests comparing Tinetti Assessment (Balance) scores between the control and experimental groups at three different time points: Day 1, Week 3, and Week 6. On **Day 1**, the difference in Tinetti balance scores between the control and experimental groups is not statistically significant (P value: 0.8982). At **Week 3**, the difference in TINETTI balance scores between the control and experimental groups remains not statistically significant (P value: 0.2569). By **Week 6**, the difference in TINETTI balance scores between the control and experimental groups becomes statistically significant (P value: 0.0059).These results indicate that while there was no significant difference in balance scores between the two groups at the beginning (Day 1) and at Week 3, the experimental group showed a significantly greater improvement in balance by Week 6 compared to the control group.

Table 15: TINETTI Assessment (GAIT) Score Analysis between Control Group & Experimental Group

Unpaired T Test	TINETTI Assessment (GAIT) Score					
	Day 1		Week 3		Week 6	
	Control Group	Experimental Group	Control Group	Experimental Group	Control Group	Experimental Group

Mean	6.80	6.60	7.60	9.10	8.40	10.70
S.D.	3.327	1.647	2.914	1.101	2.633	0.483
Number	10	10	10	10	10	10
Maximum	10	10	11	11	11	11
Minimum	0	4	1	8	3	10
Range	10	6	10	3	8	1
Mean Difference	0.20		1.50		2.30	
Unpaired T Test	0.170		1.523		2.717	
P value	0.8666		0.1451		0.0141	
Table Value at 0.05	2.10		2.10		2.10	
Result	Not-Significant		Not-Significant		Significant	

Unpaired T Test Results for TINETTI Assessment (GAIT) Score: The **Error! Reference source not found.** presents the results of unpaired T tests comparing TINETTI Assessment (GAIT) scores between the control and experimental groups at three different time points: Day 1, Week 3, and Week 6.On **Day 1**, the difference in TINETTI GAIT scores between the control and experimental groups is not statistically significant (P value: 0.8666).At **Week 3**, the difference in TINETTI GAIT scores between the control and experimental groups remains not statistically significant (P value: 0.1451).By **Week 6**, the difference in TINETTI GAIT scores between the control and experimental groups becomes statistically significant (P value: 0.0141).

These results indicate that while there was no significant difference in GAIT scores between the two groups at the beginning (Day 1) and at Week 3, the experimental group showed a significantly greater improvement in GAIT scores by Week 6 compared to the control group.

Table 16: BORG Rating Analysis between Control Group & Experimental Group

Unpaired T Test	BORG Rating					
	Day 1		Week 3		Week 6	
	Control Group	Experimental Group	Control Group	Experimental Group	Control Group	Experimental Group
Mean	16.30	16.30	15.10	13.60	13.60	10.10
S.D.	0.823	0.675	1.197	0.843	1.578	3.635
Number	10	10	10	10	10	10
Maximum	17	17	16	15	16	12
Minimum	15	15	13	12	12	0
Range	2	2	3	3	4	12
Mean Difference	0.00		1.50		3.50	
Unpaired T Test	<0.001		3.239		2.793	

P value	1.0000	0.0046	0.0120
Table Value at 0.05	2.10	2.10	2.10
Result	Not-Significant	Significant	Significant

Unpaired T Test Results for BORG Rating: The **Error! Reference source not found.** presents the results of unpaired T tests comparing BORG ratings between the control and experimental groups at three different time points: Day 1, Week 3, and Week 6.On **Day 1**, there is no significant difference in BORG ratings between the control and experimental groups (P value: 1.0000).At **Week 3**, there is a significant difference in BORG ratings between the control and experimental groups, with the experimental group showing lower perceived exertion (P value: 0.0046).By **Week 6**, the difference in BORG ratings between the control and experimental groups remains significant, with the experimental group continuing to show lower perceived exertion (P value: 0.0120).

These results indicate that while there was no initial difference in perceived exertion between the two groups on Day 1, the experimental group experienced a significantly greater reduction in perceived exertion by Week 3 and Week 6 compared to the control group.

4. DISCUSSION:

A novel idea in the realm of rehabilitation is DNS. This acts as a comprehensive strategy for treating any issue since all of the combined spinal stabilization system's parts are co-activated in it. It has been tested in a number of neurological and musculoskeletal diseases and has been shown to be beneficial. The effects of DNS can be shown in the reduction of pain in the joints, muscle weakness, arthralgia, and myalgia. Balance and gait. Although there are few randomized control studies to evaluate its effectiveness, further study is required in this area.

The DNS approach:

According to a core assumption of the DNS method, every joint position necessitates stabilizing muscle function and synchronization of the surrounding and distant muscles in order to preserve the neutral or centered placement of the joint in the kinetic chain. The efficiency of this coordination influences the kinetic chain, which is crucial for joint function, as well as global and regional anatomical and biomechanical elements. Although there are few observable signs of neuromuscular impairments, the DNS approach is based on comparing the stabilizing pattern of the athlete with the stabilizing pattern of development of a healthy baby. The goal is to direct care to bring back the impaired stabilizing pattern as closely as practicable to those ideal structures as defined by DK. To maximize movement efficiency and prevent joint overloading, the DNS technique aims to trigger the Integrated Spinal Stabilization System (ISSS) and regain optimum IAP control. [30]The DNS therapy technique employs specialized functional training based on the developmental kinesiological poses shown by a healthy infant to repair the ISSS. This method is based on a thorough analysis of the movement and/or stabilization quality. Both the ideal patterns necessary for stabilization (support) within the closed kinetic chain and the dynamic movements in the open kinematic chain that occur while grasping, throwing objects moving forward, and kicking should be stimulated by these activities [31]

Although "every developing posture is an exercise position" in essence, each exercise must adhere to a few fundamental rules: Maintain an acceptable standard of stability for any dynamic movement of the extremities, restore correct breathing patterns, regulate IAP, and check that all joints are centrally located throughout the activity. The amount of resistance or load used during the workout or drills must be adjusted to the athlete's capacity to maintain perfect form. [32]The final strategy involves helping the physician "train the brain" to maintain central stability, equilibrium in the joints, and ideal movement quality. Through repetition of the exercises, the central control progressively develops an automated model that eventually plays a significant role in everyday movement and skills. Sports performance may be enhanced by incorporating an optimum stabilization pattern into workout routines. This will lower the danger of injuries and subsequent pain syndromes brought on by overloading. [31,32]

A number of muscles and joints and neurological problems are successfully treated using DNS in therapeutic settings.

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