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To Compare the Effects of UST and TENS with PNF Stretching To Increase the Mobility and Reduce Pain in OA - A Randomised Control Trial

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Abstract: ***Osteoarthritis is a chronic disorder which is degenerative in nature having a multifactorial etiology characterized by subchondral sclerosis, loss of the articular cartilage, hypertrophy of the marginal bone along with morphological and biochemical changes in the joint capsules and synovium. Knee osteoarthritis is the most common form of osteoarthritis. Knee OA is characterized by quadriceps muscle weakness, hamstring weakness, possible joint stiffness, effusion, loss of proprioception loss of range of motion and knee pain. Transcutaneous electrical nerve stimulation is the most widely used physical modalities for the management osteoarthritis knee. The benefits of TENS for relive chronic pain are well documented. The UST for the treatment of OA will lead to improvement of life by decreasing the swelling and reducing the pain at the knee joint. PNF relieves pain improves the ROM, restores proprioception as confirmed by clinical research. The aim of study to find out the effect of UST and TENS with PNF stretching to increase the mobility and reduce pain in OA Patients. Study duration is 6-week, source of data is Goldi masala factory, Kanpur. Sample size is 60 and method of data collection is random. Subjects were divided into two equal group, for group A we give PNF with ultrasound and for group B we give PNF with TENS for six consecutive weeks. After analysis of collected data result was null hypothesis is rejected and alternate hypothesis is accepted. In this way both technique is statistically significant. So, we concluded that both the technique i.e., PNF with UST and PNF with TENS is effective in treating the osteoarthritis patient with relieving pain and increasing range of motion. But statistically PNF with TENS is more significant over PNF with UST.***

Keywords: ***Osteoarthritis, proprioceptive neuromuscular facilitation, ultrasound therapy, transcutaneous electrical nerve stimulator, pain, range of motion, VAS scale, goniometer.***

I. INTRODUCTION

Osteoarthritis (OA) is a progressive joint disorder. It is caused by gradual loss of cartilage that result in a clinical syndrome with predominant symptoms like inflammation, pain, stiffness, limited movement, periarticular muscles weakness and possible deformity of the joint[1]. Osteoarthritis (OA) is a chronic disorder which is degenerative in nature having a multifactorial aetiology characterized by subchondral sclerosis, loss of the articular cartilage, hypertrophy of the marginal bone along with morphological and biochemical changes in the joint capsules and synovium.[2]

Knee osteoarthritis is the most common form of osteoarthritis and characterized by the chronic degeneration of the articular cartilage; the disease has been related to mechanical overload, which result in pain and disfunction in elderly individuals[3]. Knee OA is characterized by quadriceps muscle weakness [4,5] hamstring weakness, possible joint stiffness, effusion, loss of proprioception and knee pain.[6,7]

Transcutaneous electrical nerve stimulation (TENS) is the most widely used physical modalities for the management osteoarthritis (OA) knee. The benefits of TENS for relive chronic pain are well documented[8,9,10]. The UST for the treatment of OA will lead to improvement of life by decreasing the swelling and reducing the pain at the knee joint. This randomized, placebo-controlled, double-blind study was designed to investigate the short-term efficacy of ultrasound therapy in 90 patients with knee osteoarthritis (OA).[11]

Proprioceptive neuromuscular facilitation technique (PNF) moves joint in sagittal, frontal, and horizontal planes with a spiral and diagonal motion[12]. PNF relieves pain improves the ROM, restores proprioception as confirmed by clinical research. It can also enhance the gait ability among the elderly with fall experience[13]. Researches have proven that Proprioceptive Neuromuscular Facilitation (PNF) can be used in the treatment of neuro musculoskeletal disorder .PNF induces alteration in muscle fibre type,[14] increase range of motion, muscle strength, endurance and improve medio lateral postural stability.[15]

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II. METHODOLOGY

The duration of study is 6-week, source of collection of data is Goldi masala factory. The sample size is 60 subjects (30 – 30 in each group). Method of data collection is Randomised control trial. The Material used in this study is Goniometer, UST, and TENS. The Inclusion criteria is Patient who are diagnosed with OA, Pain Present, Crepitus sound present, all female subjects and Age between 40-50 yr. Exclusion criteria is No injury, fracture and no Medications. Test we use in the present study is VAS scale for pain assessment and goniometer for range of motion assessment.

