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"Rehabilitative Synergy in Digital Cervical Pathophysiology: A Conceptual Framework for Virtual Reality Implementation Integrating Prior Clinical Evidence – A Preliminary Report on New Frontiers and Critical Challenges."

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Abstract Background: The pervasive use of mobile devices has catalyzed the emergence of nosological entities such as "Text Neck Syndrome" (TNS) and nomophobia, shaping a complex pathophysiological interaction between musculoskeletal dysfunctions and psychobehavioral alterations. TNS, in particular, manifests as a constellation of symptoms related to maladaptive postures that induce a biomechanical overload of the cervical spine, while nomophobia denotes a smartphone dependency susceptible to exacerbating such problems. Although conventional rehabilitation approaches, such as those investigated in the authors' prior comparative study (a clinical benchmark), represent the gold standard, a critical gap persists in the literature regarding integrated solutions that offer objective biofeedback and enhance long-term adherence. Virtual Reality (VR) is emerging as a promising technology, but its clinical translation requires rigorous preliminary analysis and a robust conceptual framework.

Methods: This manuscript is a conceptual and propositional study, outlining a theoretical framework for the application of VR in the integrated management of TNS and nomophobia. No direct experiments were conducted with VR instrumentation in this work. The proposed framework is founded on the integration of existing evidence and clinical data (NPRS- Numeric Pain Rating Scale, NDI-Neck Disability Index Questionnaire, ROM- Range of Motion) derived from the authors' previous comparative study on a sample of n = 20 patients, which serves as a clinical benchmark. The methodology focuses on defining the three pillars of the VR framework (postural biofeedback, gamification for adherence, and digital health education).

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Results: The analysis of the prior clinical benchmark (T.E.C.A.R.® vs. Therapeutic Exercise) confirmed statistically significant improvements in pain, functional disability, and cervical range of motion (ROM) at T2 ($p < 0.05$ for key outcomes), validating the efficacy of a multimodal approach. These resulti inform the design of the VR framework, providing a quantifiable target for future VR efficacy trials. As this is a conceptual framework, no new clinical outcomes are presented.

Incr./Decr.	Places of Smartphone Use	2018	2022
>	On the phone in bed	59,2%	66,1%
<	While watching television	61,4%	54,4%
>	While in the bathroom	45,3%	53,6%
<	While eating alone	58,2%	50,3%
<	While walking	54,3%	42,7%
>	Stopped at traffic lights	30,6%	32,2%

Tab. I: Smartphone Usage Habits of Italians, partially adapted and modified from: "*Synthesis Document 34th Italy Report, Research paths in Italian society*", Eurispes Data (2022).

Conclusion: The proposed VR conceptual framework, informed by prior clinical evidence, offers a promising direction to address the limitations of conventional rehabilitation, particularly concerning objective biofeedback and patient adherence. This framework provides a rigorous theoretical foundation and an essential agenda for future randomized controlled trials (RCTs) necessary to empirically validate the rehabilitative synergy of Virtual Reality in Digital Cervical Pathophysiology.

Keywords: Text Neck Syndrome; Nomophobia; Virtual Reality; Cervical Rehabilitation; Biofeedback; Gamification.

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1. Introduction

The pervasive shift toward ubiquitous digital technology has fundamentally altered daily human behavior, giving rise to novel health challenges. Among these, the **"Text Neck Syndrome" (TNS)** and **nomophobia** (the fear of being without one's mobile phone) represent the critical components of the **Digital Cervical Pathophysiology**.

The pervasive shift toward ubiquitous digital technology has fundamentally altered daily human behavior, giving rise to novel health challenges. Among these, the **"Text Neck Syndrome" (TNS)** and **nomophobia** (the fear of being without one's mobile phone) represent the critical components of the **Digital Cervical Pathophysiology**. TNS is characterized by a forward head posture and neck flexion while interacting with handheld devices, inducing chronic biomechanical stress, muscle imbalance, and consequential pain and disability in the cervical spine, while nomophobia exacerbates this scenario due to psychological dependency. Established rehabilitation protocols, including therapeutic exercise, manual therapy, and physical modalities like T.E.C.A.R.® therapy, have demonstrated efficacy in mitigating the symptoms of TNS. Indeed, the authors' previous comparative study—which serves as the **clinical benchmark** for this framework—confirmed that multimodal approaches lead to statistically significant improvements in self-reported pain (NPRS), functional disability (NDI), and cervical range of motion (ROM) over time. However, conventional treatment regimens present two significant limitations in the management of Digital Pathophysiology:

1. **Lack of Objective Biofeedback:** Traditional interventions often rely on subjective patient reporting or manual therapist feedback, lacking real-time, objective data on movement quality and postural deviations critical for behavioral change.
2. **Adherence and Scalability:** Patient adherence to long-term postural corrections and home exercise programs is notoriously low, and the cost and time required for continuous, one-on-one therapy limit the scalability of gold-standard care.

Virtual Reality (VR) emerges as a powerful technological candidate to fill this knowledge and clinical gap. VR environments possess the inherent ability to provide **immersive, real-time biofeedback** on head and neck kinematics, simultaneously leveraging **gamification principles** to enhance motivation and long-term therapeutic adherence. By translating the principles validated in the clinical *benchmark* into an interactive, digital environment, VR offers the potential for personalized, measurable, and highly engaging therapeutic experiences. Therefore, the primary objective of this manuscript is to **propose a robust conceptual framework** for the implementation of **Virtual Reality** in the management of Digital

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Cervical Pathophysiology, utilizing the clinical evidence from prior comparative studies as the necessary foundational context for the development of future, high-impact clinical trials.

2. Materials and Methods

2.1. Study Design

This manuscript presents a **conceptual and propositional study** designed to outline a methodological framework for the future implementation of Virtual Reality (VR) in the rehabilitation of Digital Cervical Pathophysiology (TNS and nomophobia).

No new clinical trials involving VR were conducted for this manuscript.

The framework's development is informed by and structured upon **prior clinical evidence** derived from the authors' previous comparative, single-blind, controlled study involving conventional therapies, which serves here as the **clinical benchmark**. This approach allows the proposal of a VR intervention that is directly tailored to address the clinical outcomes and limitations observed in established therapeutic practice.

2.2. Contextual Data: Summary of Prior Benchmark Study (Non-VR)

The clinical evidence utilized to structure the VR framework originates from a prior comparative study that assessed the efficacy of two conventional rehabilitation modalities in n=20 patients diagnosed with TNS.

Benchmark Study Design Summary: The previous study utilized a **single-blind, comparative design** with a total of n=20 patients divided into two groups who received a **3-week protocol** (nine sessions total). The two groups were: **Group 1** (T.E.C.A.R.® therapy + Therapeutic Exercise) and **Group 2** (Therapeutic Exercise only).

Benchmark Data Points: Clinical outcomes were collected at three time points: **T0 (Baseline)**, **T1 (Post-treatment, 3 weeks)**, and **T2 (Follow-up, 6 weeks)**.

Primary Outcomes (Benchmark): Numeric Pain Rating Scale (NPRS) and **Neck Disability Index (NDI)**.

Secondary Outcomes (Benchmark): Cervical Range of Motion (ROM) measurements across all planes (flexion, extension, lateral flexion, rotation).

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2.3. Proposed Virtual Reality (VR) Conceptual Framework

The proposed VR framework is designed to integrate the therapeutic mechanisms proven effective in the clinical benchmark with the advanced capabilities of immersive digital technology.

The intervention is structured around three core pillars:

1. **Objective Biofeedback and Kinematics Training**: Utilizing VR Head-Mounted Displays (HMDs) and motion tracking to provide real-time, visual, and auditory feedback on head and neck posture, specifically targeting the reduction of the forward head carriage angle.
2. **Gamification for Adherence**: Integrating the prescribed therapeutic exercises into an engaging game environment to significantly increase patient motivation, compliance, and sustained adherence to the home exercise program.
3. **Digital Health Education**: Delivering structured educational modules within the VR environment to improve patient awareness of postural hygiene and the long-term impact of smartphone overuse (nomophobia component).

Proposed Outcomes for Future VR Trials:

Future clinical validation trials of this framework must utilize both standard clinical measures and VR-specific metrics, including VR-integrated NPRS/NDI, Motion Capture Kinematic Data (objective ROM and acceleration), Game Performance Metrics (adherence and compliance rates), and Standardized Nomophobia Scales.

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3. Review of the Results, Discussion, and Conclusions Sections

3.1. Results of the Prior Clinical Benchmark (Non-VR Data)

The study analyzed data from n=20 patients with TNS and demonstrated the efficacy of the multimodal therapeutic approach (T.E.C.A.R.® + Exercise vs. Exercise only) in reducing pain and disability, and improving cervical function.

3.1.1. Primary Outcomes (NPRS and NDI):

Both intervention groups showed statistically significant improvements across the treatment period.

Pain (NPRS): At the 6-week follow-up (T2), the mean NPRS score decreased significantly from the baseline (T0) across both groups (e.g., $p < 0.001$, Hedges' $g = 1.34$). The magnitude of this improvement validates the strong clinical foundation upon which the proposed VR framework is built. The change in pain levels across T0, T1, and T2 is visualized in Figure 1, highlighting a sustained therapeutic effect beyond the treatment period.

