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Combined effects of Tanzberger, tens and Kegel's exercises on quality of life in women with mixed urinary incontinence

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Abstract
Background: Mixed Urinary Incontinence (MUI), involving both stress and urge urinary leakage, affects over 30% of women with urinary incontinence and is associated with a disproportionately negative impact on health-related quality of life and psychological well-being. Conservative physiotherapeutic approaches combining different modalities have shown promise in managing MUI symptoms effectively.
Objective: To evaluate the combined effects of Tanzberger exercises, Transcutaneous Electrical Nerve Stimulation (TENS), and Kegel's exercises on quality of life and urinary leakage in women diagnosed with Mixed Urinary Incontinence.
Participants and Setting: A total of 20 female participants diagnosed with MUI were recruited through convenience sampling from the Department of Physiotherapy and Urology at Sri Ramakrishna Hospital. After accounting for attrition, 15 participants completed the study.
Methods: A quasi-experimental, pre-post study design was used. Participants underwent a 4- week intervention comprising Tanzberger exercises, TENS, and Kegel's exercises. Quality of life was assessed before and after the intervention using the King's Health Questionnaire (KHQ), and urinary leakage was measured using the One Hour Pad Test. Pre- and post-intervention mean scores were compared. Statistical significance was set at p ¡ 0.05.
Results: Post-intervention KHQ scores showed substantial improvements across multiple domains, with mean scores reducing from pre-intervention values (82, 73.4, 73.6, 79.53, 74.66, 75.86, 71.33, 76.06, 78.26, 22.66) to post-intervention values (31.8, 29.86, 33.6, 39.2, 40, 36.53, 40.53, 47.93, 7.53). This reflects a clinically meaningful enhancement in quality of life. The One Hour Pad Test showed a significant reduction in urinary leakage, with mean leakage decreasing from 12.4 X ml to 7.6 Y ml (p ¡ 0.05). Although exact effect sizes (e.g., Cohen's d) were not calculated, the magnitude of change indicates a strong clinical effect.
Conclusions: The combined physiotherapeutic intervention of Tanzberger exercises, TENS, and Kegel's exercises significantly improved quality of life and reduced urinary leakage in women with Mixed Urinary Incontinence. This multimodal approach provides a non-invasive and effective management strategy for MUI.

Keywords: Mixed urinary Incontinence, Tanzberger, Transcutaneous Electrical Nerve Stimulation, Kegel's, King's Health Questionnaire, One hour pad test, Quality Of Life

Introduction
Mixed urinary incontinence is a condition characterized by involuntary leakage of urine, encompassing symptoms of both stress and urge incontinence Harris *et al.* (2024) [8]. The International Continence Society defines mixed urinary incontinence (MUI) as the complaint of involuntary urine leakage accompanied by urgency, exertion, effort, sneezing, or coughing. It is estimated that over 30% of all inconti- nent women suffer from both stress urinary incontinence (SUI) and urgency urinary incontinence (UUI), with the urge component typically causing a significantly greater negative impact on health-related quality of life (HRQL) Gomelsky and Dmochowski (2011) [7].
In India, stress incontinence was more common (73.8%) among 3000 women, followed by mixed (16.8%) and urge (9.5%) Singh *et al.* (2013) [15]. Out of 350 women in Tamil Nadu

between the ages of 30 and 65, 52.43% had stress incontinence, 29.12% had urge incontinence, and 18.45% had mixed incontinence Boornema *et al*. (2018) [6]. The prevalence of urgency and mixed urinary incontinence in the United States was higher in women aged 60 years and older (urgency 49.5%, mixed 31.4%) than in those aged 40 to 59 years (urgency 27.9%, mixed 15.9%) Abufaraj *et al*., 2021 [2]. Prevalence of both mixed and urge incontinence continues to increases with age Aoki *et al*. (2017) [4].

Mixed urinary incontinence occurs when the endopelvic fascia weaken, which causes urethral distortion, malposition, hypermobility, decreased urethral tension, support and loss of normal bladder positioning which results in involuntary urine loss Harris *et al*. (2024) [8]. Factors that increase the risk of developing MUI are advanced age, multiparity, obesity, comorbidities like (depression, diabetes, faecal incontinence), high-impact exercise (running and jumping) Harris *et al*. (2024) [8] and vaginal birth Parazzini *et al*. (2003) [11]. The bladder, urethra, and urinary sphincters work together to hold urine at low pressure and allow us to urinate when it is socially convenient. The detru- sor muscle and internal urethral sphincter are primarily smooth muscles, while the external urethral sphincter and pelvic floor muscles are primarily striated. The bladder lumen is coated by epithelial cells (called urothelium) and the basement membrane (mucosal layer), which protect the underlying detrusor muscle from toxins in the urine and allow communication with brain cells that coordinate storage and voiding Aoki *et al*. (2017) [4].

