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Effect of Mulligan Technique versus Core Stability Exercises on Low Back Pain in Postmenopausal Women

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ABSTRACT

Background: Postmenopausal low back pain (LBP) has become a major worldwide health issue that negatively influences women's self-perception and quality of life. Mulligan technique and core stability exercises were reported as treatment approaches suggested for management of chronic non-specific LBP in postmenopausal women.

Objective: To compare between the effect of Mulligan technique and core stability exercises on LBP in postmenopausal women.

Patients and Methods: Sixty participants suffering from chronic LBP, aged 50-60 years old, were allocated from the Outpatient Clinic of Obstetric Department of Dar El Salam General Hospital. They were distribited randomly into three equal groups. Study group (A), (n=20) received Mulligan techniques (L 4-5); 30 minutes/session, 3 times/week, and lifestyle modifications advice for 4 weeks, Study group (B), (n=20) received core stability exercises; 30 minutes/session, 3 times/week, and lifestyle modifications advice for 4 weeks, and Control group (C), (n=20) received lifestyle modifications advice, only as in groups (A), and (B). All participants were assessed before and after intervention via measuring pain intensity utilizing Visual Analog Scale, functional disability utilizing Oswestry Disability Index (ODI), lumbar flexion and extension using modified Schober method, and lateral trunk flexion using tape measurement.

Results: There was a statistically significant decrease in the mean values of pain intensity and functional disability, a significant increase in the lumbar flexion and extension ROM, and a significant improvement in the right and left lateral trunk flexion's mean values in all groups after treatment compared with pretreatment values. Also, there was a statistically significant improvement in all outcome measures post-treatment in favor of group (A) **(p=0.001)**.

Conclusion: Using Mulligan technique was more effective than core stability exercises in the treatment of chronic LBP in postmenopausal women.

Keywords: Core stability exercises, Low back pain, Mulligan technique, Post menopausal period.

INTRODUCTION

Menopause is the permenant stoppage of the menstruation, signifying the termination of female's reproductive years. Though the actual timing can differ, it generally occurs between 45 and 55 years [1].

Most women who go through the early menarche or late menopause have been given endogenous estrogen for prolonged durations. Because estrogen is known to significantly lower the rates of osteoporosis and fractures, it may also lower the risk of low back pain (LBP) [2].

Menopause occurs physiologically as a result of the ovaries producing less estrogen and progesterone [3].

Women usually experience irregular menses in the years preceding menopause, meaning that their cycles may be lighter or heavier in amount , longer or shorter in length [4].

Bone loss in postmenopausal women has been linked to the incidence and intensity of LBP [5]. The whole range of the menopausal transition, including pre and postmenopausal, has been linked to hormone-related issues. Furthermore, additional lifestyle variables like physical activity and health behaviors, as well as obesity, may have an impact on LBP in this population [6]. LBP impacts over 80% of individuals and often leads to a considerable decline in working hours and impairments [7].

Non-steroidal anti-inflammatory drugs (NSAIDs) can be utilized as an assistive therapy rather than a terminal cure in the management of LBP. Gastrointestinal and renal problems such bleeding ulcers and perforation are among its adverse effects [8].

Since physical therapy encourages both proximal stability and distal mobility, it remains the most advanced conservative treatment for LBP [9]. Core muscles Stabilization Exercises (CSE) are becoming increasingly important in the field of sports medicine [10].

The core connects the lower and upper limbs and is the key component of the kinetic chain. Strong core muscles allow one to distribute ground-generated forces through the trunk, lower, and the upper limbs [11]. It is believed that a weak core impairs performance by changing energy transfer. For improved performance in many daily tasks, such as walking, jogging, sitting to standing, and transfers, the capacity to produce lower body power is crucial [12].

CSE enhances cardiovascular health, spinal flexibility and stability, muscle power, and motor control by training muscular activity patterns without tissue strain. The use of CSE is strongly supported by theoretical concepts for treating spinal disorders that help individuals with LBP feel less pain and have better function [13].

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LBP has been frequently treated with physiotherapy, which includes a variety of therapeutic approaches but primarily consists of manual mobilization exercises [14].