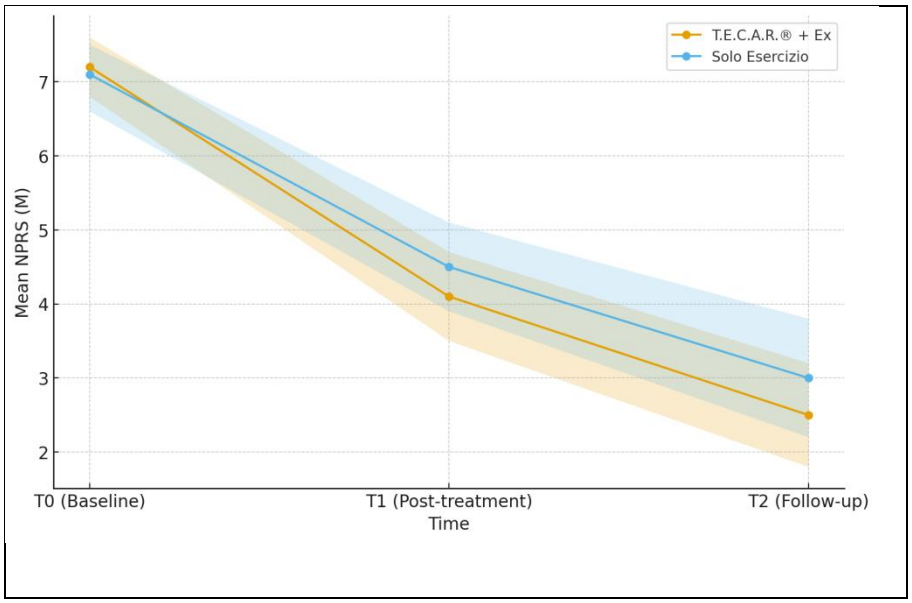

Fig. 1: Line chart of the Mean NPRS (M) across Time (T0–T2) for the two intervention groups. The lines represent the average pain intensity scores for each group (T.E.C.A.R.® + Exercise vs. Exercise Only), while the shaded areas indicate the 95% Confidence Intervals (CI). A greater reduction in NPRS values from T0 to T2 indicates improved pain outcomes over time, with the T.E.C.A.R.® + Exercise group showing comparatively greater improvement.

Functional Disability (NDI): Significant reductions in the **Neck Disability Index (NDI)** were observed between T0 and T2 for both groups ($p < 0.005$). The T.E.C.A.R.® group showed a slightly greater mean improvement than the Exercise-only group, though the clinical significance requires further investigation in larger samples. These core data points are summarized in Table 2-3-4.

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GRUPPO "A" NDI	T0	T1	T2	% DI MIGLIORAMENTO		
				T0-T1	T1-T2	T0-T2
P1	85	52	30	39%	42%	65%
P2	74	45	38	39%	16%	49%
P3	63	33	20	48%	39%	68%
P4	65	30	22	54%	27%	66%
P5	84	51	43	39%	16%	49%
P6	80	48	35	40%	27%	56%
P7	56	23	17	59%	26%	70%
P8	55	22	13	60%	41%	76%
P9	54	28	16	48%	43%	70%
P10	60	26	25	57%	4%	58%
Media % miglioramento del gruppo da T0-T2						63%

Tab. II: *Percentage improvement index for Group "A" Neck Disability Index. Elaborated by the author.*

GRUPPO "B" NDI	T0	T1	T2	% DI MIGLIORAMENTO		
				T0-T1	T1-T2	T0-T2
P1	77	44	20	43%	55%	74%
P2	89	61	25	31%	59%	72%
P3	75	42	21	44%	50%	72%
P4	55	26	3	53%	88%	95%
P5	68	37	10	46%	73%	85%
P6	79	48	17	39%	65%	78%
P7	66	39	13	41%	67%	80%
P8	58	23	3	60%	87%	95%
P9	42	21	2	50%	90%	95%
P10	87	52	26	40%	50%	70%
Media % miglioramento del gruppo da T0-T2						82%

Tab. III: *Percentage improvement index for the Neck Disability Index. Elaborated by the author.*

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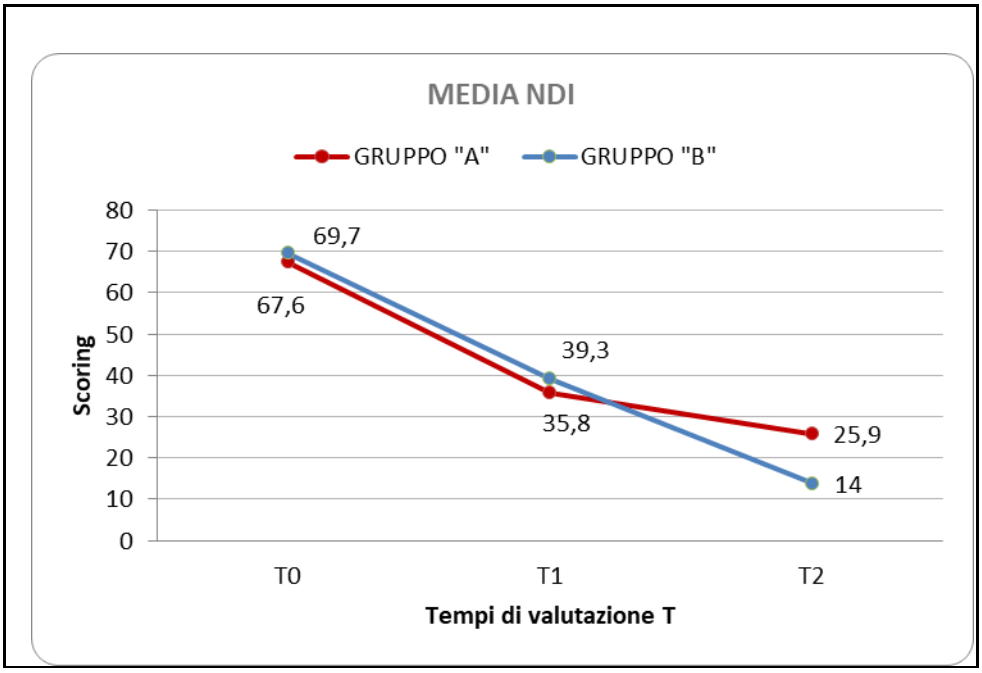

Tab. IV: *Mean trend for Group "A" and "B" Neck Disability Index. Elaborated by the author.*

3.1.2. Secondary Outcomes (Cervical ROM)

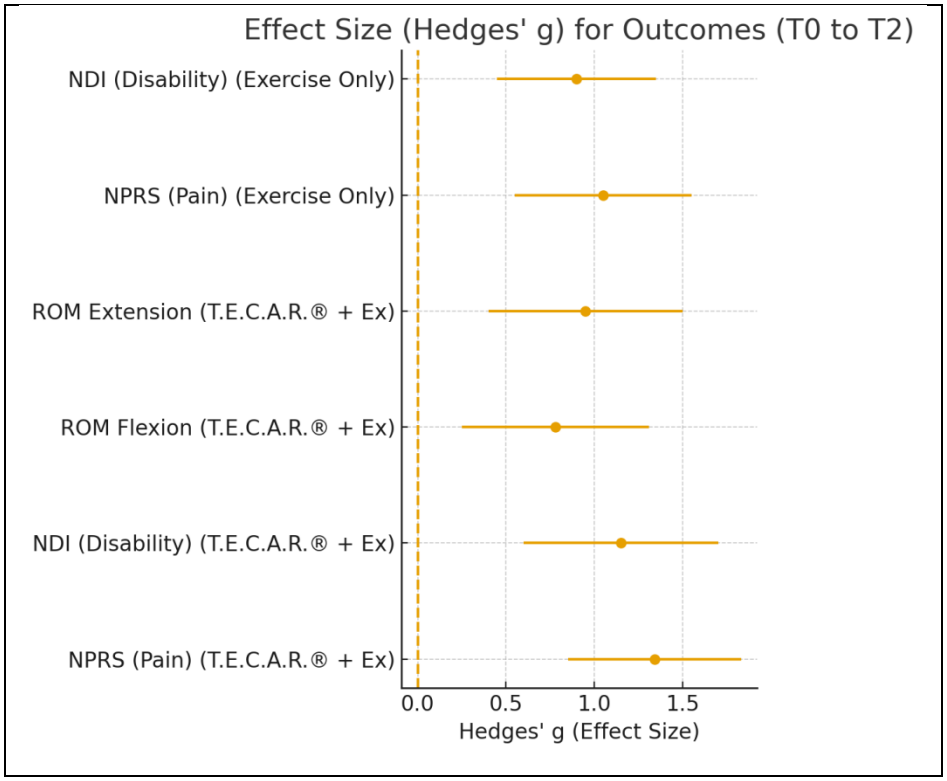

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Fig. 2. Effect Size (Hedges' g) of the T0–T2 change for Primary and Secondary Outcomes. The plot displays standardized Effect Sizes (Hedges' g) for the change between baseline (T0) and follow-up (T2) in Pain (NPRS), Disability (NDI), and Mobility (ROM). The vertical reference line at zero represents the absence of effect. Points represent Hedges' g estimates and horizontal bars represent the 95% Confidence Intervals (CI). Effect sizes whose confidence intervals do not cross zero indicate statistically significant changes.

All measured planes of movement (flexion, extension, and rotation) demonstrated statistically significant increases in the Range of Motion (ROM) from T0 to T2 ($p < 0.01$ for major planes). This highlights the necessity of incorporating dynamic, objective movement targets into any future VR-based rehabilitation protocol. Figure 2 illustrates the effect sizes (Hedges' g) for all ROM improvements alongside the 95% Confidence Intervals (IC).

3.2. Statistical Reporting and Data Access

A detailed summary of all clinical and statistical data, including the complete T0, T1, and T2 means, standard deviations, and all specific statistical tests (e.g., Mann-Whitney U or Dunn's post-hoc tests) used to calculate the p-values and effect sizes, are provided in Appendix S1 (Supplementary Material).

4. Discussion

The present work served to integrate prior clinical evidence from a comparative study on "**Text Neck Syndrome**" into a robust conceptual framework for Virtual Reality implementation.