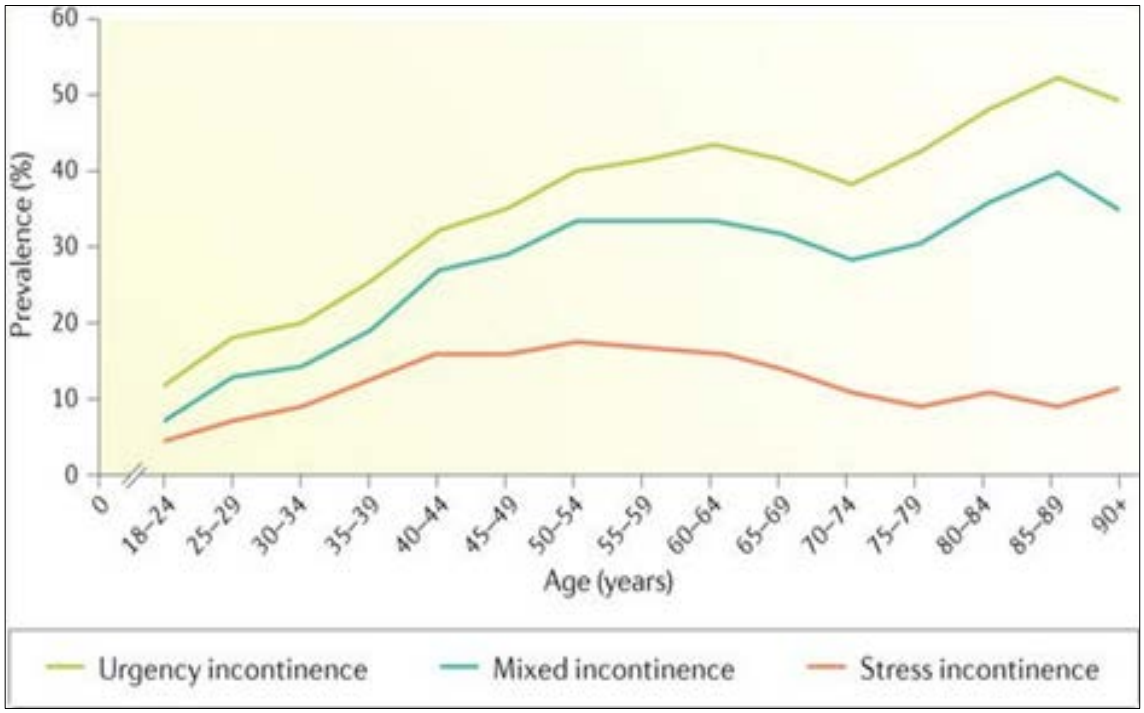

Fig 1: Prevalence of Stress, Urgency and Mixed Inconti- nence Stratified by Age

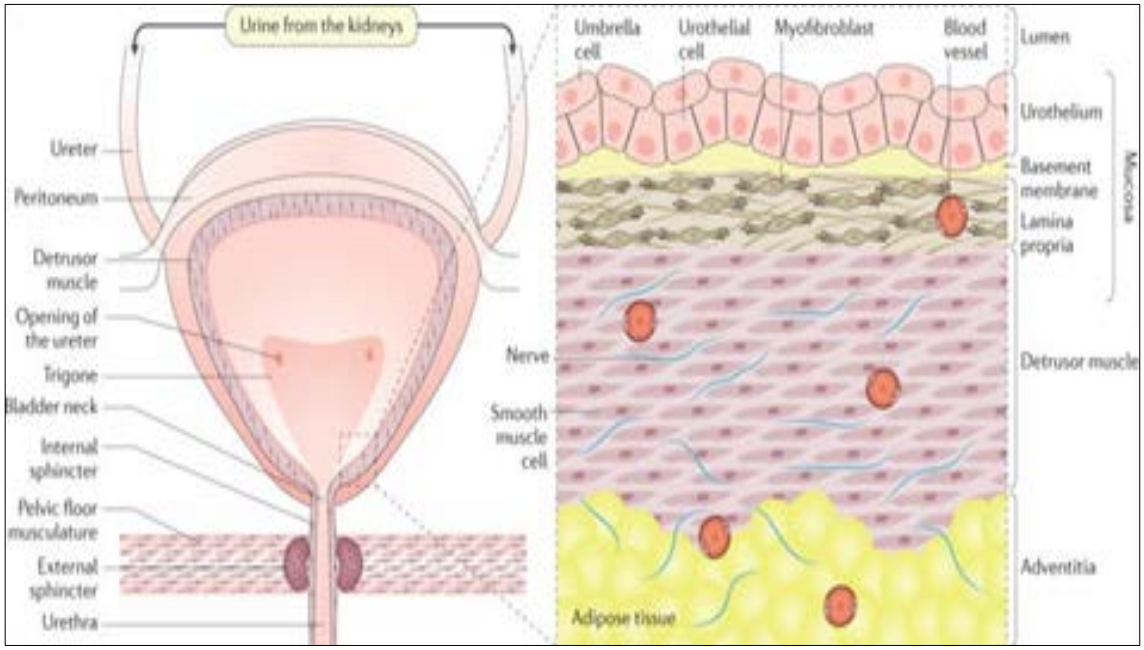

Fig 2: Anatomy and Histology of female bladder

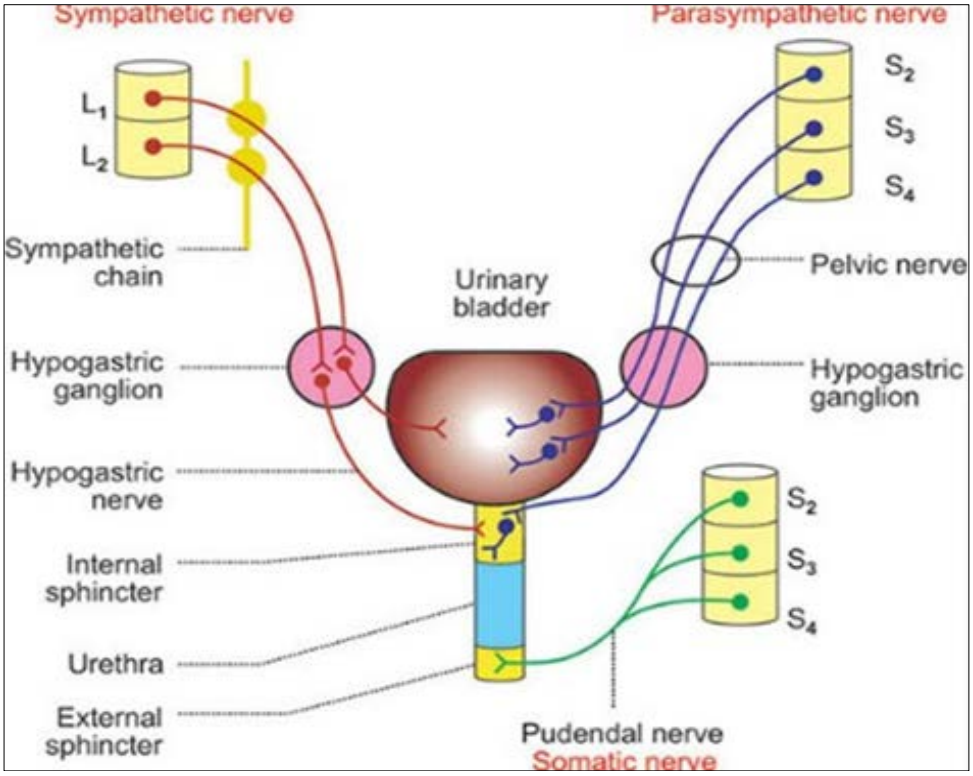

Fig 3: Micturition Reflex

The pubic bones are directly behind the bladder. The bladder has a pyramidal form when it is empty. The bladder rises in an oval shape above the pubic bones as it fills and expands. Smooth muscle fibres interdigitate in circular and longitudinal layers to form the detrusor muscle of the bladder wall. During normal bladder filling, they can stretch up to four times their resting length, which causes a minimal increase in pressure. The urothe- lium is a transitional epithelium that lines the bladder and ureters. Both cuboidal and flattened (or " umbrella") cells are present, enabling the bladder to expand during filling. Trigone refers to the base of the bladder. The neck of the bladder is located at the inferior corner of this triangle, whereas the ureters enter at the two superior corners. The urethra, which is 2.5–4 cm long in women, is continuous with the neck of the bladder. The pelvic floor muscles form the external sphincter, whereas the internal sphincter is formed by the smooth muscular rings at the bladder's neck. Both sphincters help to close off the urethra to maintain continence Aoki *et al.* (2017) [4].

Micturition reflex is the reflex by which micturition occurs. Elicited by stimulation of stretch receptors situated on the wall of the urinary bladder and urethra. Intravesical pressure increases when 300 to 400 ml of urine is collected in the bladder. This stretches the wall of the bladder, resulting in the stimulation of stretch receptors and the generation of sensory impulses. Sensory impulses from receptors reach sacral segments of the spinal cord via sensory fibres of the pelvic nerve. Motor impulses produced in the spinal cord travel through the motor fibres of the pelvic nerve towards the bladder and internal sphincter.

