Study on the effect of Western medicine caltrate D combined with traditional Chinese medicine eight section brocade practice therapy on preventing postmenopausal osteoporosis

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Abstract: Caltrate D is a commonly used drug in the treatment of postmenopausal osteoporosis (PMOP), but the effect of single application is not ideal. Therefore, to investigate the eight section brocade therapy combined with caltrate D effect in preventing and treating PMOP. From January 2021 to June 2022, 110 postmenopausal women with decreased bone mass were selected and randomized into group A ($n = 54$) and group B ($n = 56$). The both group receiving caltrate D treatment, and group B added receiving Chinese medicine eight section brocade therapy. Bone mineral density (BMD), WHOQOL-BREF score and incidence of PMOP were compared in both groups. The bone metabolism indexes [serum calcium, phosphorus, alkaline phosphatase (ALP)], bone formation indexes [serum Procollagen I N-Terminal Propeptide (PINP), type 1 collagen C-terminal cross-linked telopeptides (β-CTX)] were detected in both groups. After treatment, lumbar BMD, femoral neck BMD, serum calcium level and WHOQOL-BREF score in group B were significantly higher compared to group A, serum phosphorus and ALP levels, PMOP recurrence rate decreased significantly, and no significant difference in serum PINP and β-CTX levels in both groups. This combination therapy is significantly effective and provides a new reference for the clinical treatment of PMOP.

Keywords: Postmenopausal osteoporosis, caltrate D, eight section brocade, bone metabolism, bone formation.

INTRODUCTION

Postmenopausal osteoporosis (PMOP) belongs to the high incidence of disease in postmenopausal women, it is caused by the female menopause estrogen lack in bone mass decrease and bone structure change, easy cause skeletal deformation, fracture, reduce the patients quality of life (Kanis *et al.*, 2019; TN *et al.*, 2021). According to related reports (Si *et al.*, 2015), there were about 23,300 osteoporotic fractures in China in 2010, three times more in women than men, costing US $945 million and it is estimated that the number and cost of osteoporotic fractures will double by 2035, bringing a heavy burden to families and society. Women's bone mass decreases rapidly after menopause. Studies(Prince *et al.*, 1991) have shown that in early menopause, bone mineral density (BMD) of forearm decreases by about 3% per year and BMD of spine and neck of femur decreases by 2% ~ 3% per year.

Studies have shown (LeBoff *et al.*, 2022; Reid *et al.*, 2014) that older age, low BMD, vitamin D deficiency are risk factors for osteoporosis. Post-menopausal females having lower BMD, estrogen replacement or exercise plus calcium therapy could prevent bone loss, but estrogen replacement therapy had relatively more side effects. At present, suggest that there are calcium and vitamin D supplements available here, exercise and other measures to slow down the occurrence of osteoporosis for those with reduced bone mass (Papadopoulou *et al.*, 2021). caltrate D is a routine medication frequently prescribed in clinics for the treatment of bone metabolic disorders, and is useful in promoting calcium absorption and utilization, and improving bone density. Its main components include calcium carbonate and vitamin D3, which promote the absorption of calcium and phosphorus in the intestine and promote the normal calcification of bone. Calcium carbonate is involved in the formation of bone and the reconstruction of bone tissue after fracture. Vitamin D3 can promote the absorption and utilization of calcium, regulate the reabsorption of calcium by the kidney, and maintain the balance of calcium in the body. Eight section brocade, a traditional Chinese medicine fitness exercise, can dredge meridians, regulate qi and blood, which is suitable for most people to practice and has positive significance for regulating body state and promoting rehabilitation (YT *et al.*, 2022). At present, the effect of eight section brocade in the prevention of PMOP is still lacking. Based on the concept of "prevention before disease", this study selected postmenopausal women with bone loss as the research object to analyze the treatment effect of eight section brocade therapy combined with Caltrate D on PMOP.

MATERIALS AND METHODS

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Subject profiles

A total of 110 postmenopausal women with bone loss in Beijing Geriatric Hospital from January 2021 to June 2022 were selected as the study objects. They were divided into group A (54 cases) and group B (56 cases) by random number table method. Group A were treated by Calcium D. Group B were treated by eight section brocade chips combined with Calcium D. The informed consent of all participants was obtained, and the studies were authorized by Ethics Committee at Beijing Geriatric Hospital.