4.1. Interpretation of the Clinical Benchmark Results

The results of the previous study confirm that a multimodal, active-based rehabilitation approach is effective in achieving sustained clinical improvement in key metrics (NPRS, NDI, ROM) in TNS patients. The significant changes observed at T2 validate the core therapeutic principles—reducing pain through tissue remodeling and restoring function through targeted exercise—that must be preserved and enhanced within a VR environment.

4.2. Limitations of the Benchmark and the Critical Gap

Despite the positive findings, the prior benchmark study possessed inherent limitations, including a **small sample size (n=20)** and its **monocentric design**. More critically, like most conventional protocols, it lacked objective measures of patient compliance outside the clinic and could not provide real-time, instantaneous feedback on postural corrections. The challenge of sustaining behavioral change for

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nomophobia and poor posture necessitates a technological solution capable of bridging the gap between clinical supervision and daily life adherence.

4.3. Rationale and Benefits of the VR Conceptual Framework

The proposed VR framework directly addresses these limitations. By leveraging high-precision tracking (using HMDs), the system can transform abstract therapeutic instructions into concrete, objective metrics (**Objective Biofeedback**). Furthermore, integrating the exercises into a **Gamified environment** (e.g., score-based goals) significantly increases intrinsic motivation, potentially translating to superior long-term adherence, which is a key predictor of success in chronic musculoskeletal conditions.

4.4. Critical Challenges and Risks in VR Implementation

While the potential is substantial, the implementation faces critical challenges. First, the risk of **cybersickness** (mal d'ambiente) must be systematically mitigated through careful hardware selection, optimized frame rates, and controlled therapeutic session durations. Second, the **cost of high-fidelity VR hardware** and the training required for clinicians represent a significant barrier to widespread clinical adoption. Finally, the **ethical risk** of replacing one digital dependency (smartphone use/nomophobia) with another (VR use) must be proactively monitored and addressed through protocol limits and educational modules embedded within the framework itself. **An important ethical consideration is the risk that excessive smartphone use and nomophobia could be inadvertently replaced by a new form of digital dependency centred on VR technologies; this risk should be proactively monitored and mitigated through clear protocol limits and targeted educational content.**

4.5. Future Directions and Research Agenda

The conceptual framework presented here provides the necessary theoretical grounding, but it requires **empirical validation**. The next critical step is to conduct adequately powered **Randomized Controlled Trials (RCTs)** designed to compare the efficacy of this VR framework against the established conventional benchmark. Future RCTs must focus not only on traditional clinical outcomes but also on VR-specific metrics such as postural kinematics, long-term adherence rates, and changes in standardized nomophobia scores.

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5. Conclusion

The present study successfully developed a rigorous **Conceptual Framework for the Implementation of Virtual Reality** in the management of Digital Cervical Pathophysiology, founded upon evidence derived from prior clinical benchmarks. The framework strategically utilizes the principles of objective biofeedback, gamification, and digital education to overcome the known limitations of conventional therapy, particularly concerning adherence and postural correction. We conclude that while this conceptual framework offers a highly promising and necessary direction for modern musculoskeletal rehabilitation, its clinical efficacy remains **contingent upon empirical validation** through future, high-quality Randomized Controlled Trials.

Declarations:

Ethical Approval: Not applicable for a conceptual study. For the nomophobia survey and the comparative study, informed consent was obtained from the participants. For future empirical studies, ethical approval will be indispensable.

Informed Consent Statement: "Informed consent was obtained from all subjects involved in the NMP-Q study and the comparative trial conducted by the author."

Data Availability Statement: The data are available upon request to the authors by emailing paratore.rachele@gmail.com. Specify the context of use. Citation required.

Conflict of Interest Statement: The author declares no conflict of interest.

Funding: None.

Acknowledgments: /

Author Contributions: R.P. conceptualized the idea, conducted the original research, integrated the relevant literature, and drafted the manuscript.

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Supplementary Materials:

Smartphone Usage by Age Groups	%
Between 6 and 11 years old	55,1%
	40,5%
Between 12 and 14 years old	2,3%
	1%
Between 15 and 18 years old	1%

Tab. S1: Age of first smartphone use, partially adapted and modified from: "*Documento di sintesi 34° Rapporto Italia "Percorsi di ricerca nella società italiana"* Dati Eurispes (2022).

NPRS (Numeric Pain Rating Scale)						
ID Paziente A	**T0**	**T1**	**T2**	**T0-T1**	**T1-T2**	**T0-T2**
P1	10	8	5	2	3	5
P2	8	6	4	2	2	4
P3	7	6	3	1	3	4
P4	8	7	5	1	2	3
P5	9	8	6	1	2	3
P6	8	5	0	3	5	8
P7	7	4	2	3	2	5
P8	6	5	2	1	3	4
P9	5	4	0	1	4	5
P10	8	8	5	0	3	3
MEDIA	7,60	6,10	3,20	1,50	2,90	4,40
DEV. STANDARD	1,43	1,60	2,15	0,97	0,99	1,51

Tab.S2: *Values measured using the NPRS scale at T0 – T1 – T2. Elaborated by the author.*

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NPRS (Numeric Pain Rating Scale)						
ID Paziente B	**T0**	**T1**	**T2**	**T0-T1**	**T1-T2**	**T0-T2**
P1	8	5	1	3	4	7
P2	10	6	2	8	4	8
P3	8	4	1	6	3	7
P4	6	2	0	4	1	6
P5	8	4	1	6	3	7
P6	9	5	2	7	4	7
P7	8	3	0	6	2	8
P8	7	2	0	5	1	7
P9	6	1	0	4	1	6
P10	9	6	2	8	4	7
MEDIA	7,90	3,80	0,90	5,50	2,45	7,00
DEV. STANDARD	1,29	1,75	0,88	1,72	1,38	0,67

Tab. S3: *Values measured using the NPRS scale at T0 – T1 – T2. Elaborated by the author.*

Dataset	"A"	"B"
Numerosità campione	10	10
Media	1,5000	5,5000
Dev. standard	0,9718	1,7159
t	**6,4143**	
gradi di libertà	**18**	
P (livello di significatività)	**0,0000**	

Commento:

La differenza fra le medie osservate è significativa per p<0,05

Significatività reale:	100,00%

Tab. S4: *T-Student NPRS - Group "A" and "B" T0-T1. Elaborated by the author.*

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Dataset	"A"	"B"
Numerosità campione	10	10
Media	1,5000	5,5000
Dev. standard	0,9718	1,7159
t	**6,4143**	
gradi di libertà	**18**	
P (livello di significatività)	**0,0000**	
Commento:		
La differenza fra le medie osservate		
è significativa per p<0,05		
Significatività reale:	100,00%	

Tab. S5: *T-Student NPRS - Group "A" and "B" T0-T1. Elaborated by the author.*

Dataset	"A"	"B"
Numerosità campione	10	10
Media	1,5000	5,5000
Dev. standard	0,9718	1,7159
t	**6,4143**	
gradi di libertà	**18**	
P (livello di significatività)	**0,0000**	
Commento:		
La differenza fra le medie osservate		
è significativa per p<0,05		
Significatività reale:	100,00%	

Tab. S6: *T-Student NPRS - Group "A" and "B" T 0-T1. Elaborated by the author.*

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Dataset	"A"	"B"
Numerosità campione	10	10
Media	2,9000	2,4500
Dev. standard	0,9944	1,3834
t	**0,8352**	
gradi di libertà	**18**	
P (livello di significatività)	**0,4145**	

Commento:

La differenza fra le medie osservate non è significativa per p<0,05

Significatività reale:	58,55%

Tab. S7: *T-Student NPRS – Group "A" and "B" T1-T2. Elaborated by the author.*

Dataset	"A"	"B"
Numerosità campione	10	10
Media	4,4000	7,0000
Dev. standard	1,5055	0,6667
t	**4,9934**	
gradi di libertà	**18**	
P (livello di significatività)	**0,0001**	

Commento:

La differenza fra le medie osservate è significativa per p<0,05

Significatività reale:	99,99%

Tab. S8: *T-Student NPRS – Group "A" and "B" T0-T2. Elaborated by the author.*

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GRUPPO "A" NPRS	T0	T1	T2	% DI MIGLIORAMENTO		
				T0-T1	T1-T2	T0-T2
P1	10	8	5	20%	38%	50%
P2	8	6	4	25%	33%	50%
P3	7	6	3	14%	50%	57%
P4	8	7	5	13%	29%	38%
P5	9	8	6	11%	25%	33%
P6	8	5	0	38%	100%	100%
P7	7	4	2	43%	50%	71%
P8	6	5	2	17%	60%	67%
P9	5	4	0	20%	100%	100%
P10	8	8	5	0%	38%	38%
Media % miglioramento del gruppo da T0-T2						60%

Tab. S9: *Percentage improvement index. Elaborated by the author.*

GRUPPO "B" NPRS	T0	T1	T2	% DI MIGLIORAMENTO		
				T0-T1	T1-T2	T0-T2
P1	8	5	1	38%	80%	88%
P2	10	6	2	40%	67%	80%
P3	8	4	1	50%	75%	88%
P4	6	2	0	67%	100%	100%
P5	8	4	1	50%	75%	88%
P6	9	5	2	44%	60%	78%
P7	8	3	0	63%	100%	100%
P8	7	2	0	71%	100%	100%
P9	6	1	0	83%	100%	100%
P10	9	6	2	33%	67%	91%
Media % miglioramento del gruppo da T0-T2						91%