III. PROCEDURE

In the present study total 60 subjects recruited and equally divided (30 – 30 each) into two groups. In GROUP A we give Proprioceptive neuromuscular facilitation technique with ultrasound. The subject will be positioned in supine lying with 90-degree hip flexion. Therapist extends the patient's knee until a mild stretch is felt in the hamstring. An isometric contraction is achieved by asking the subject to flex his knee against resistance by therapist. Contraction is held for 8 sec after which the therapist commands to relaxed the hamstring, immediately after which the muscle is extended until a mild to moderate painless stretch is felt which is held for 30 sec. The procedure is performed into sets with 5 repetitions and 10 sec relaxation phases. In GROUP-B PNF stretching is applied as given to group A and TENS is applied on the subject after the PNF stretching on knee joint.

IV. ANALYSIS

The data analysis was done using IBM SPSS statistics 2019 version – 26. The Descriptive statistical analysis was done to determine the demographic characteristics of the subjects recruited in the research. The paired samples t -test used in the analysis of this study. P – value is used to test the Hypothesis, which help in deciding whether to accept or reject the null hypothesis. A commonly used value for the p – value is 0.05.

Table 1: Represents the Descriptive data of Group 1 (PNF +US)

	N	Minimum	Maximum	Mean	Std. Deviation
Age	30	42	60	50.20	5.202
Height	30	155	193	164.80	10.159
Weight	30	52	75	64.27	7.414
Body Mass Index	30	20	26	23.56	2.109

The Descriptive Data of Table 1 shows that average age of group 1 participants was 50.20 years, the Average weight was 64.27 Kg and the average height was 164.80 cm. The average BMI of group 1 was calculated to be 23.56. This shows that average participants were in normal weight category in group 1.

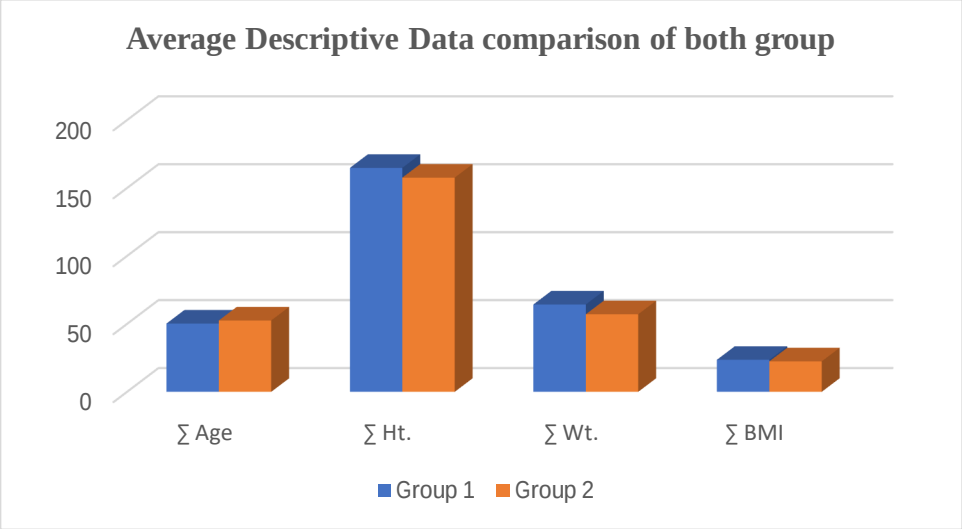
Table 2: Represents the Descriptive data of Group 2 (PNF + TENS)

	N	Minimum	Maximum	Mean	Std. Deviation
Age	30	43	65	52.53	6.937
Height	30	145	167	157.63	5.857
Weight	30	44	66	57.07	5.771
Body Mass Index	30	19	26	22.41	1.973

The Descriptive Data of Table 2 shows that average age of group 2 participants was 52.53 years, the average weight was 57.07 Kg and the average height was 157.63 cm. The average BMI of group 2 was calculated to be 22.41. This shows that average participants were in normal weight category in group 2.