An interesting Mulligan mobilization approach that combines joint gliding and natural spinal motion is known as modified Lumbar Sustained Natural Apophyseal Glide (SNAG). As the patient engages in active activities, the glide can be delivered unilaterally over the transverse processes, to the facets, or to the spinous processes [15]. By correcting the positional fault between the surfaces of the affected facet joints, this procedure can increase spinal ROM and reduce pain. Additionally, it inhibits pain by activating the pain inhibitory pathway [16].

Few studies have examined how modified SNAGS affects the lumbar spine and how it compares to other physical therapy approaches in terms of its impact on LBP. This research aimed to compare the impact of CSE and the Mulligan technique (SNAG) on LBP in postmenopausal women.

PATIENTS AND METHODS

This randomized controlled study included sixty postmenopausal women who were allocated from the outpatient clinic of Obstetric Department of Dar El-Salam General Hospital, Cairo, Egypt. This study was performed between May 2024 and January 2025.

All participants had chronic LBP for at least 3 months. They were aged between 50 and 60 years; their body mass index (BMI) was less than 30 kg/m^2.

All of them were at the same activity level. The degree of pain was 2 or more according to visual analogue scale (VAS).

Exclusion criteria:

Patients with spinal fractures or any other neurological disorders, lumbar disc herniation or spondylolisthesis, pelvic pathology, gynecological disorders as chronic pelvic pain, uterine prolapse or retroverted-flexed uterus were excluded from the study.

Age, height, weight, BMI, medical history, and menstrual history were among the demographic details of the patient that were gathered and recorded on a data sheet.

The participating women were split into three equal groups at random (n = 20). Individually and sequentially and unbiased research assistant gave each numbered index cards were put in opaque envelopes. A blinded and unbiased research assistant gave each participant a hand-picked envelope, which was opened, and the participants were assigned to their group accordingly.

- **Group (A)** included twenty participants who had been treated with Mulligan technique on lumbar facet joints (L 4-5), 3-sessions/week, plus lifestyle modification advice for 4 weeks.
- **Group (B)** included twenty participants who had been treated with core stability exercises for 30 min/session, 3-sessions/ week, plus lifestyle modification advice for 4 weeks.
- **Group (C)** included twenty participants who had been treated with lifestyle modification advice, only, as in group (A), (B) for 4 weeks.

There were no participant dropouts following randomization (Figure 1).