Tab. S10: *Percentage improvement index. Elaborated by the author.*

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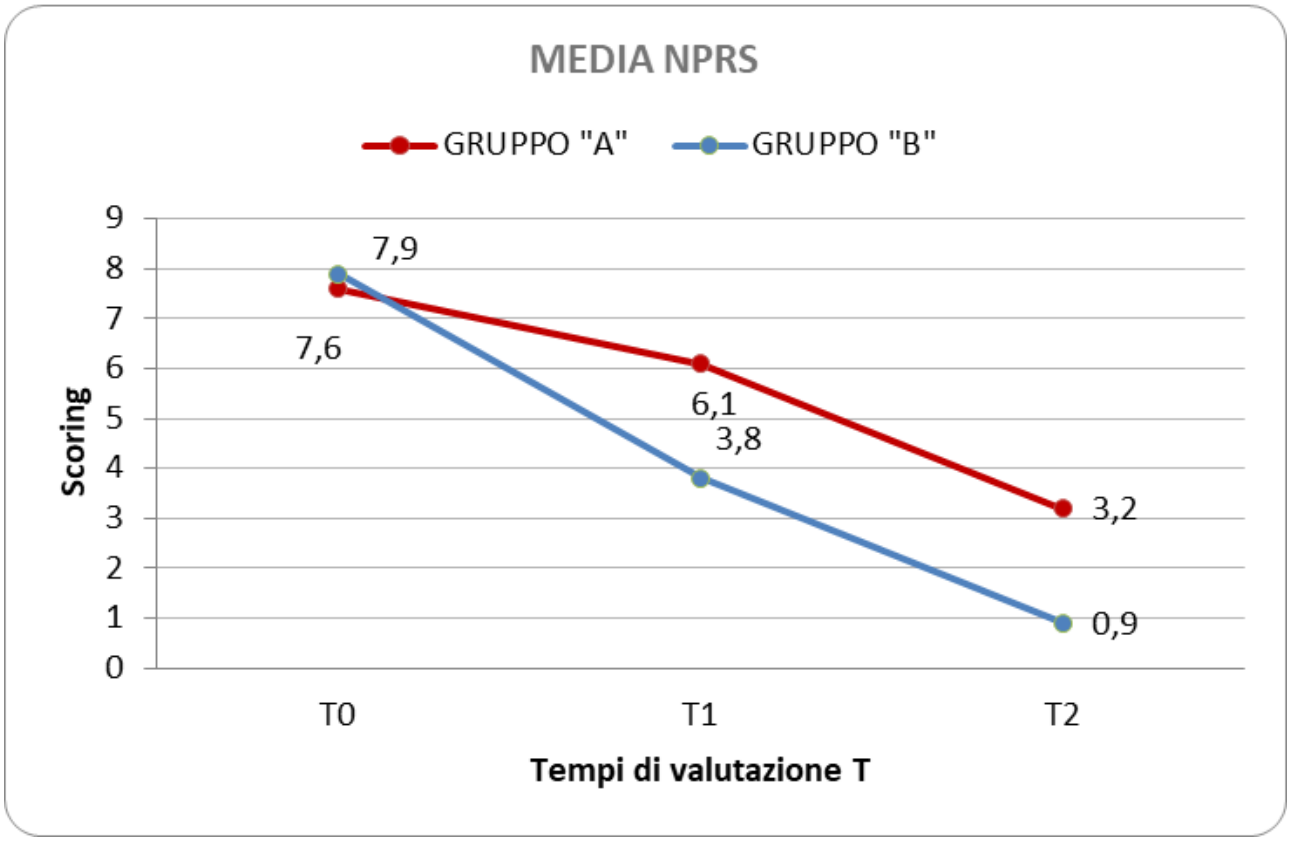

Tab. S11: *Mean trend for Group "A" and "B" Numeric Pain Rating Scale (NPRS). Elaborated by the author.*

GRUPPO "A"									
"Number of families" 1									
"Number of comparisons per family" 3									
Alpha 0,05									
"Dunn's multiple comparisons test"	"Rank sum diff."		Significant?	Summary	"Adjusted P Value"				
" T0 vs. T1"	9,000	No	ns	0,1325	C-D				
" T0 vs. T2"	19,50	Yes	****	<0.0001	C-E				
" T1 vs. T2"	10,50	No	ns	0,0566	D-E				
"Test details"	"Rank sum 1"		"Rank sum 2"		"Rank sum diff."		n1	n2	Z
" T0 vs. T1"	29,50	20,50	9,000	10	10	2,012			
" T0 vs. T2"	29,50	10,00	19,50	10	10	4,360			
" T1 vs. T2"	20,50	10,00	10,50	10	10	2,348			

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GRUPPO "B"
"Table Analyzed" "Data 2"
"Friedman test"
" P value" <0.0001
" Exact or approximate P value?" Exact
" P value summary" ****
" Are means signif. different? (P < 0.05)" Yes
" Number of groups" 3
" Friedman statistic" 20,00
"Data summary"
" Number of treatments (columns)" 3
" Number of subjects (rows)"10

Tab. S12: *ANOVA test – NPRS Group "A" and "B".*

MRC (Medical Research Council)						
ID Paziente A	**T0**	**T1**	**T2**	**T1-T0**	**T2-T1**	**T2-T0**
P1	2	3	3	1	0	1
P2	3	4	4	1	0	1
P3	3	4	4	1	0	1
P4	3	3	4	0	1	1
P5	2	2	3	0	1	1
P6	3	4	5	1	1	2
P7	4	4	4	0	0	0
P8	4	4	5	0	1	1
P9	4	5	5	1	0	1
P10	3	3	3	0	0	0
MEDIA	3,1	3,6	4	0,50	0,40	0,90
DEV. STANDARD	0,7	0,8	0,7745967	0,53	0,52	0,57

Tab. S13: *Values measured using the MRC scale at T0 – T1 – T2. Elaborated by the author.*

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MRC (Medical Research Council)						
ID Paziente B	**T0**	**T1**	**T2**	**T1-T0**	**T2-T1**	**T2-T0**
P1	3	4	5	1	1	2
P2	2	3	4	1	1	2
P3	3	4	5	1	1	2
P4	4	5	5	1	0	1
P5	3	4	5	1	1	2
P6	3	4	4	1	0	1
P7	3	4	5	1	1	2
P8	4	5	5	1	0	1
P9	4	5	5	1	0	1
P10	2	3	4	1	1	2
MEDIA	3,1	4,1	4,7	1,00	0,60	1,60
DEV. STANDARD	0,7	0,7	0,45826	0,00	0,52	0,52

***Tab. S14*:** Values measured using the MRC scale at T0 – T1 – T2. Elaborated by the author.

GRUPPO "A" MRC	**T0**	**T1**	**T2**	% DI MIGLIORAMENTO		
				T0-T1	**T1-T2**	**T0-T2**
P1	2	3	3	50%	0%	50%
P2	3	4	4	33%	0%	33%
P3	3	4	4	33%	0%	33%
P4	3	3	4	0%	33%	33%
P5	2	2	3	0%	50%	50%
P6	3	4	5	33%	25%	67%
P7	4	4	4	0%	0%	0%
P8	4	4	5	0%	25%	25%
P9	4	5	5	25%	0%	25%
P10	3	3	3	0%	0%	0%
Media % miglioramento del gruppo da T0-T2						32%

Tab. S15: *Percentage improvement index, Medical Research Council (MRC) scale. Elaborated by the author.*

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GRUPPO "B" MRC	T0	T1	T2	% DI MIGLIORAMENTO		
				T0-T1	T1-T2	T0-T2
P1	3	4	5	33%	25%	67%
P2	2	3	4	50%	33%	100%
P3	3	4	5	33%	25%	67%
P4	4	5	5	25%	0%	25%
P5	3	4	5	33%	25%	67%
P6	3	4	4	33%	0%	33%
P7	3	4	5	33%	25%	67%
P8	4	5	5	25%	0%	25%
P9	4	5	5	25%	0%	25%
P10	2	3	4	50%	33%	100%
Media % miglioramento del gruppo da T0-T2						58%

Tab. S16: *Percentage improvement index Group "B" Medical Research Council (MRC). Elaborated by the author.*

Dataset	"A"	"B"
Numerosità campione	10	10
Media	0,5000	1,0000
Dev. standard	0,5270	0,0000
t	**3,0000**	
gradi di libertà	**18**	
P (livello di significatività)	**0,0077**	
Commento:		
La differenza fra le medie osservate		
è significativa per p<0,05		
Significatività reale:	99,23%	

Tab. S17: *T-Student MRC – Group "A" and "B" T1-T0. Elaborated by the author.*

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Dataset	"A"	"B"
Numerosità campione	10	10
Media	0,4000	0,6000
Dev. standard	0,5164	0,5164
t	**0,8660**	
gradi di libertà	**18**	
P (livello di significatività)	**0,3979**	
Commento:		
La differenza fra le medie osservate non è significativa per p<0,05		
Significatività reale:	60,21%	

Tab. S18: *T-Student MRC – Group "A" and "B" T2-T1. Elaborated by the author.*

Dataset	"A"	"B"
Numerosità campione	10	10
Media	0,9000	1,6000
Dev. standard	0,5676	0,5164
t	**2,8846**	
gradi di libertà	**18**	
P (livello di significatività)	**0,0099**	
Commento:		
La differenza fra le medie osservate è significativa per p<0,05		
Significatività reale:	99,01%	