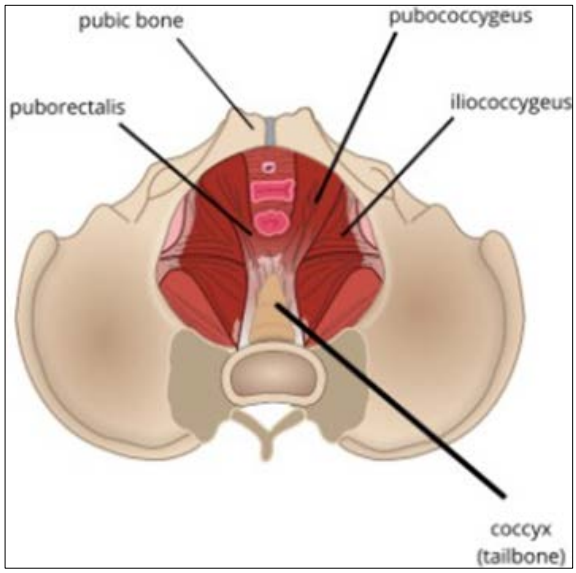

Fig 4: Pelvic floor Muscles.

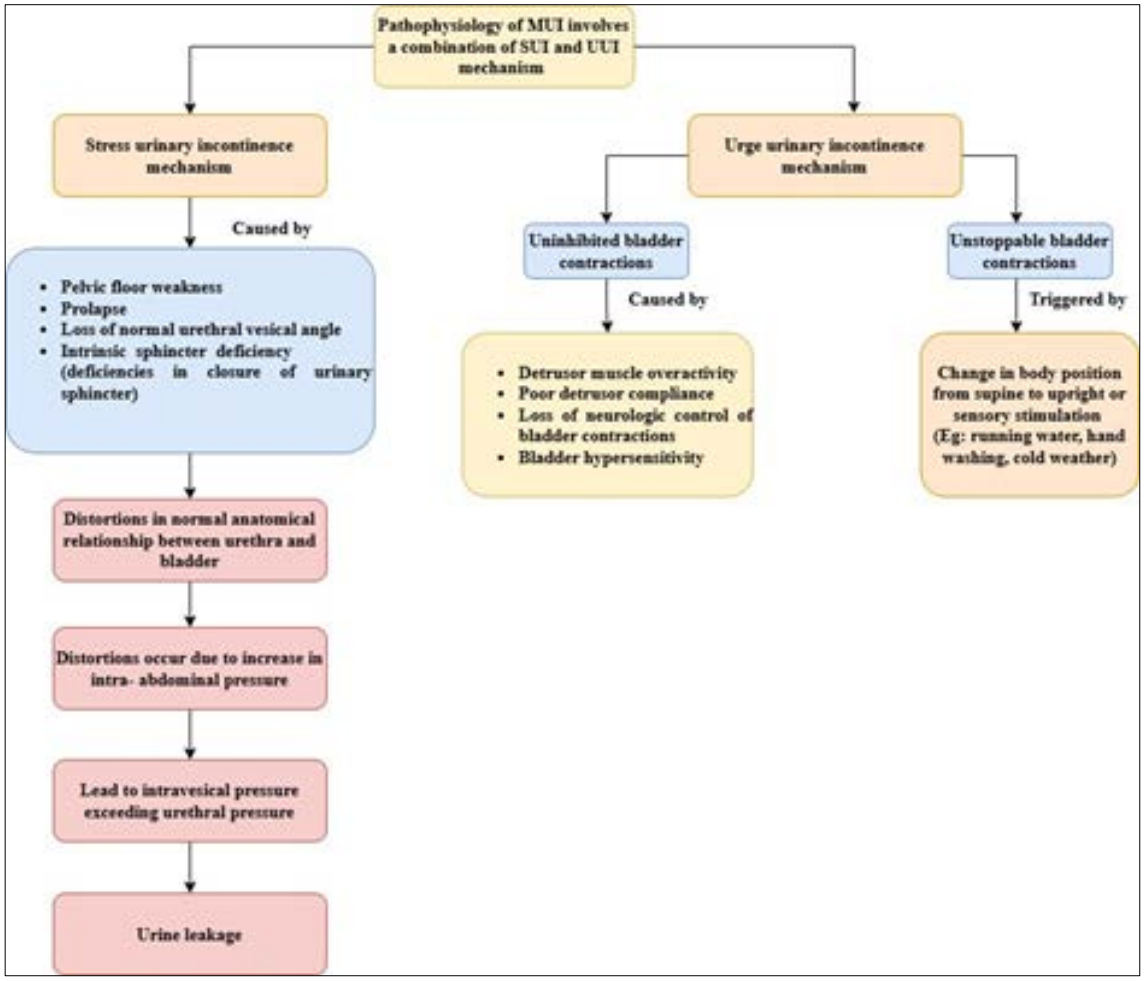

Fig 5: Pathophysiology of MUI.

Motor impulses cause contraction of the detrusor muscle and relaxation of the internal sphincter; urine enters the urethra from the bladder. The urethra sends afferent impulses to the spinal cord via the pelvic nerve. Inhibition of the pudendal nerve relaxes the external sphincter and voids urine. The pelvic floor is made up of a variety of muscles that are separated into superficial and deep muscle layers. The deep pelvic floor muscles include the pubococcygeus, ilIococcygeus, coccygeus, and puborectalis muscles. The puborectalis muscle is placed between the superficial and deep muscle layers. In addition to the pelvic floor skeletal muscles, the anal canal's internal and external anal sphincters are formed by the caudal extension of the circular and longitudinal smooth muscles from the rectum Jha *et al*. (2024) [10].