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Graph 1: shows average comparison of Descriptive data between both groups



Graph – 1 represents compare wise distribution of Age, height, Weight and BMI of all recruits of both groups i.e., - Group – 1: Proprioceptive Neuromuscular facilitation with ultrasound and Group – 2: Proprioceptive Neuromuscular facilitation with Transcutaneous Electrical nerve stimulation. A finding shows no significant difference in between all four parameters among both groups.

Table 3: Represents the pre - intervention Descriptive Data of VAS score and ROM of Group 1

	N	Minimum	Maximum	Mean	Std. Deviation
Pre intervention of right knee VAS score	30	4	9	6.60	1.329
Pre intervention of right knee flexion ROM	30	30	85	64.67	16.344
Pre intervention of left knee VAS score	30	0	9	5.79	2.043
Pre intervention of left knee flexion ROM	30	30	125	77.33	24.415

The Table 3 shows the pre intervention descriptive Data of VAS score and ROM of group 1; i.e., Proprioceptive Neuromuscular facilitation with ultrasound, where pre intervention right knee VAS score mean is 6.60, and pre intervention left knee VAS score mean is 5.79. Pre intervention right knee Flexion ROM mean is 64.67, and pre intervention left knee Flexion range of motion mean is 77.33.

Table 4: Represents the post - intervention Descriptive Data of VAS score and ROM of Group 1

	N	Minimum	Maximum	Mean	Std. Deviation
Post intervention of right knee VAS score	30	4	8	5.80	1.243
Post intervention of right knee flexion ROM	30	40	95	73.00	16.274
Post intervention of left knee VAS score	30	0	9	4.93	2.333
Post intervention of left knee flexion ROM	30	35	125	84.00	22.221

The Table 4 shows the post intervention descriptive Data of VAS score and ROM of group 1; i.e., Proprioceptive Neuromuscular facilitation with transcutaneous electrical nerve stimulator, where post intervention right knee VAS score mean is 5.80, and post intervention left knee VAS score mean is 4.93. Post intervention right knee Flexion ROM mean is 73.00, and post intervention left knee Flexion range of motion mean is 84.00.

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Table 5: Represents the pre - intervention Descriptive Data of VAS score and ROM of Group 2

	N	Minimum	Maximum	Mean	Std. Deviation
Pre intervention of right knee VAS score	30	0	8	5.07	2.791
Pre intervention of right knee flexion ROM	30	40	125	83.33	25.303
Pre intervention of left knee VAS score	30	0	9	5.60	2.647
Pre intervention of left knee flexion ROM	30	30	125	77.33	28.458

The Table 5 shows the pre intervention descriptive Data of VAS score and ROM of group 2; i.e., Proprioceptive Neuromuscular facilitation with ultrasound, where pre intervention right knee VAS score mean is 5.07, and pre intervention left knee VAS score mean is 5.60. Pre intervention right knee Flexion ROM mean is 83.33, and pre intervention left knee Flexion range of motion mean is 77.33.

Table 6: Represents the post - intervention Descriptive Data of VAS score and ROM of Group 2

	N	Minimum	Maximum	Mean	Std. Deviation
Post intervention of right knee VAS score	30	0	7	3.93	2.333
Post intervention of right knee flexion ROM	30	65	125	100.00	18.004
Post intervention of left knee VAS score	30	0	7	4.20	2.074
Post intervention of left knee flexion ROM	30	65	125	96.00	19.757

The Table 6 shows the post intervention descriptive Data of VAS score and ROM of group 2; i.e., Proprioceptive Neuromuscular facilitation with transcutaneous electrical nerve stimulator, where post intervention right knee VAS score mean is 3.93, and post intervention left knee VAS score mean is 4.20. Post intervention right knee Flexion ROM mean is 100.00, and post intervention left knee Flexion range of motion mean is 96.00.