Tab. S19: *T-Student MRC – Group "A" and "B" T2-T0. Elaborated by the author.*

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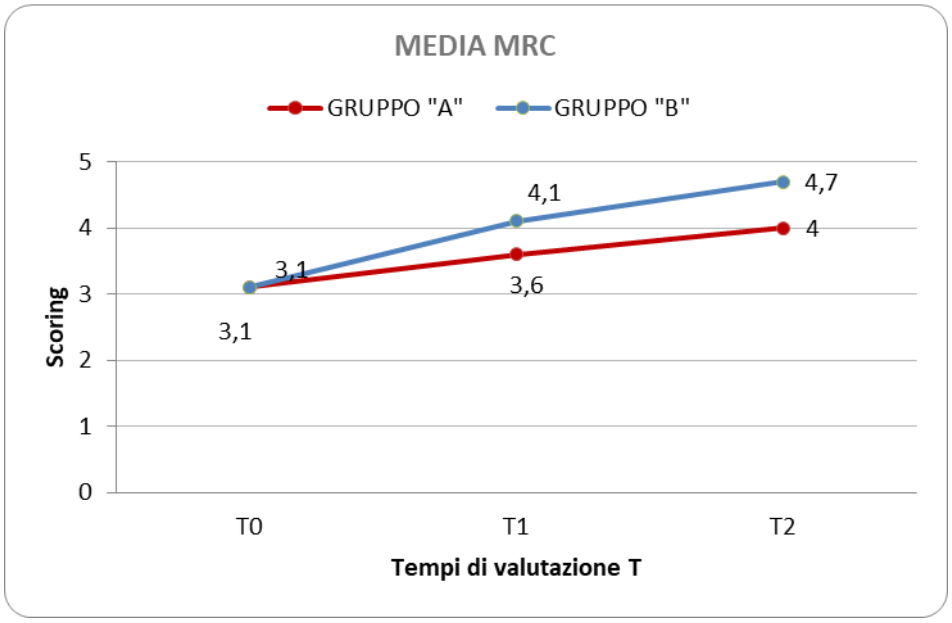

Tab. S20: *Mean trend for Group "A" and "B". Elaborated by the author.*

GRUPPO "A"	GRUPPO "B"
"Table Analyzed" "Data 2"	"Table Analyzed" "Data 2"
"Friedman test" " P value" 0,0005 " Exact or approximate P value?" Exact " P value summary" *** " Are means signif. different? (P < 0.05)" Yes " Number of groups" 3 " Friedman statistic" 12,56	"Friedman test" " P value" <0.0001 " Exact or approximate P value?" Exact " P value summary" **** " Are means signif. different? (P < 0.05)" Yes " Number of groups" 3 " Friedman statistic" 18,67
"Data summary" " Number of treatments (columns)" 3 " Number of subjects (rows)"10	"Data summary" " Number of treatments (columns)" 3 **ANOVA test – MRC Group "A" and "B".** " Number of subjects (rows)"10

Tab. S21 : *ANOVA test – MRC Group "A" and "B".*

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ROM (Range Of Motion) - Estensione						
ID Paziente A	T0	T1	T2	T1-T0	T2-T1	T2-T0
P1	20	28	35	8	7	15
P2	30	40	52	10	12	22
P3	35	50	60	15	10	25
P4	34	50	59	16	9	25
P5	20	20	35	0	15	15
P6	36	45	58	9	13	22
P7	34	45	50	11	5	16
P8	37	46	61	9	15	24
P9	40	60	67	20	7	27
P10	28	36	36	8	0	8
MEDIA	31,4	42	51,3	10,60	9,30	19,90
DEV. STANDARD	6,53	10,98	11,35	5,46	4,74	6,08

Tab. S22: *Values measured through ROM – Extension at T0 – T1 – T2. Elaborated by the author.*

ROM (Range Of Motion) - Estensione						
ID Paziente B	T0	T1	T2	T1-T0	T2-T1	T2-T0
P1	25	50	69	25	19	44
P2	20	32	60	12	28	40
P3	34	42	68	8	26	34
P4	35	58	70	23	12	35
P5	33	60	70	27	10	37
P6	32	65	65	33	0	33
P7	20	52	67	32	15	47
P8	42	65	70	23	5	28
P9	40	70	70	30	0	30
P10	22	55	62	33	7	40
MEDIA	30,3	54,9	67,1	24,60	12,20	36,80
DEV. STANDARD	7,66	10,91	3,45	8,63	9,86	6,01

Tab. S23: *Percentage improvement index for Group "A" ROM Extension. Elaborated by the author. .*

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Dataset	"A"	"B"
Numerosità campione	10	10
Media	10,6000	24,6000
Dev. standard	5,4610	8,6307
t	**4,3347**	
gradi di libertà	**18**	
P (livello di significatività)	**0,0004**	
Commento:		
La differenza fra le medie osservate		
è significativa per p<0,05		
Significatività reale:	99,96%	

Tab. S24: T-Student ROM Extension – Group "A" and "B" T1-T0. Elaborated by the author.

Dataset	"A"	"B"
Numerosità campione	10	10
Media	9,3000	12,2000
Dev. standard	4,7387	9,8635
t	**0,8381**	
gradi di libertà	**18**	
P (livello di significatività)	**0,4130**	
Commento:		
La differenza fra le medie osservate		
non è significativa per p<0,05		
Significatività reale:	58,70%	

Tab. S25*: T-Student ROM Extension – Group "A" and "B" T2-T1. Elaborated by the author.*

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Dataset	"A"	"B"
Numerosità campione	10	10
Media	19,9000	36,8000
Dev. standard	6,0818	6,0148
t	**6,2478**	
gradi di libertà	**18**	
P (livello di significatività)	**0,0000**	
Commento:		
La differenza fra le medie osservate		
è significativa per p<0,05		
Significatività reale:	100,00%	

Tab. S26: *T-Student ROM Extension – Group "A" and "B" T2-T0. Elaborated by the author.*

GRUPPO "A" ROM Estensione	**T0**	**T1**	**T2**	% DI MIGLIORAMENTO		
				T0-T1	**T1-T2**	**T0-T2**
P1	20	28	35	40%	25%	75%
P2	30	40	52	33%	30%	73%
P3	35	50	60	43%	20%	71%
P4	34	50	59	47%	18%	74%
P5	20	20	35	0%	75%	75%
P6	36	45	58	25%	29%	61%
P7	34	45	50	32%	11%	47%
P8	37	46	61	24%	33%	65%
P9	40	60	67	50%	12%	68%
P10	28	36	36	29%	0%	29%
Media % miglioramento del gruppo da T0-T2						64%

Tab. S27: *Percentage improvement index Group "A" ROM Extension. Elaborated by the author. .*

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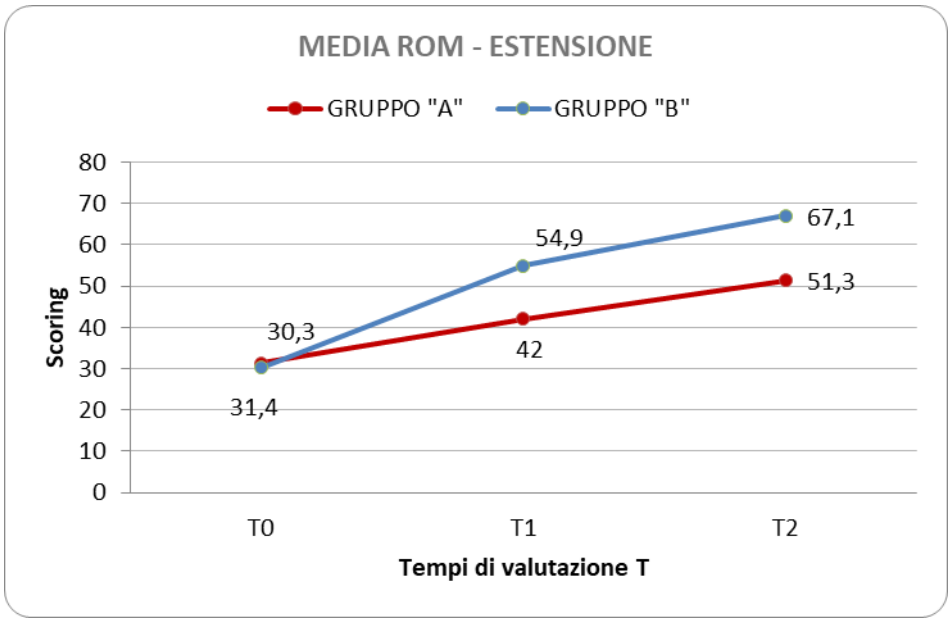
GRUPPO "B" ROM Estensione	T0	T1	T2	% DI MIGLIORAMENTO		
				T0-T1	T1-T2	T0-T2
P1	25	50	69	100%	38%	176%
P2	20	32	60	60%	88%	200%
P3	34	42	68	24%	62%	100%
P4	35	58	70	66%	21%	100%
P5	33	60	70	82%	17%	112%
P6	32	65	65	103%	0%	103%
P7	20	52	67	160%	29%	235%
P8	42	65	70	55%	8%	67%
P9	40	70	70	75%	0%	75%
P10	22	55	62	150%	13%	182%
Media % miglioramento del gruppo da T0-T2						135%

Tab. S28: *Percentage improvement index Group "B" ROM Extension. Elaborated by the author.*



Tab. S 29: *Mean trend for Group "A" ROM Extension. Elaborated by the author.*

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GRUPPO "A"	GRUPPO "B"
"Table Analyzed" "Data 2"	"Table Analyzed" "Data 2"
"Friedman test"	"Friedman test"
" P value" <0.0001	" P value" <0.0001
" Exact or approximate P value?" Exact	" Exact or approximate P value?" Exact
" P value summary" ****	" P value summary" ****
" Are means signif. different? (P < 0.05)" Yes	" Are means signif. different? (P < 0.05)" Yes
" Number of groups" 3	" Number of groups" 3
" Friedman statistic" 19,00	" Friedman statistic" 19,16
"Data summary"	"Data summary"
" Number of treatments (columns)" 3	" Number of treatments (columns)" 3
" Number of subjects (rows)"10	" Number of subjects (rows)"10