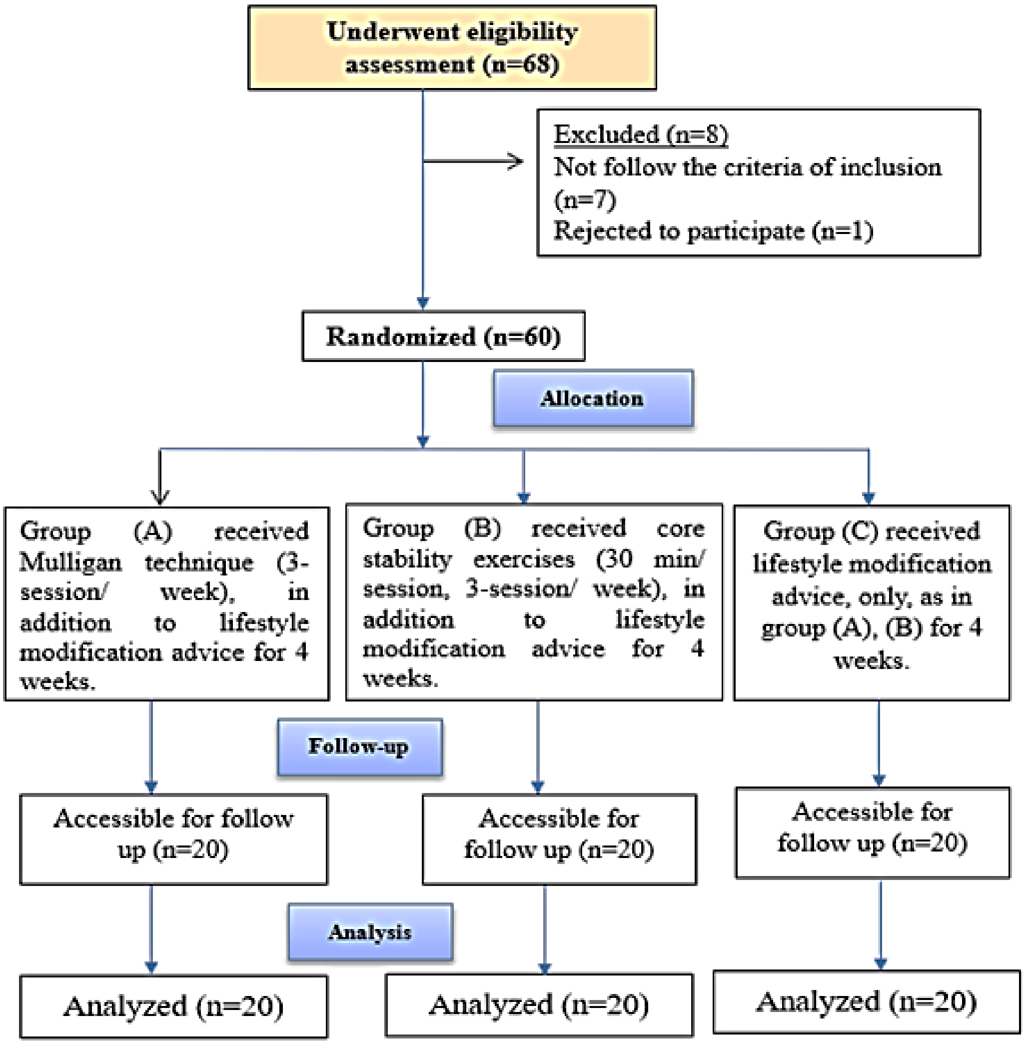

Fig. (1): Flow chart of the study.

Procedures:

For four weeks, all women in groups A, B, and C were directed to follow the same lifestyle modification guidelines [17]: reduce salt intake, reduce animal fat intake, stop smoking, perform relaxation techniques, apply heat to the lower back at least once a day, wear loose cotton clothing, walk for aerobic exercise, and refrain from heavy lifting.

Mulligan technique: Each patient in group (A) received treatment for the lumbar facet joints (L 4-5) using the Mulligan technique (SNAG) for 30 minutes each session, three times a week, for a total of four weeks. For the purpose of gaining their trust and cooperation during the treatment processes, each lady in group (A) received brief and straightforward instruction regarding the approach and its impact. It was requested that each woman in group (A) sit comfortably on a plinth with her legs resting on the small steps. Facing the patient's back, the therapist stood behind her. The participant was directed to do full lumbar flexion while the pelvic girdle was stabilized with a belt. During active flexion, a constant manual force was employed by making direct contact with the relevant spinous process (L4-5) utilizing the hand's ulnar border. The force's direction was parallel to L4-5's facet joints. At the end of the flexion range, every SNAG was held for 5-7 seconds, and two to three sets of four to six repetitions were carried out [18].

Core stability exercises: For four weeks, each patient in group (B) received core stability exercises for thirty minutes each session, three times weekly. Every participant in group (B) received a brief explanation of the nature of therapeutic exercises to boost her collaboration and confidence.

a. Prone gluteal squeezes exercise: All women in group (B) were directed to lie prone with their arms by their sides. After that, gradually tighten her gluteal muscles, keep them there for roughly six seconds, and then slowly relax, with 10-12 repetitions.

b. Pelvic bridging exercise: every participant in group (B) was directed to lie in a supine position with her hands by her sides, her knees flexed, and her feet flat on the plinth. Then, without arching her back, she was instructed to tighten her abdominal muscles, raise her hips three to five inches off the plinth, and sustain this position for five to seven seconds. After that, gradually lower her hips onto the plinth, with 10-12 repetitions.

c. A modified plank exercise: every participant in group (B) was instructed to assume prone kneeling position, aligning her shoulders just above her elbows, and line her head and neck with her back. She was then instructed to try to press her knees and elbows towards each other while also contracting her abdominal muscles. After three deep breaths, she was instructed to hold the position, then return to the beginning position and repeat it 10 to 12 times.

d. Curl-up exercise: Every participant in group (B) was directed to lie supine, bend her knees to a 90-degree angle, and cross her arms over her head. Then, without pulling on her head, she was instructed to raise her shoulders off the plinth, softly tense her abdominal muscles, and use her hands to support her neck. Then return to the initial position, and repeat 10-12 times.