Table 7: represent the statistical data of Group 1 (PNF + US)

	N	Mean	Std. Deviation	Std. Error Mean	df	t - value	p - value
RK_VAS	30	.800	.407	.074	29	10.770	.000
RK_FROM	30	8.333	2.397	.438	29	19.039	.000
LK_VAS	30	.500	.509	.096	29	5.196	.000
LK_FROM	30	6.667	4.420	.807	29	8.260	.000

The Table 7 shows the statistical data of group 1 i.e., Proprioceptive Neuromuscular facilitation with ultrasound, while analyzing the group 1 data it has been found that, Proprioceptive Neuromuscular facilitation with ultrasound was significant in improving the VAS score and ROM. There is improvement in right knee VAS with mean (±SD) of .800 (±.407) and t – value is 10.770 with p – value .000, in right knee FROM with mean (±SD) of 8.333 (± 2.397) and t – value is 19.039 with p – value .000. There is improvement in left knee VAS with mean (±SD) of .500 (±.509) and t – value is 5.196 with p – value .000, in right knee FROM with mean (±SD) of 6.667 (± 4.420) and t – value is 8.260 with p – value .000.

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Table 8: represent the statistical data of Group 2 (PNF + TENS)

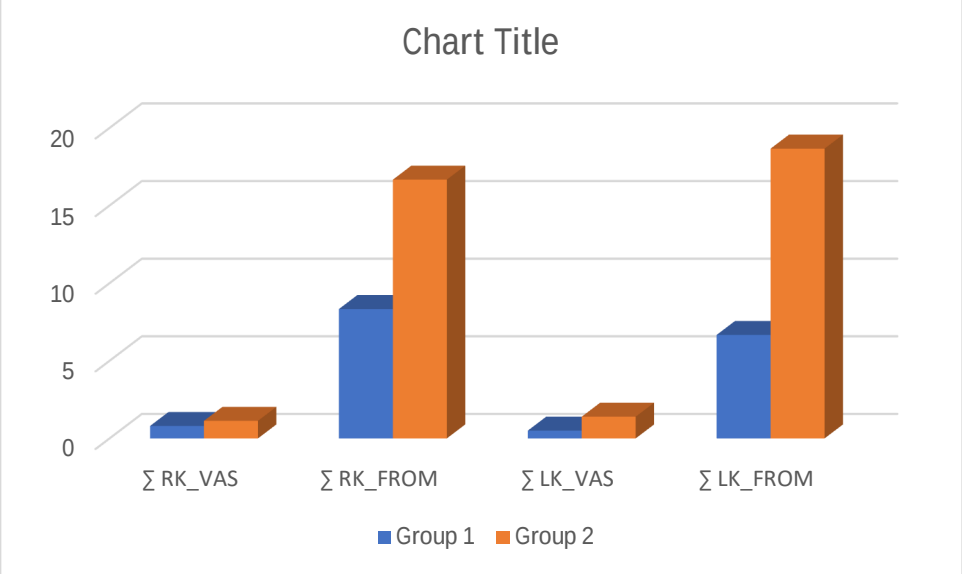
	N	Mean	Std. Deviation	Std. Error Mean	df	t - value	p - value
RK_VAS	30	1.133	.819	.150	29	7.577	.000
RK_FROM	30	16.667	13.218	2.413	29	6.906	.000
LK_VAS	30	1.400	.814	.149	29	9.424	.000
LK_FROM	30	18.667	12.243	2.235	29	8.351	.000

The Table 8 shows the statistical data of group 2 i.e., Proprioceptive Neuromuscular facilitation with ultrasound, while analyzing the group 2 data it has been found that, Proprioceptive Neuromuscular facilitation with ultrasound was significant in improving the VAS score and ROM. There is improvement in right knee VAS with mean (±SD) of 1.133 (±.819) and t – value is 7.577 with p – value .000, in right knee FROM with mean (±SD) of 16.667 (± 13.218) and t – value is 6.906 with p – value .000. There is improvement in left knee VAS with mean (±SD) of 1.400 (±.814) and t – value is 9.424 with p – value .000, in right knee FROM with mean (±SD) of 18.667 (± 12.243) and t – value is 8.351 with p – value .000.

V. RESULT

The 95% confidence level of paired samples t - test shows significant improvement so, null hypothesis is rejected and alternate hypothesis is accepted and we statistically observed improvement with effectiveness of Proprioceptive neuromuscular facilitation with transcutaneous electrical nerve stimulator in osteoarthritis patients along with VAS score and Flexion range of motion in both knee in normal weight individuals.