Tab. S30: *ANOVA test – ROM Extension Group "A" and "B".*

ROM (Range Of Motion) - Flessione laterale												
GRUPPO "A"	T0		T1		T2		T1-T0	T2-T1	T2-T0	T1-T0	T2-T1	T2-T0
	DX	SX	DX	SX	DX	SX	DX	DX	DX	SX	SX	SX
P1	20	15	26	22	30	24	6	4	10	7	2	9
P2	25	20	34	28	40	37	9	6	15	8	9	17
P3	22	27	26	33	34	41	4	8	12	6	8	14
P4	21	23	30	34	37	40	9	7	16	11	6	17
P5	13	19	15	22	20	25	2	5	7	3	3	6
P6	23	21	36	32	39	38	13	3	16	11	6	17
P7	25	28	30	39	40	45	5	10	15	11	6	17
P8	24	26	32	35	40	40	8	8	16	9	5	14
P9	29	27	35	31	43	43	6	8	14	4	12	16
P10	15	17	20	24	25	25	5	5	10	7	1	8
MEDIA	21,7	22,3	28,4	30,0	34,8	35,8	6,70	6,40	13,10	7,70	5,80	13,50
DEV. STANDARD	4,54	4,36	6,422	5,514	7,139	7,6	3,13	2,17	3,18	2,87	3,33	4,25

Tab. S31*: Values measured through ROM – Lateral Flexion R-L from T0 – T1 – T2. Elaborated by the author.*

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ROM (Range Of Motion) - Flessione laterale												
GRUPPO "B"	**T0**		**T1**		**T2**		**T1-T0**	**T2-T1**	**T2-T0**	**T1-T0**	**T2-T1**	**T2-T0**
	DX	SX	DX	SX	DX	SX	DX	DX	DX	SX	SX	SX
P1	22	20	35	34	44	45	13	9	22	14	11	25
P2	15	10	26	22	40	39	11	14	25	12	17	29
P3	23	24	30	32	42	45	7	12	19	8	13	21
P4	24	21	33	35	45	45	9	12	21	14	10	24
P5	20	19	37	32	45	45	17	8	25	13	13	26
P6	21	20	35	33	45	43	14	10	24	13	10	23
P7	22	22	38	37	40	45	16	2	18	15	8	23
P8	26	25	40	39	45	45	14	5	19	14	6	20
P9	30	31	40	40	45	45	10	5	15	9	5	14
P10	15	20	22	25	34	38	7	12	19	5	13	18
MEDIA	21,8	21,2	33,6	32,9	42,5	43,5	11,80	8,90	20,70	11,70	10,60	22,30
DEV. STANDARD	4,331	5,036	5,678	5,412	3,442	2,579	3,55	3,87	3,30	3,27	3,63	4,27

Tab. S32: *Values measured through ROM – Lateral Flexion R-L from T0 – T1 – T2. Elaborated by the author.*

Dataset	"A"	"B"
Numerosità campione	10	10
Media	6,7000	11,8000
Dev. standard	3,1287	3,5528
t	**3,4067**	
gradi di libertà	**18**	
P (livello di significatività)	**0,0031**	
Commento:		
La differenza fra le medie osservate		
è significativa per p<0,05		
Significatività reale:	99,69%	

Tab. S33: *T-Student ROM Lateral Flexion – Group "A" and "B" T1-T0 R. Elaborated by the author*

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Dataset	"A"	"B"
Numerosità campione	10	10
Media	6,4000	8,9000
Dev. standard	2,1705	3,8715
t	**1,7812**	
gradi di libertà	**18**	
P (livello di significatività)	**0,0918**	
Commento:		
La differenza fra le medie osservate non è significativa per p<0,05		
Significatività reale:	90,82%	

Tab. S34: *T-Student ROM Lateral Flexion – Group "A" and "B" T2-T1 R. Elaborated by the author.*

Dataset	"A"	"B"
Numerosità campione	10	10
Media	13,1000	20,7000
Dev. standard	3,1780	3,3015
t	**5,2445**	
gradi di libertà	**18**	
P (livello di significatività)	**0,0001**	
Commento:		
La differenza fra le medie osservate è significativa per p<0,05		
Significatività reale:	99,99%	

Tab. S35: *T-Student ROM Lateral Flexion – Group "A" and "B" T2-T0 R. Elaborated by the author.*

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Dataset	"A"	"B"
Numerosità campione	10	10
Media	7,7000	11,7000
Dev. standard	2,8694	3,2677
t	**2,9087**	
gradi di libertà	**18**	
P (livello di significatività)	**0,0094**	
Commento:		
La differenza fra le medie osservate		
è significativa per p<0,05		
Significatività reale:	99,06%	

Tab. S36: *T-Student ROM Lateral Flexion – Group "A" and "B" at T1–T0 L. Elaborated by the author*

Dataset	"A"	"B"
Numerosità campione	10	10
Media	5,8000	10,6000
Dev. standard	3,3267	3,6271
t	**3,0841**	
gradi di libertà	**18**	
P (livello di significatività)	**0,0064**	
Commento:		
La differenza fra le medie osservate		
è significativa per p<0,05		
Significatività reale:	99,36%	

Tab.S37: *T-Student ROM Lateral Flexion – Group "A" and "B" at T2–T1 L. Elaborated by the author.*

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Dataset	"A"	"B"
Numerosità campione	10	10
Media	13,5000	22,3000
Dev. standard	4,2492	4,2701
t	**4,6195**	
gradi di libertà	**18**	
P (livello di significatività)	**0,0002**	

Commento:

La differenza fra le medie osservate è significativa per p<0,05

Significatività reale:	99,98%

Tab. S38: *T-Student ROM Lateral Flexion – Group "A" and "B" at T2–T0 L. Elaborated by the author.*

GRUPPO "A"	**T0**		**T1**		**T2**		% DI MIGLIORAMENTO		
F. Laterale	DX	SX	DX	SX	DX	SX	**T0-T1**	**T1-T2**	**T0-T2**
P1	20	15	26	22	30	24	47%	9%	60%
P2	25	20	34	28	40	37	40%	32%	85%
P3	22	27	26	33	34	41	22%	24%	52%
P4	21	23	30	34	37	40	48%	18%	74%
P5	13	19	15	22	20	25	16%	14%	32%
P6	23	21	36	32	39	38	52%	19%	81%
P7	25	28	30	39	40	45	39%	15%	61%
P8	24	26	32	35	40	40	35%	14%	54%
P9	29	27	35	31	43	43	15%	39%	59%
P10	15	17	20	25	25	25	47%	0%	47%

Tab. S 39: *Percentage improvement index ROM Lateral Flexion. Elaborated by the author.*

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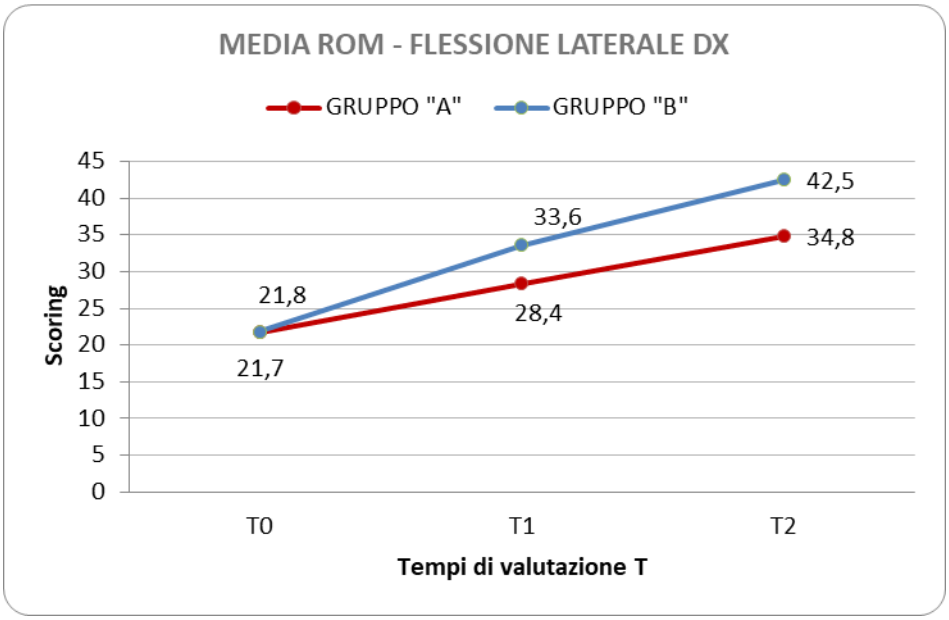
GRUPPO "B"	T0		T1		T2		% DI MIGLIORAMENTO		
F. Laterale	DX	SX	DX	SX	DX	SX	T0-T1	T1-T2	T0-T2
P1	22	20	35	34	44	45	70%	32%	125%
P2	15	10	26	22	40	39	120%	77%	290%
P3	23	24	30	32	42	45	33%	41%	88%
P4	24	21	33	35	45	45	67%	29%	114%
P5	20	19	37	32	45	45	68%	41%	137%
P6	21	20	25	33	45	43	65%	30%	115%
P7	22	22	38	37	40	45	68%	22%	105%
P8	26	25	40	39	45	45	56%	15%	80%
P9	30	31	40	40	45	45	29%	13%	45%
P10	15	20	22	25	34	38	25%	52%	90%

Tab. S40: *Percentage improvement index ROM Lateral Flexion. Elaborated by the author.*



Tab S41: *Mean ROM Lateral Flexion R for Groups "A" and "B". Elaborated by the author.*