e. Double knee to chest stretching exercise: Every participant in group B was directed to lie supine with her feet flat on the plinth and her knees flexed. She was then instructed to raise one knee to her chest, followed by the other, and to maintain this posture for 15 to 30 seconds. After that, she was instructed to relax and lower each leg to the plinth one at a time, then relax for 30 seconds, and repeat for 10-12 times.

f. Diaphragmatic breathing: every participant in group (B) was instructed to lie supine with one hand on her chest and the other on her tummy. After inhaling through her nose, she was instructed to hold her breath while feeling her abdomen rise, her sides and lower ribs expand laterally and her low back press on the plinth. After that, she was instructed to exhale via her mouth. After exhaling in this manner, she was told to rest one hand on her chest and the other on her abdomen. She was instructed to hold her breath for two seconds after taking a four-second breath and feeling her abdomen expand. She then breathed through her mouth for six seconds, very slowly and steadily. She was then instructed to take a 30-second break before repeating this exercise ten to twelve times [19].

Outcome measures:

Pain intensity level:

Before and after treatment, the VAS was utilized to determine the pain level experienced by each participant of the three groups. On a VAS line, each participant was instructed to indicate the point between the extremes that corresponded to the level of her pain [20].

Functional disability:

The Oswestry Disability Index (ODI) was utilized to assess each participant's functional disability prior to and after the intervention in the three groups. It initially served as a clinical evaluation instrument that would yield a disability estimate shown as a percentage score. Ten topics were covered, including pain intensity, lifting, self-care skills, walking and sitting abilities, sexual function, standing abilities, social life, sleep quality, and travel capabilities. Every question received a score between 0 and 5. The index, which ranges from 0 to 100, was calculated by adding the scores for each question that was answered and then multiplying the result by two. 100 represent the maximum disability, and zero was considered no disability. An Arabic version of the ODI was employed in this trial, and each participant was required to complete a comprehensive questionnaire on their own, both at the start of the study and four weeks after the treatment [21,22].

Lumbar mobility:

Lumbar mobility was assessed for all participants in the 3 groups prior to and following intervention using Modified Schober test for lumbar flexion and extension, and tapr measurement for right and left lateral trunk flexion. The normal values are 6-7cm for flexion, 2-3cm for extension, and 16.2-28 cm for both right and left lateral trunk flexion [23].

Ethical consent:

The Institutional Review Board of Cairo University's Faculty of Physical Therapy authorized ethical approval for this study (No: 012/005170). Each participating woman gave written informed consent after being told of the study's objectives and her freedom to withdraw at any moment. The study's protocol complied with thethe Helsinki Declaration, the World Medical Association's ethical standard for human experiments.

Sample size estimation:

Using G* Power statistical software (version 3.1.9.2; Universitat Kiel, Germany), the optimal sample size was calculated based on a pilot study with 90% power at α = 0.05 level, two measures for three groups, and an effect size of 0.5 using the F-test MANOVA repeated measures within and between interaction. The sample size should be at least 54 participants, plus 6 (10%) dropout subjects, for a total of 60 subjects (20 in each group).

Statistical analysis

The Statistical Package for the Social Sciences (SPSS) (IBM SPSS, Chicago, IL, USA) (version 25) for Windows was utilized to gather and statistically analyze the data. To confirm that the data were normally distributed, the Shapiro-Wilk test was employed. Using Leven's test, homogeneity of variances between groups was examined. For every variable, descriptive statistics were measured, including mean ± SD. To analyze each group before and after treatment, as well as to compare the three groups, analysis of variance (ANOVA) was employed. The significance level for all statistical analyses was determined at p 0.05.

RESULTS

The descriptive statistics for the demographic data of the patients in all groups are displayed in table 1. The mean values of age, weight, height, and BMI did not change significantly among all groups at baseline (p>0.05).

Table (1): Patients' demographic data of the three groups (A, B and C) at the baseline.

Variables	Group A (n=20)	Group B (n=20)	Group C (n=20)	F-value	p-value
Age (years)	55.35±3.54	55.5±2.98	55.45±3.24	2.01	0.14
Weight (kg)	78.9±6.63	78.55±7.38	77.5±7.99	0.62	0.54
Height (cm)	170.7±2.01	170.35±3.25	169.55±3.87	1.74	0.18
BMI (kg/m²)	27.03±1.62	27.02±1.72	26.99±1.67	0.01	0.99

BMI: body Mass index.