The levator ani muscles are the largest group of pelvic muscles. They help support the pelvic organs and consist of three separate muscles.

1. **Puborectalis:** This muscle is responsible for holding the urine and faeces. It relaxes when you urinate or have a bowel movement.
2. **Pubococcygeus:** These muscles make up most of the levator ani muscles. Contracting the muscle can prevent leakage and relaxing it allows for proper elimination.
3. **Iliococcygeus:** It has thinner fibres. It serves to lift the pelvic floor as well as the anal canal. It works with other pelvic floor muscles to control the release of urine and faeces.

The two main roles of the pelvic floor muscles are to

1. Support or serve as a " floor" for the abdominal viscera, including the rectum.
2. Operate as a constrictor or continence mechanism for the urethral, anal, and vaginal orifices Jha *et al*. (2024) [10].

Conservative, nonsurgical methods such as bladder training, biofeedback, Kegel exercises, dietary changes (avoiding too much caffeine), acupuncture, electroacupuncture, vaginal estrogen in postmenopausal women, weight loss, and medications such as alpha-adrenergic (mirabegron, vibegron), anticholinergics (oxybutynin, solifenacin, tolterodine, and trospium), calcium channel blockers (amlodip-ine, nifedipine, verapamil), estrogen (in females), and se- lective serotonin and norepinephrine reuptake inhibitors (duloxetine) are often used as the first line of treatment for incontinence. Last but not least, physiotherapy is cru- cial in lowering mixed incontinence Harris *et al*. (2024) [8]. Complications include bleeding, infection, injury to the genitourinary or gastrointestinal tract, persistent or recurrent urinary incontinence or prolapse Harris *et al*. (2024) [8], and impairment of quality of life and psychological well-being Jha *et al*. (2024) [10]. Mixed incontinence is not a life-threatening condition, but it can affect the quality of life AlQuaiz *et al*. (2023) [3]. Mixed urinary incontinence is defined as the involuntary leakage of urine associated with both stress incontinence (leakage of urine when performing activities such as coughing, sneezing, laughing or exercise, which increases abdominal pressure) and urge incontinence(loss of urine associated with sudden, strong urge to

urinate). Women are affected physically, mentally, and socially, and face embarrassment, depression and isolation Hebbar *et al*. (2015) [9].

King's Health Questionnaire (KHQ) is a valid and trust-worthy tool for evaluating the quality of life of women with urine incontinence. It is a patient-administered self-report with 21 items divided into three sections. Part 1 con- tains general health perception and incontinence impact (one item each). Part 2 contains role limitations, physical limitations, social limitations (two items each), personal relationships, emotions (three items each), sleep/energy (two items), and severity measures (four items). Part 3 is considered a single item and contains ten responses in relation to frequency, nocturia, urgency, urge, stress, inter- course incontinence, nocturnal enuresis, infections, pain, and difficulty in voiding. The responses in KHQ have a four-point rating system. The eight subscales ("domains") scored between 0 (best) and 100 (worst). The Symptom Severity scale is scored from 0 (best) to 30 (worst). De- creases in KHQ domain scores indicate an improvement in quality of life. The minimally significant difference - the smallest change in score that subjects perceive as beneficial is 3 points for the symptom severity scale and 5 points for all other KHQ domains. It is interesting to note that lower scores indicate patient wellbeing, and higher scores mean the person is severely affected by the disease Hebbar *et al*. (2015) [9]. The pad test can be used to diagnose urinary incontinence noninvasively. It is a simple, low-cost diagnostic tool that is used in clinical research and everyday patient care. The test has a demonstrated benefit in initial diagnosis, treatment selection, and follow- up evaluation. The type of pad test selected is based on goals. A one hour paired test is usually administered during initial evaluation to select treatment and estimate prognosis for cure. Twenty-four-hour or longer pad testing is necessary for quantifying the degree of urine leakage Krhut *et al*. (2014) [11]. Tanzberger exercise is a methodical program that uses a Swiss ball to enhance functional retraining and sensory awareness while integrating muscle function. This exercise works for various muscle groups in addition to the pubococcygeus muscles. It includes retrain- ing weak pelvic floor muscles with a Swiss ball. Exercises are beneficial because they strengthen the back, abdom- inal, and pulmonary diaphragm muscles, which restores the pelvic floor. Additionally, each movement enhances the sensory awareness of the pelvic floor Bhatt *et al*. (2013) [5]. It improves pelvic floor muscle strength, control and co- ordination and is primarily used in physical therapy to manage pelvic floor dysfunctions like urinary incontinence, pelvic pain and prolapse. Transcutaneous Electrical Nerve Stimulation (TENS) is a non-invasive pain treatment tech- nique that uses low-voltage electrical currents to treat both acute and chronic pain. TENS is the application of electrical stimulation to the skin using surface electrodes to stimulate nerve fibres, primarily for pain management. Ronald Melzack and Patrick Wall's gate control theory explains how TENS works to reduce pain. It is used to treat urinary incontinence. It entails administering modest electrical pulses via electrodes placed on the skin to stim- ulate nerves that impact bladder control. By altering the nerve activity, TENS can help "retrain" the bladder and lower urinary frequency. Conventional TENS is the most commonly used mode of TENS with a pulse duration of 200 ms and a frequency of 10Hz in continuous mode, and there is a mobilisation of the hallux toe Schreiner *et al*. (2021) [14]. The tibial nerve is a branch of the sciatic nerve, which innervates the legs and feet. It is formed from the ventral roots segments of L4, L5, S1, S2, and S3 spinal nerves Soetoko and Fatmawati (2023) [16]. The tibial nerve travels posterolateral to the posterior tibial vessels and 8–10 mm perpendicularly deep to the skin at the level of the most prominent point of the medial malleolus Nagaraj *et al*. (2024) [12]. The stimulation of S3-S4 nerve roots causes anal reflexive contraction of the external anal sphincter.