Graph 2 represents the comparison of ∑ Statistical data between both groups



The present study reveals that the ROM and VAS score can be improved with the Proprioceptive Neuromuscular Facilitation plus Ultrasound therapy and Proprioceptive Neuromuscular Facilitation plus transcutaneous electrical nerve stimulation both in patients with Osteoarthritis. So statistically both group shows significant improvement. The **graph 2** shows the comparison of Mean average of all variables in both groups, in which group 2 (Proprioceptive Neuromuscular Facilitation with transcutaneous electrical nerve stimulation) shows statistically more significant in all variable over group 1 (Proprioceptive Neuromuscular Facilitation plus Ultrasound therapy) with p – value .000 in treating Osteoarthritis patients with normal BMI.

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VI. CONCLUSION

As per the result, it has been concluded that the Proprioceptive Neuromuscular Facilitation with Ultrasound therapy and Proprioceptive Neuromuscular Facilitation with transcutaneous electrical nerve stimulation shows significant effect and can be treat the Osteoarthritis patients. While both protocols were effective, there is more significant improvement found in group 2 treatment over group 1. Hence it has been concluded that both the treatments can be used for Osteoarthritis patients but group 2 statistically shows significant improvement over Group 1.

VII. DISCUSSION

The present study was done to determine the efficacy of Proprioceptive Neuromuscular Facilitation with Ultrasound therapy and Proprioceptive Neuromuscular Facilitation with transcutaneous electrical nerve stimulation on pain and range of motion in osteoarthritis patients. The study was done on normal individuals. The pre and post effect of PNF + US and PNF +TENS is taken with the help of VAS score and goniometer. There is total 60 subjects (30 – 30 in each group) were recruited according to inclusion and exclusion criteria. Those who are satisfied were allowed to recruit in the study. All the recruited subjects were successfully completed the study in the given time and all the subjects were recruited from Goldi masala factory, Kanpur.

The data collected from the present study represents that null hypothesis is rejected and alternate hypothesis is accepted, which means both treatment intervention Proprioceptive Neuromuscular Facilitation with Ultrasound therapy and Proprioceptive Neuromuscular Facilitation with transcutaneous electrical nerve stimulation were effective in lowering pain and increase range of motion in normal weight individual with Osteoarthritis. The study also shows that by comparing the average mean of both group variable, Proprioceptive Neuromuscular Facilitation with transcutaneous electrical nerve stimulation statistically significant than Proprioceptive Neuromuscular Facilitation with ultrasound.

We also found same conclusion in 2015, Seema Gul, et al the study effectiveness of proprioceptive neuromuscular facilitation versus convention therapeutic exercise in knee osteoarthritis concluded that both proprioceptive neuromuscular facilitation and conventional exercise can be used in patients with knee OA. As both physical therapy regimes produced a clinically important improvement in pain and disability index. The selection of technique can be based according to the individual needs.[16]

In 2021, Minal Bhrat Masekar , et al the study Effectiveness of Muscle Energy Technique and Proprioceptive Neuromuscular Facilitation in knee Osteoarthritis concluded that this study resulted in conclusion that PNF stretching and MET both are effective in decreasing pain levels , enhancing hamstring flexibility and improving functional mobility in patient with OA knee.[17]

In 2020, Peixin Shen, et al the study Effects of PNF Intervention On Pain, Joint Proception And Knee Moments In The Elderly With Knee Osteoarthritis During Stair Ascending. Concluded that this study confirmed that a 6-week PNF intervention positively effect OA treatment by relieving pain, recovering proprioception, and improving joint force distribution in the elderly with KOA. The overall climbing stair function level was enhanced.[18]

In 2004, Pearl P. W. Law .et al the study optimal stimulation frequency of tens on people with knee OA. Concluded that our finding suggested that 2 weeks of repeated application of TENS 2Hz, 100Hz or 2/100Hz produced similar treatment of effect for people suffering knee OA.[19]

The present study is unique, so we can do a lot in future with referance of this study. This study was conducted for a short period of time and with small sample size; In future research involving long time period and larger sample size and comparing of two different intervention is also possible. The result of present study will help the physiotherapist to choose whether which protocol is best for lowering the pain and increase range of motion in normal weight subjects with osteoarthritis.