Within and between groups` analysis:

As represented in table 2, the mean values of all groups (A, B and C) regarding pain intensity (VAS), and functional disability (ODI) significantly improvemeed posttreatment compared to pretreatment, also lumbar mobility variable (flexion, extension, right and left lateral trunk flexion) significantly improvemed posttreatment compared to pretreatment ($p < 0.001$).

The percentage of pain severity, and functional disability mean values decrease in the three groups were 73%, 51%, and 20% for VAS, and 43%, 24%, and 13.6%, for ODI, respectively. Where, the percentage of lumbar mobility (flexion, extension, right and left lateral trunk flexion) mean values improvement in the three groups were 105%, 72.5%, and 40.5% for flexion, 337%, 215%, and 98% for extension, 10%, 5%, and 1.6% for right lateral trunk flexion, and 9.3%, 4.7%, and 0.5% for left lateral trunk flexion, respectively.

Table (2): Outcome measures pre- and posttreatment for all groups.

Variable		Group (A) (n=20)	Group (B) (n=20)	Group (C) (n=20)	F-value	p-value
Pre	VAS	7.6 ± 0.99	7.7 ± 0.98	7.4 ± 1.19	0.417	0.661
	Flex	3.08 ± 0.75	3.13 ± 0.72	3.08 ± 0.67	0.03	0.968
	Ext	0.57 ± 0.15	0.58 ± 0.17	0.52 ± 0.16	0.69	0.502
	Rt	19.98 ± 1.64	20.1 ± 1.29	19.95 ± 1.43	0.06	0.941
	Lt	20 ± 1.49	20.1 ± 1.29	20.1 ± 1.34	0.03	0.965
	ODI	71.4 ± 4.01	71.8 ± 3.83	71.9 ± 3.46	0.09	0.907
Post	VAS	2.05 ± 0.99	3.75 ± 0.97	5.95 ± 1.1	73.07	0.001
	Flex	6.33 ± 0.4	5.4 ± 1.34	4.33 ± 0.73	24.14	0.001
	Ext	2.72 ± 0.19	1.83 ± 0.23	1.03 ± 0.52	118.6	0.001
	Rt	18.05 ± 1.3	19.1 ± 1.34	19.63 ± 1.48	6.8	0.002
	Lt	18.15 ± 1.34	19.17 ± 1.28	20 ± 1.29	10.37	0.001
	ODI	40.6 ± 3.05	54.6 ± 4.36	62.1 ± 4.47	147.9	0.001
MD	VAS	5.55	3.95	1.45		
	Flex	-3.25	-2.27	-1.25		
	Ext	-2.15	-1.25	-0.51		
	Rt	1.93	1	0.32		
	Lt	1.85	0.94	0.1		
	ODI	30.8	17.2	9.8		
% of improve	VAS	73%	51%	20%		
	Flex	105%	72.5%	40.5%		
	Ext	377%	215%	98%		
	Rt	10%	5%	1.6%		
	Lt	9.3%	4.7%	0.5%		
	ODI	43%	24%	13.6%		
P-value	VAS	0.001	0.001	0.001		
	Flex	0.001	0.001	0.001		
	Ext	0.001	0.001	0.001		
	Rt	0.001	0.001	0.001		
	Lt	0.001	0.001	0.423		
	ODI	0.001	0.001	0.001		

VAS: Visual Analogue Scale; ODI: Oswestry Disability Index. MD: Mean difference. * Data are mean±SD, P-Value < 0.05 indicate statistical significance.

DISCUSSION

A global attention was paid for postmenopausal women-associated complains that can negatively impact physical capacity, postmenopausal low back pain affects 80% of women. A global attention was paid for postmenopausal women associated complains that can negatively impact physical capacity [24], cause physical and psychological problems, disability and deterioration in the general well-being [25]. This study was conducted to compare between the impact of Mulligan technique and core stability exercises on LBP in postmenopausal women.