Dr. Arnold Kegel developed the Kegel exercise, which strengthens the pelvic floor muscles (pubococcygeus). The muscles can be contracted and relaxed to boost strength and prevent mixed urine incontinence Abu Raddaha and Nasr (2022) [1]. It is also called pelvic floor muscle training. It can be done at any time while sitting at a desk, lying down, eating, driving, or watching television. TENS, Kegel's, and Tanzberger exercises work together to improve quality of life, strengthen the pelvic floor muscles, and lessen Mixed Urinary Incontinence. Consistent, regular exercise sessions improve women's quality of life and lessen Mixed Urinary Incontinence symptoms. Mixed urinary incontinence has an increased prevalence rate in Indian women and affects their quality of life and psychological co-morbidity. Even though many studies were done separately on TENS and Kegel's to reduce the mixed urinary incontinence. But no study have conducted to find the effect of tanzberger exercise on mixed urinary incontinence. Hence, this study was conducted to find out the improvement in quality of life among mixed urinary incontinence patients using the combined effects of Tanzberger, TENS, and Kegel's exercises. The aim of the study was to find out the combined effectiveness of Tanzberger, TENS, and Kegel's exercises on QOL in women with Mixed Urinary Incontinence. To study the combined effects of Tanzberger, TENS, and Kegel's exercises on QOL in reducing Mixed Urinary In- continence symptoms among women. The research design used for the study was a quasi-experimental study. The study was carried out in the Department of Physiother- apy and Urology, at Sri Ramakrishna Hospital, under the supervision. The study was carried out for a period of 8 months. The patients were treated with TENS, Tanzberger and Kegel's exercises for 4 weeks and the value of the parameter selected were assessed on the day of referral and end day of the treatments. A total of 20 patients were selected for the study. Out of 20 patients 5 patients were excluded for various reasons. Among the 15 patients, the pre-test and the post-test values were assessed.