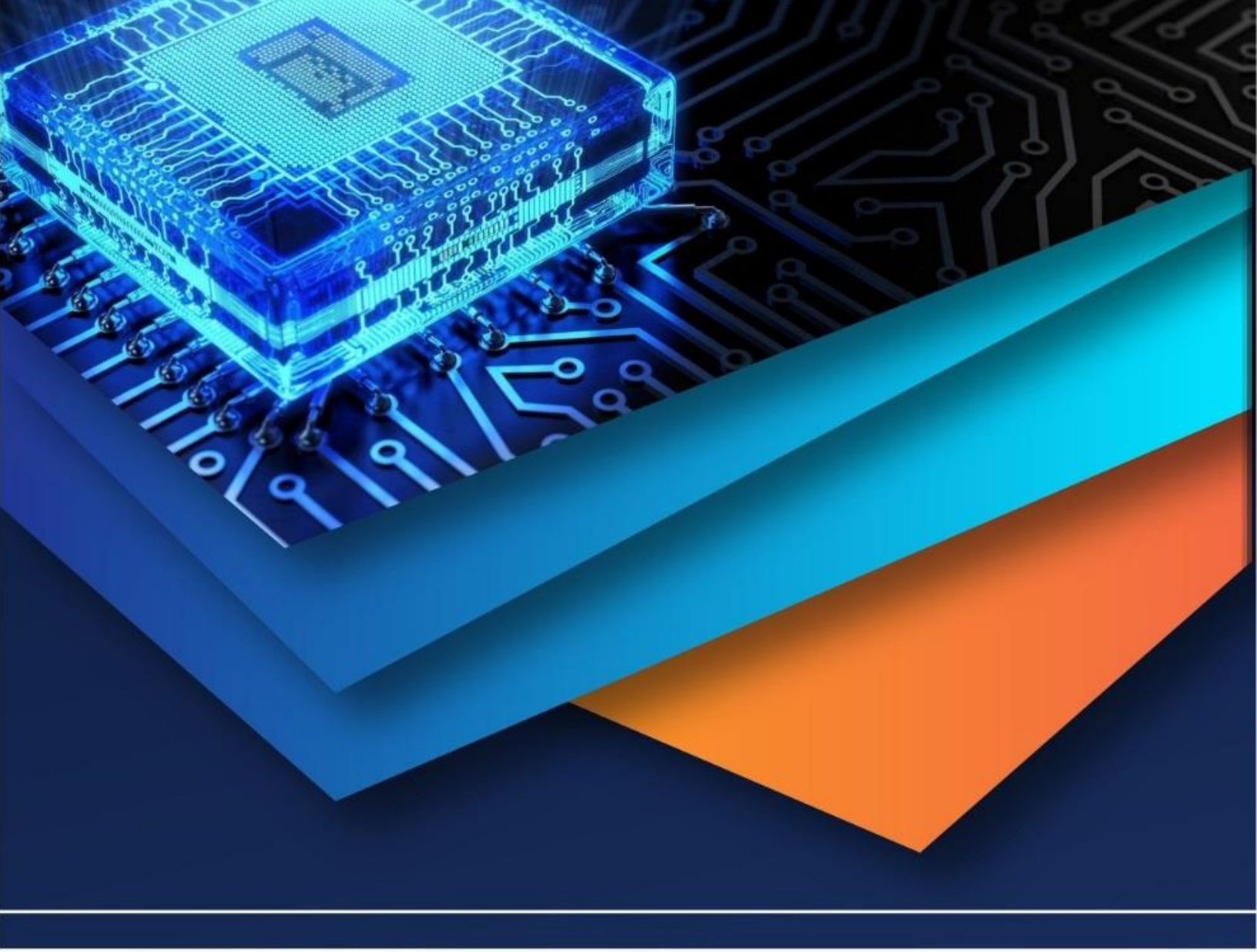
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