Inclusion criteria

(1) Diagnostic criteria for bone loss: compared with the normal population of the same race and gender, Dual energy X ray absorptiometry (DXA) measured axial bone, $-2.5 < T < -1.0$; (2) natural menopause for more than 1 year, age >40 years old; (3) The subjects have no cognitive impairment and can communicate normally.

Exclusion criteria

(1) Patients with secondary osteoporosis caused by endocrine metabolic diseases such as hyperthyroidism and rheumatoid arthritis; (2) patients with previous ovariectomy and hysterectomy; (3) Have taken glucocorticoids, estrogen, calcitonin, bisphosphonates and other drugs that affect bone metabolism in the past 3 months; (4) Patients with serious primary diseases such as cardiovascular and cerebrovascular diseases; (5) Physical dysfunction, or loss of mobility; (6) Patients with malignant tumors.

Intervention method

Health education was given to postmenopausal women with bone loss in both groups. The postmenopausal osteoporosis prevention manual was issued at the time of enrollment, and health guidance was given face-to-face, including the meaning of PMOP and daily preventive measures (eating foods rich in calcium and vitamins, such as eggs, milk, vegetables and avoiding high-fat and high-salt diet. Appropriate amount of sunlight exposure, about 30 minutes a day, to promote calcium absorption. Change bad living habits.)

On the basis of the above, group A was treated with Caltrate D (National drug approval number H10950029, specification: 600mg/tablet, Wyeth Pharmaceutical Co., LTD.), 1 tablet/time, once/d, orally for 1 year. Group B was treated with eight section brocade therapy combined with Caltrate D. The method of using Caltrate D was the same as that of group A. Eight section brocade exercise therapy was performed as reported by Li (2024), including ① Press the sky in both hands; ② Draw a bowl and let the arrows flew; ③ Separate sky and world; ④ Wisdom owl gazed rearward; ⑤ Gazed angrily; ⑥ Hopped on his toes; ⑦ Bear turned from one side to the other; ⑧ Touched his toes and bent them rearward. Professional medical staff will guide the movements to ensure that the subjects are proficient in them. Specific methods: Exercise for 5 minutes before practice, practice once at 8:30am and 5:30pm respectively, telephone follow-up every 2 weeks, with follow-up visits every 3 months and movement regularity visits every 2 months, adjust the exercise intensity according to the condition of the selected subjects, last for 1 year. The specific flow diagram is shown in fig. 1.

Index evaluation

(1) BMD: BMD levels of lumbar $L_{1\sim4}$ and femoral neck in women were detected by dual energized X-rays absorbography (Pumajing Medical Technology (Beijing) Co., LTD., Model: InAlyzer) before treatment and 1 year after treatment.

(2) Common indicators of bone metabolism. Fasting venous blood samples of postmenopausal women with bone loss before and after treatment were collected, serum was separated after centrifuge and serum alkaline phosphatase (ALP), calcium and phosphorus levels were detected by automatic biochemical analyzer (Siemens, Model: AtellicaCH930).

(3) Bone formation indexes. Serum samples were collected and serum Procollagen type I prenterminal N-primary peptide (PINP) and C-terminal crosslinked telopeptides of type I collagen (β-CTX) were detected by automatic immunoanalyzer (German Roche, Model: E601) before and after treatment.

(4) Incidence of PMOP. Over the follow-up periods, the incidence of PMOP in both groups was analyzed. The PMOP determination was as follows: the axial bone was measured by DXA, and the T value was ≤ -2.5.

(5) Quality of life: The WHOQOL-BREF scores were evaluated to assess the subjects' qualities of living before and after treatment. The content of the WHOQOL-BREF consists of 26 items, including individual subjective feelings about survival and health, subjective feelings about quality of life, physiology, psychology, environment and society and is scored by 5-level scoring method. The original score was linearly converted into a percentage scale. The higher the score, the better the survival.

STATISTICAL ANALYSIS

SPSS 20.0 was used to analyze the data. The count data were represented by frequency. $n \geq 40$, $T \geq 5$ and χ^2 test was performed. $n \leq 40$, $1 \leq T \leq 5$, Chi-square calibration test shall be performed. Measurements conform to normal distributions and are expressed as means ± standards deviations (x ± s). Comparisons among groups were made using t-tests for independents samples and pairwise t-tests for within-group comparisons. $P < 0.05$ indicates a statistical significance of the data discrepancy.

Ethical approval

This study was approved by the Ethics Committee of Beijing Geriatric Hospital vide ethical approval No.2014-109.