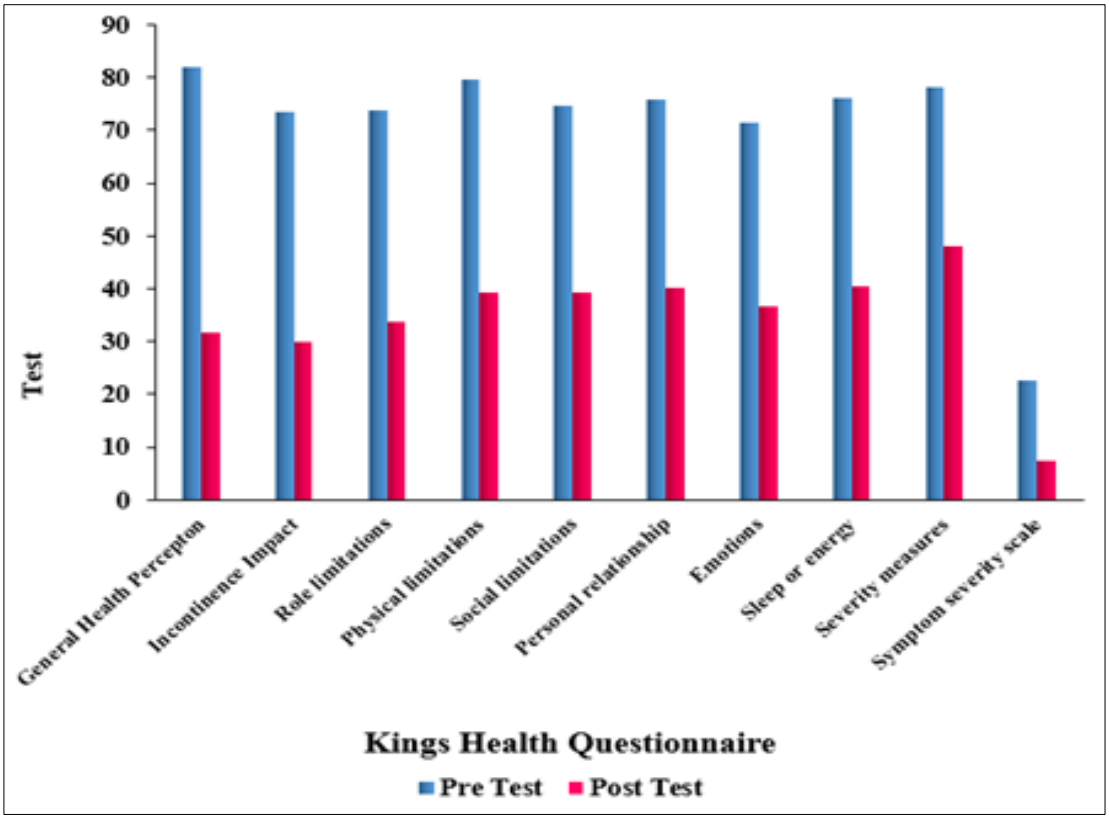

Fig 6: Pre and post-test mean values of king's health questionnaire (KHQ)

Data analysis and interpretation

Patient is made to sit on a swiss ball (approx. 68-70cm), with hip and knee flexed at 900 and feet appropriately placed on ground. Patient were asked to contract the pelvic floor muscles while exhaling and relax while inhaling. Electrodes were placed over the course of tibial nerve. A negative electrode was placed on the medial malleolus of the right ankle, and the positive electrode was placed 10 cm proximally to it, both connected to a conventional electrostimulator. Pulses varying from 10 to 50 mA (sensitivity and mobilization of patient's hallux toe during therapy).

Result

A total of 20 women with mixed urinary incontinence symptoms were selected by convenient sampling method, between the age group 40-75 years. Five of them were excluded for various reasons. Among the 15 patients, the data collected were statistically analyzed. Paired t-tests were used to find out the statistical difference. Pre-test values were obtained on the first day of the treatment, and the post-test was obtained at the end of the fourth week. The p-value was set at ¡0.05. Corresponding formulas for paired t-tests were used. Mixed urinary incontinence significantly impacts social, physical and sexual well-being. Hence, the King's Health questionnaire is used to check the quality of life. General health perception is calculated using KHQ. The pre-mean value before the intervention is 82, and after 4th week of intervention, the post-mean value is 31.8, and the standard deviation is 309.6. Using this data, the calculated 't' value is 11.0496, which is greater than the table' t value of 1.761 at the 0.05 significant level. The next part of KHQ includes Incontinence Impact. Before the intervention, the mean score was 73.4, while after 4th week of intervention, the mean score decreased to 29.86, with a standard deviation of 165.0909. The calculated t-value was 17.1523, which exceeds the critical t-value of 1.761 at the 0.05 significance level. This suggests the intervention led to a statistically significant change in Incontinence Impact.

Table 1: Pre and post test values – one hour pad test

No. of patients	Pre-test	Post test	Mean [*d*]	Mean Difference [d^2]
1	12	7	-5	25
2	10	6	-4	16
3	8	5	-3	9
4	7	3	-4	16
5	13	8	-5	25
6	6	4	-2	4
7	21	16	-5	25
8	17	14	-3	9
9	8	4	-4	16
10	11	8	-3	9
11	14	7	-7	49
12	3	1	-2	4
13	25	13	-12	144
14	16	10	-6	36
15	15	8	-7	49