The present findings indicated a statistical reduction in the mean values of pain intensity, and functional disability in the three groups, with superiority of group A ($p < 0.001$), where percentage of improvements were 73%, and 73%, respectively. In addition, a statistically significant increase in the mean values of lumbar mobility (flexion, extension, right and left lateral trunk flexion) in the three groups, with superiority of group A ($p < 0.001$), where percentage of improvements were 105%, 377%, 10%, and 9.3%, respectively.

The non-opioid endogenous pain inhibition pathways provide the instant pain alleviation that SNAGs provide. Progressive mobilization can be utilised to desensitize the neural system through habituation, and pain may be reduced by preventing unpleasant impulses from being transmitted by the presynaptic nerve terminal[26].

The significant improvement in functional disability, lumbar flexion and extension ROM and lateral trunk flexion while using Mulligan technique could be attributed to: First, rectifying the positioning fault of the lumbar facet joint, which will restore normal function and remove the muscle guarding adjacent to the joint. Second, extinction may have lessened the severity of the conditioned response due to numerous experiences of painful motions that are neither painful nor threatening; as a result, the disability is diminished [27].

The present results were corroborated with that of **Chitale *et al.*** [28] who found that Mulligan mobilization program alone or combined with conventional physical therapy could improve both arthrokinematics and osteokinematics that manage clinical manifestations in terms of backache, mobility restrictions, and functional disabilities among postmenopausal women with LBP.

Additionally, the present findings aligned with those of **Cankaya and Pala** [29] who investigated the impact of Mulligan technique use on functional disability, lumbar mobility, and pain complaints. They discovered notable improvements in particular ROM directions, including flexion, extension, and lateral flexion, and concluded that a Mulligan mobilization program offered long-lasting benefits in terms of pain reduction and a higher rate of disability improvement.

The study's findings were in line with that of **Kumar *et al.*** [30] who performed a clinical randomized trail along four-weeks intervention consisted of 12 sessions of Mulligan mobilization program and found significant improvements in terms of lumbar mobility, pain intensity scores and function disabilities.

Simsek *et al.* [31] stated that the Mulligan mobilization technique was found to be more effective than traditional therapy in improving pain level, lumbar flexion ROM, and functional capacities within three weeks of treatment.

The significant improvement in pain severity, lumbar flexion and extension ROM, lateral trunk flexion, and functional disability while using core stability exercise could be attributed to strengthening of weakened back, abdominal, and gluteal musculatures that in turn improves spinal segmental stabilization, which considered an actual regaining of mechanical spinal control that breakdown painful complains, improve spinal mobility, and overall maximize functional capabilities [32].

The current findings agreed with that of **Adnan *et al.*** [33] who tested the efficacy of static core exercise training program on postnatal women with LBP and reported that there was a statistically significant improvement in the participants' pain level, functional disability, and lumbar mobility throughout the intervention.

The study's findings were also corroborated by **Islam *et al.*** [34], who suggested a combination of therapeutic and CSE (on the rectus abdominis and oblique abdominal muscles), as well as CSE and pelvic tilt to offer greater benefits in the context of improving the abdominal muscle strengthening. They seemed to over-activate superficial global musculatures, but they compromised the control and stimulation of deep vertebral musculatures. As a result, CSE provide a strong theoretical basis for both the management of spinal disorders and the prevention of LBP.

Furthermore, this study's findings supported those of **Abdel-Aziem *et al.*** [35], who indicated that postmenopausal women with LBP who utilized core stabilization exercises experienced a significant improvement in both functional impairment scores and pain intensity. It was determined that CSE reduced functional impairment in patients with persistent LBP more effectively than traditional exercise regimens.

STRENGTHS AND LIMITATIONS

To author's knowledge, no other study compared the impacts of CSE and the Mulligan approach on LBP in postmenopausal women. Furthermore, this study's randomized design, objective assessment tools, and the beneficial therapeutic strategies provided by qualified physiotherapists are other strengths. However, this study had certain limitations, including the possibility that the patients' physical and mental health may have influenced the evaluation and treatment outcomes, as well as the possibility that the patients' response was influenced by their environment. Additionally, this study did not follow up the patients' future responses to treatment procedures. Therefore, more research is required to study different physical therapy procedures for postmenopausal women's chronic LBP.

CONCLUSION

It could be concluded that using Mulligan technique was more effective than core stability exercises in the treatment of chronic LBP in postmenopausal women.

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