Table 1: Fundamental informations of both groups ($\bar{x} \pm s$)

Group	N	Age (years)	BMI (kg/m²)	Menopause time (years)	Alcohol consumption (Yes/No)	Education level (junior high school and below/Senior high school and above)
Group A	51	54.29±5.32	22.52±2.28	7.12±2.01	15/36	34/17
Group B	52	55.06±6.11	22.19±2.45	6.85±1.76	18/34	32/20
χ^2/t value		0.682	0.707	0.726	0.320	0.294
P value		0.497	0.481	0.470	0.571	0.588

Table 2: Compared BMD levels of lumbar spine and femoral neck before and after treatment (g/cm², $\bar{x} \pm s$)

Group	N	Lumbar spine BMD		Femoral neck BMD	
		Before treatment	After treatment	Before treatment	After treatment
Group B	52	0.80±0.06	1.12±0.19*	0.65±0.03	1.17±0.25*
Group A	51	0.79±0.07	0.82±0.10*#	0.66±0.03	0.86±0.14*#
t value		0.779	9.998	1.691	7.744
P value		0.438	0.000	0.094	0.000

Note: "*" represents *P* < 0.05 versus before treatment and "*#" represents *P*< 0.05 versus group B after treatment

Table 3: Comparisons of bone metabolism indicators before and after treatment among both groups ($\bar{x} \pm s$)

Group	N	Blood calcium (mmol/L)		Blood phosphorus (mmol/L)		ALP (U/L)	
		Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment
Group A	51	2.20±0.13	2.35±0.12*#	1.32±0.10	1.22±0.08*#	85.71±6.53	82.36±6.14*#
Group B	52	2.19±0.14	2.59±0.15*	1.34±0.09	1.14±0.11*	86.15±6.02	79.52±5.78*
t value		0.375	8.956	1.067	4.214	0.356	2.418
P value		0.708	0.000	0.288	0.000	0.723	0.017

Note: "*" represents *P* < 0.05 versus before treatment and "*#" represents *P*<0.05 versus group B after treatment

RESULTS

General information

During the study period, in group A, 1 cases of personal factors withdrew, 2 cases lost follow-up, 51 cases were included;In group B, 52 cases were included, including 2 non-adherence cases, 1 serious accident and 1 shedding case. There was no statistical significance in body mass index (BMI), age, menopause age, menopause time and alcohol consumption among both groups (*P*>0.05). The relevant information is presented in table 1.

BMD levels of lumbar spine and femoral neck

BMD levels of patients in both groups are shown in table 2. Before treatment, the difference in lumbar spine and femoral neck bone density in both groups had not been statistically significance (*P*<0.05). After treatment, the lumbar spine and femoral neck bones densities of both groups where higher as compared to before treatment (*P* < 0.05) and group B was substantially greater in comparison to group A (*P*<0.05).

Bone metabolism index level

The levels of bone metabolic index in both groups presented in table 3. Before treatment, patients in both groups had not significantly differences among serum calcium, phosphorus and ALP levels (*P*>0.05). After treatment, serum calcium increased, serum phosphorus and ALP decreased for all groups and changed significantly (*P*<0.05). In comparison to group A, group B showed a significantly higher blood calcium level and decreased blood phosphorus and ALP levels (*P*<0.05).

Bone formation index and quality of life score

The results of Bone formation index and quality of life score of patients in both groups are presented in fig. 2. Before treatment, serum PINP, β-CTX and WHOQOL-BREF scores for both groups showed no statistical significance (*P*>0.05). The patients in both groups had fewer serum PINP and β-CTX layers after treatment versus before treatment (*P*<0.05), but the differences at serum PINP and β-CTX layers among the both groups of patients were not statistically significance (*P*>0.05). After treatment, both WHOQOL-BREF scores were elevated for all groups (*P*<0.05) and WHOQOL-BREF scores were greater in group B versus group A (*P*<0.05).