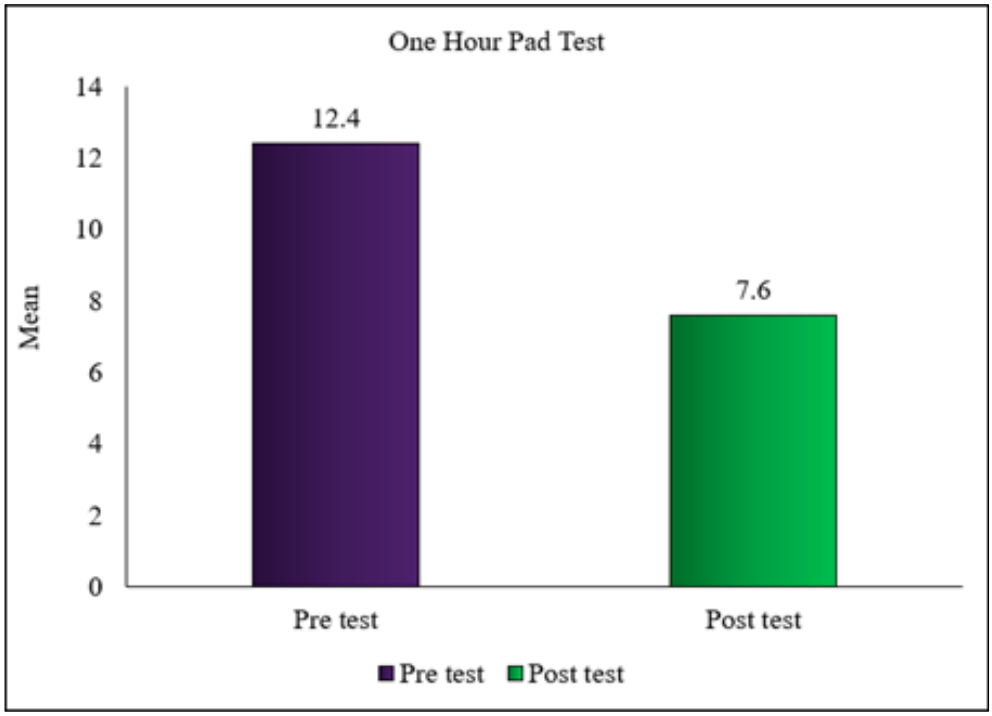

Fig 7: Pre and post-test mean values for one hour pad test

Table 2: Pre and post-test mean value of one hour pad test

One hour Pad test	Mean	Mean difference	Standard deviation	Calculated 't' value	Table 't' value	'p' value
Pre-test	12.4	4.8	6.45714	7.3158	1.761	0.05

References

1. Abu Raddaha AH, Nasr EH. Kegel exercise training program among women with urinary incontinence. Healthcare. 2022;10:2359.
2. Abufaraj M, Xu T, Cao C, Siyam A, Isleem U, Massad A, *et al*. Prevalence and trends in urinary incontinence among women in the United States, 2005–2018. Am J Obstet Gynecol. 2021;225(2):166.e1.
3. AlQuaiz AM, Kazi A, AlYousefi N, Alwatban L, AlHabib Y, Turkistani I. Urinary incontinence affects the quality of life and increases psychological distress and low self-esteem. Healthcare. 2023;11:1772.
4. Aoki Y, Brown HW, Brubaker L, Cornu JN, Daly JO, Cartwright R. Urinary incontinence in women. Nat Rev Dis Primers. 2017;3(1):1–20.
5. Bhatt HA, Hande DN, Shinde N, Khatri S. Effect of Tanzberger exercises in women with stress urinary incontinence. Int J Health Sci Res. 2013;13(3):44–50.
6. Boornema A, Kalyani P, John William F. Prevalence of urinary incontinence and its severity among women in urban Chidambaram – a cross-sectional study. Int J Community Med Public Health. 2018;5(10):4543–7.
7. Gomelsky A, Dmochowski RR. Treatment of mixed urinary incontinence. Cent Eur J Urol. 2011;64(3):120.
8. Harris S, Leslie SW, Riggs J. Mixed urinary incontinence. StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024.
9. Hebbar S, Pandey H, Chawla A. Understanding King's Health Questionnaire (KHQ) in assessment of female urinary incontinence. Int J Res Med Sci. 2015;3(3):531–8.
10. Jha S, Jeppson PC, Dokmeci F, Marquini GV, Sartori MG, Moalli P, *et al*. Management of mixed urinary incontinence: IUGA committee opinion. Int Urogynecol J. 2024;35(2):291–301.
11. Krhut J, Zachoval R, Smith PP, Rosier PF, Valansky L, Martan A, Zvara P. Pad weight testing in the evaluation of urinary incontinence. Neurourol Urodyn. 2014;33(5):507–10.
12. Nagaraj S, Mistry T, Sonawane K, Sekar C. Navigating the anomalous path of the tibial nerve at the ankle – attention to the intricacies! Indian J Anaesth. 2024;68(3):307–8.
13. Parazzini F, Chiaffarino F, Lavezzari M, Giambanco V, Group VS. Risk factors for stress, urge or mixed urinary incontinence in Italy. BJOG. 2003;110(10):927–33.
14. Schreiner L, Nygaard CC, Dos Santos TG, Knorst MR, da Silva Filho IG. Transcutaneous tibial nerve stimulation to treat urgency urinary incontinence in older women: 12-month follow-up of a randomized controlled trial. Int Urogynecol J. 2021;32(3):687–93.
15. Singh U, Agarwal P, Verma ML, Dalela D, Singh N, Shankhwar P. Prevalence and risk factors of urinary incontinence in Indian women: a hospital-based survey. Indian J Urol. 2013;29(1):31–6.
16. Soetoko AS, Fatmawati D. Anatomical variations of the tibial nerve and their clinical correlation. Anat Cell Biol. 2023;56(4):415–20.