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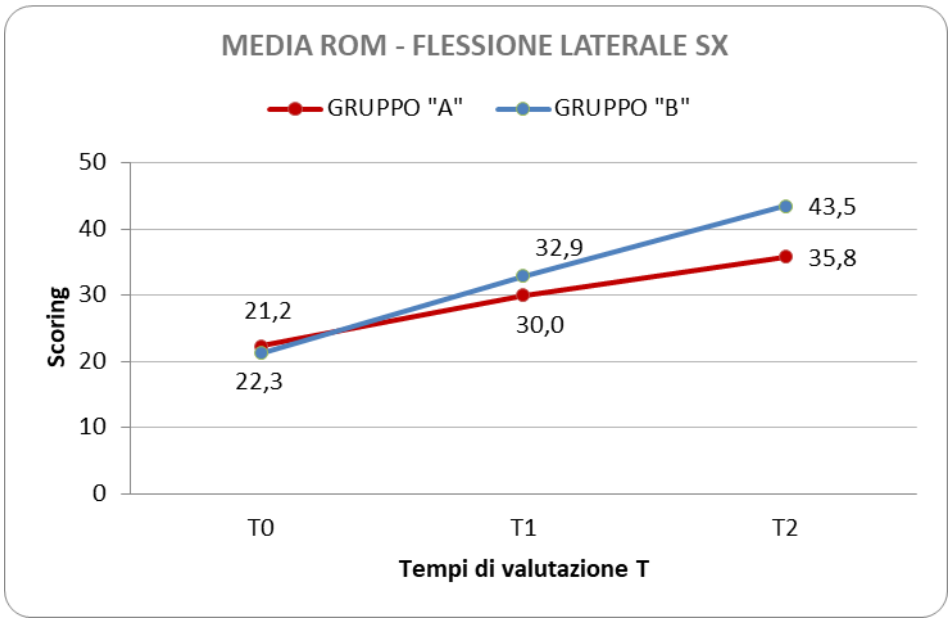

***Tab S42**: Mean ROM Lateral Flexion L for Groups "A" and "B". Elaborated by the author*

GRUPPO "A"	GRUPPO "B"
"Table Analyzed" "Data 2"	"Table Analyzed" "Data 2"
"Friedman test"	"Friedman test"
" P value" <0.0001	" P value" <0.0001
" Exact or approximate P value?" Exact	" Exact or approximate P value?" Exact
" P value summary" ****	" P value summary" ****
" Are means signif. different? (P < 0.05)" Yes	" Are means signif. different? (P < 0.05)" Yes
" Number of groups" 3	" Number of groups" 3
" Friedman statistic" 19,54	" Friedman statistic" 20,00
"Data summary"	"Data summary"
" Number of treatments (columns)" 3	" Number of treatments (columns)" 3
" Number of subjects (rows)" 10	" Number of subjects (rows)" 10

***Tab.S43:** ANOVA test – ROM Lateral Flexion L Group "A" and "B".*

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GRUPPO "A"	GRUPPO "B"
"Table Analyzed" "Data 2"	"Table Analyzed" "Data 2"
"Friedman test"	"Friedman test"
" P value" <0.0001	" P value" <0.0001
" Exact or approximate P value?" Exact	" Exact or approximate P value?" Exact
" P value summary" ****	" P value summary" ****
" Are means signif. different? (P < 0.05)" Yes	" Are means signif. different? (P < 0.05)" Yes
" Number of groups" 3	" Number of groups" 3
" Friedman statistic" 20,00	" Friedman statistic" 20,00
"Data summary"	"Data summary"
" Number of treatments (columns)" 3	" Number of treatments (columns)" 3
" Number of subjects (rows)" 10	" Number of subjects (rows)" 10

Tab. S44: *ANOVA test – ROM Lateral Flexion R Group "A" and "B".*

ROM (Range Of Motion) - Rotazione												
GRUPPO "A"	T0		T1		T2		T1-T0	T2-T1	T2-T0	T1-T0	T2-T1	T2-T0
	DX	SX	DX	SX	DX	SX	DX	DX	DX	SX	SX	SX
P1	25	20	35	26	43	40	10	8	18	6	14	20
P2	40	30	56	42	75	69	16	19	35	12	27	39
P3	37	43	45	61	60	74	8	15	23	18	13	31
P4	31	38	43	52	74	79	12	31	43	14	27	41
P5	20	24	33	39	40	46	13	7	20	15	7	22
P6	34	30	45	45	59	56	11	14	25	15	11	26
P7	45	50	69	73	78	80	24	9	33	23	7	30
P8	46	52	65	68	75	75	19	10	29	16	7	23
P9	55	50	70	63	80	77	15	10	25	13	14	27
P10	20	22	36	40	40	40	16	4	20	18	0	18
MEDIA	35,3	35,9	49,7	50,9	62,4	63,6	14,40	12,70	27,10	15,00	12,70	27,70
DEV. STANDARD	11,03	11,7	13,53	14,23	15,5	15,6	4,70	7,75	7,91	4,45	8,65	7,69

Tab. S45: *Values measured through ROM – Rotation R-L from T0 – T1 – T2. Elaborated by the author*

ROM (Range Of Motion) - Rotazione												
GRUPPO "B"	T0		T1		T2		T1-T0	T2-T1	T2-T0	T1-T0	T2-T1	T2-T0
	DX	SX	DX	SX	DX	SX	DX	DX	DX	SX	SX	SX
P1	35	30	66	60	80	79	31	14	45	30	19	49
P2	25	20	56	50	70	65	31	14	45	30	15	45
P3	33	36	49	58	77	80	16	28	44	22	22	44
P4	40	38	71	69	80	80	31	9	40	31	11	42
P5	35	32	60	58	78	80	25	18	43	26	22	48
P6	31	30	72	65	80	78	41	8	49	35	13	48
P7	34	34	60	65	75	80	26	15	41	31	15	46
P8	45	40	75	72	80	80	30	5	35	32	8	40
P9	45	46	72	74	80	80	27	8	35	28	6	34
P10	20	24	40	52	69	76	20	29	49	28	24	52
MEDIA	34,3	33	62,1	62,3	76,9	77,8	27,80	14,80	42,60	29,30	15,50	44,80
DEV. STANDARD	7,524	7,225	10,78	7,682	4,036	4,445	6,84	8,23	4,95	3,56	6,17	5,16

Tab. S46: *Values measured through ROM – Rotation R-L from T0 – T1 – T2. Elaborated by the author. .*

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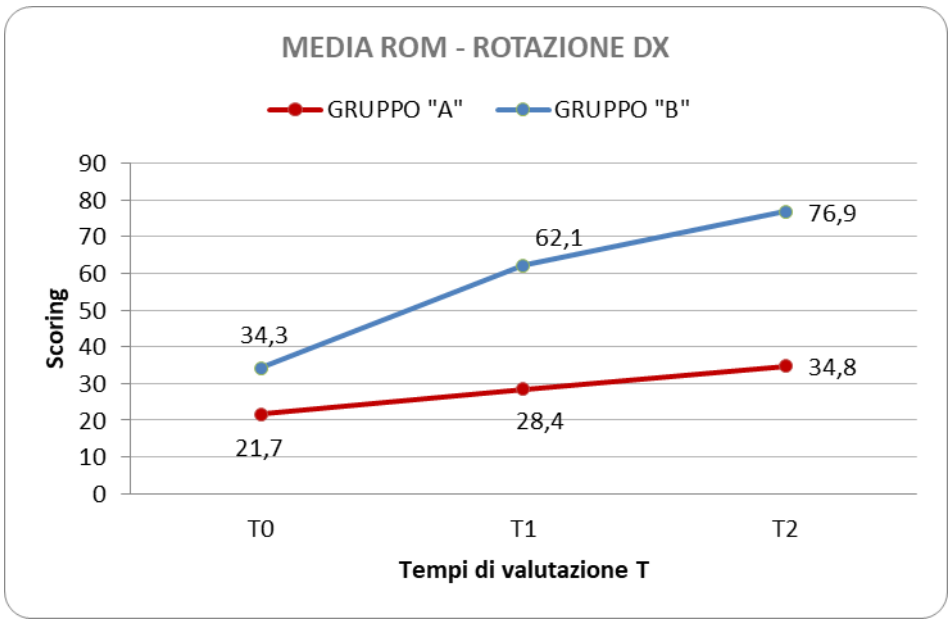
GRUPPO "A"	T0		T1		T2		% DI MIGLIORAMENTO		
Rotazione	DX	SX	DX	SX	DX	SX	T0-T1	T1-T2	T0-T2
P1	25	20	35	26	43	40	30%	54%	100%
P2	40	30	56	42	75	69	40%	64%	130%
P3	37	43	45	61	60	74	42%	21%	72%
P4	31	38	43	52	74	79	37%	52%	108%
P5	20	24	33	39	40	46	63%	18%	92%
P6	34	30	45	45	59	56	50%	24%	87%
P7	45	50	69	73	78	80	46%	10%	60%
P8	46	52	65	68	75	75	31%	10%	44%
P9	55	50	70	63	80	77	26%	22%	54%
P10	20	22	36	40	40	40	82%	0%	82%

Tab. S47: *Percentage improvement index. Elaborated by the author.*

GRUPPO "B"	T0		T1		T2		% DI MIGLIORAMENTO		
Rotazione	DX	SX	DX	SX	DX	SX	T0-T1	T1-T2	T0-T2
P1	35	30	66	60	80	79	100%	32%	163%
P2	25	20	56	50	70	65	150%	30%	225%
P3	33	36	49	58	77	80	61%	38%	122%
P4	40	38	71	69	80	80	82%	16%	111%
P5	35	32	60	58	78	80	81%	38%	150%
P6	31	30	72	65	80	78	117%	20%	160%
P7	34	34	60	65	75	80	91%	23%	135%
P8	45	40	75	72	80	80	80%	11%	100%
P9	45	46	72	74	80	80	61%	8%	74%
P10	20	24	40	52	69	76	117%	46%	217%

Tab. S48: *Percentage improvement index. Elaborated by the author.*



Tab: S49: *Mean trend for Group "A" and "B" ROM Rotation R. Elaborated by the author.*

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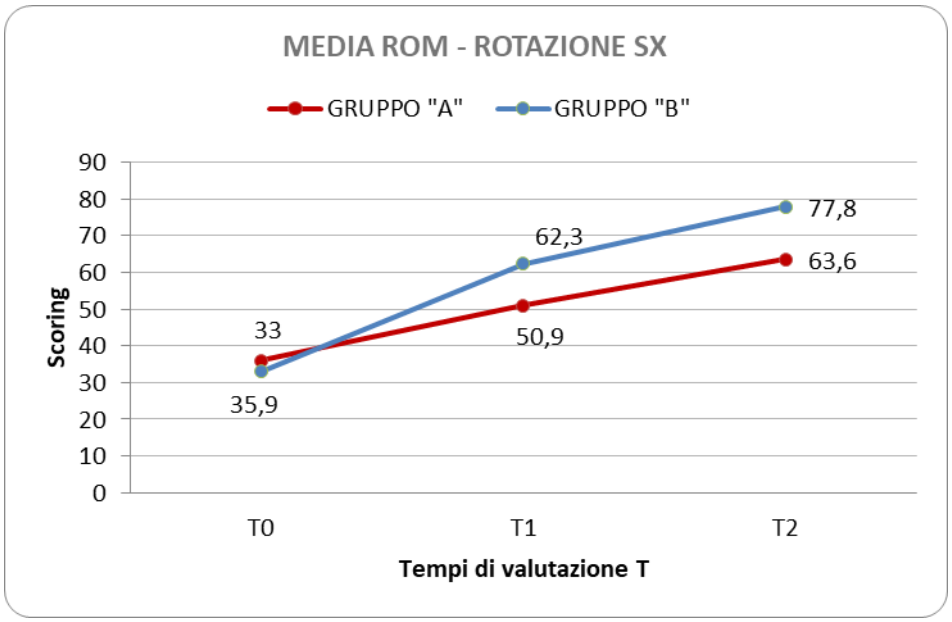

Tab: S50: *Mean trend for Group "A" and "B" ROM Rotation L. Elaborated by the author.*

NECK DISABILITY INDEX QUESTIONNAIRE						
ID Paziente A	T0	T1	T2	T0-T1	T1-T2	T0-T2
P1	85	52	30	33	22	55
P2	74	45	38	29	7	36
P3	63	33	20	30	13	43
P4	65	30	22	35	8	43
P5	84	51	43	33	8	41
P6	80	48	35	32	13	45
P7	56	23	17	33	6	39
P8	55	22	13	33	9	42
P9	54	28	16	26	12	38
P10	60	26	25	34	1	35
MEDIA	67,60	35,80	25,90	31,80	9,90	41,70
DEV. STANDARD	12,16	11,92	10,18	2,70	5,59	5,68

Tab. S51: *Values measured using the Neck Disability Index questionnaire. Elaborated by the author*

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NECK DISABILITY INDEX QUESTIONNAIRE						
ID Paziente B	T0	T1	T2	T0-T1	T1-T2	T0-T2
P1	77	44	20	33	24	57
P2	89	61	25	28	36	64
P3	75	42	21	33	21	54
P4	55	26	3	29	23	52
P5	68	37	10	31	27	58
P6	79	48	17	31	31	62
P7	66	39	13	27	26	53
P8	58	23	3	35	20	55
P9	43	21	2	22	19	41
P10	87	52	26	35	26	61
MEDIA	69,70	39,30	14,00	30,40	25,30	55,70
DEV. STANDARD	14,61	13,00	9,20	4,03	5,21	6,53

Tab. S52: *Values measured using the Neck Disability Index questionnaire. Elaborated by the author.*

Dataset	"A"	"B"
Numerosità campione	10	10
Media	31,8000	30,4000
Dev. Standard	2,6998	4,0332
T	**0,9122**	
gradi di libertà	**18**	
P (livello di significatività)	**0,3737**	

Commento:

La differenza fra le medie osservate non è significativa per p<0,05

Significatività reale:	62,63%

Tab. S53*: T-Student Neck Disability Index – Group "A" and "B" T0-T1. Elaborated by the author..*

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Dataset	"A"	"B"
Numerosità campione	10	10
Media	9,9000	25,3000
Dev. Standard	5,5867	5,2079
T	**6,3762**	
gradi di libertà	**18**	
P (livello di significatività)	**0,0000**	

Commento:

La differenza fra le medie osservate
è significativa per p<0,05

Significatività reale:	100,00%

Tab. S54: *T-Student Neck Disability Index – Group "A" and "B" T1-T2. Elaborated by the author.*

Dataset	"A"	"B"
Numerosità campione	10	10
Media	41,7000	55,7000
Dev. Standard	5,6774	6,5328
T	**5,1151**	
gradi di libertà	**18**	
P (livello di significatività)	**0,0001**	

Commento:

La differenza fra le medie osservate
è significativa per p<0,05

Significatività reale:	99,99%

Tab. S55*: T-Student Neck Disability Index – Group "A" and "B" T0-T2. Elaborated by the author.*

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GRUPPO "A" NDI	T0	T1	T2	% DI MIGLIORAMENTO		
				T0-T1	T1-T2	T0-T2
P1	85	52	30	39%	42%	65%
P2	74	45	38	39%	16%	49%
P3	63	33	20	48%	39%	68%
P4	65	30	22	54%	27%	66%
P5	84	51	43	39%	16%	49%
P6	80	48	35	40%	27%	56%
P7	56	23	17	59%	26%	70%
P8	55	22	13	60%	41%	76%
P9	54	28	16	48%	43%	70%
P10	60	26	25	57%	4%	58%
Media % miglioramento del gruppo da T0-T2						63%

Tab. S56: *Percentage improvement index for Group "A" Neck Disability Index. Elaborated by the author.*

GRUPPO "B" NDI	T0	T1	T2	% DI MIGLIORAMENTO		
				T0-T1	T1-T2	T0-T2
P1	77	44	20	43%	55%	74%
P2	89	61	25	31%	59%	72%
P3	75	42	21	44%	50%	72%
P4	55	26	3	53%	88%	95%
P5	68	37	10	46%	73%	85%
P6	79	48	17	39%	65%	78%
P7	66	39	13	41%	67%	80%
P8	58	23	3	60%	87%	95%
P9	42	21	2	50%	90%	95%
P10	87	52	26	40%	50%	70%
Media % miglioramento del gruppo da T0-T2						82%

Tab. S57: *Percentage improvement index for the Neck Disability Index. Elaborated by the author.*

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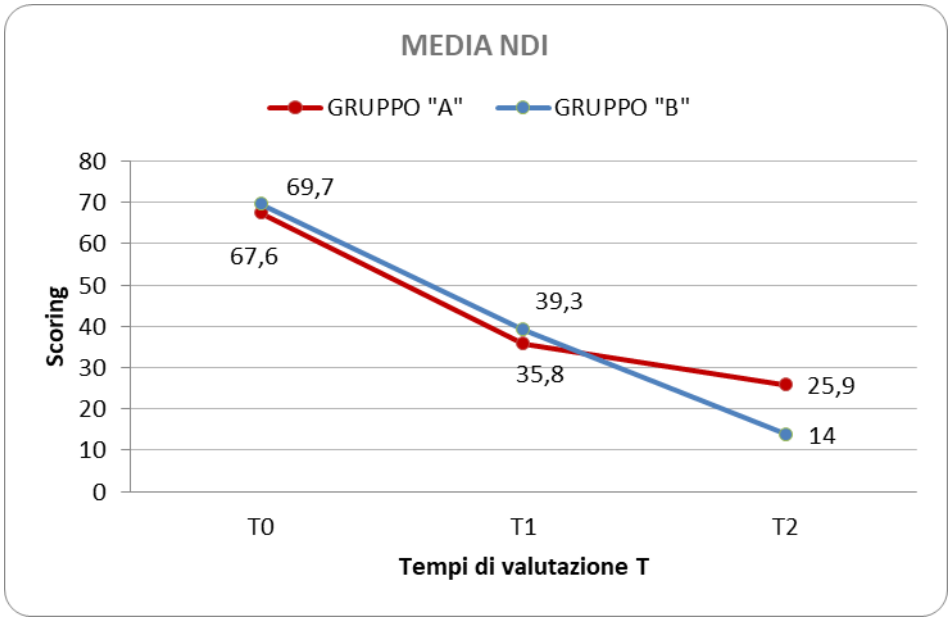

Tab. S58: *Mean trend for Group "A" and "B" Neck Disability Index. Elaborated by the author.*

GRUPPO "A"	GRUPPO "B"
"Table Analyzed" "Data 2"	"Table Analyzed" "Data 2"
"Friedman test"	"Friedman test"
" P value" <0.0001	" P value" <0.0001
" Exact or approximate P value?" Exact	" Exact or approximate P value?" Exact
" P value summary" ****	" P value summary" ****
" Are means signif. different? (P < 0.05)" Yes	" Are means signif. different? (P < 0.05)" Yes
" Number of groups" 3	" Number of groups" 3
" Friedman statistic" 20,00	" Friedman statistic" 20,00
"Data summary"	"Data summary"
" Number of treatments (columns)" 3	" Number of treatments (columns)" 3
" Number of subjects (rows)" 10	" Number of subjects (rows)" 10

Tab. S59*: ANOVA test – Neck Disability Index Group "A" and "B".*