PMOP recurrence rate

During the study period, the recurrence rate of PMOP was 3.85% (2/52) in group B and 9.80% (5/51) in group A, with not statistically significant among the both groups (χ^2 = 0.656, *P* = 0.418).
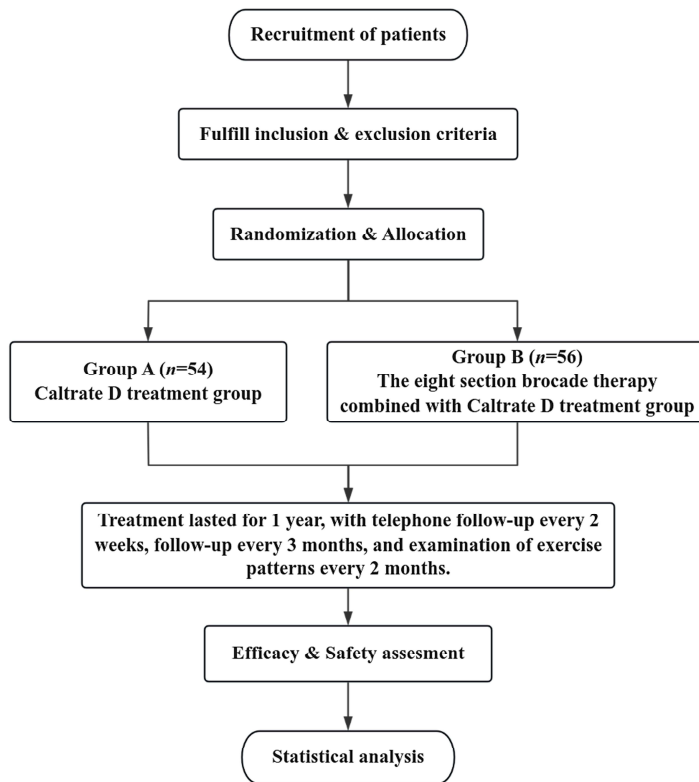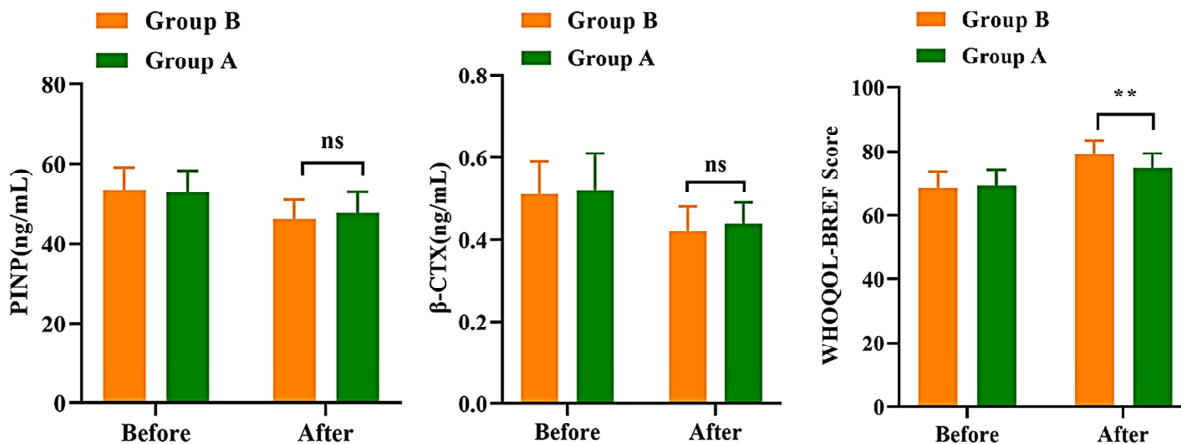
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Fig. 1: Research flow diagram

Note: "ns" indicates *P*>0.05 for comparison between both groups; "**" indicates *P*<0.01 for comparisons among both groups

Fig. 2: Compared the bone turnover index and quality of life score of the two groups before and after treatment

DISCUSSION

Current studies have shown that estrogen deficiency in postmenopausal women causes increased expression of receptor-activator of nuclear factor κ-B ligand (RANKL), which accelerates bone loss (Tao *et al.*, 2021). At this stage, bone resorption dominates, bone metabolism is impaired and osteogenic activity is reduced and changes in bone structure and quality lead to decreased bone strength and increased risk of osteoporotic fracture. For menopausal women, reasonable prevention of osteoporosis is very necessary and clinical prevention in China is mainly based on health education to improve awareness and timely supplementation of calcium and vitamin D. Caltrate D is a compound preparation, which is produced by calcium carbonate and vitamin D. Daily supplement can reduce calcium salt deposition and bone ablation and slow bone loss. Some scholars conducted group treatment for patients with primary osteoporosis, and found that after 3 months of treatment, bone mineral density, blood calcium, blood phosphorus and clinical symptoms of the lumbar spine and femoral neck condition

increased in the Caltrate D group group in comparison to the before treatment. However, the improvement of the above indexes after treatment in other combined groups (including Caltrate D) was better than that in Caltrate D group, suggesting that Caltrate D alone had limited effect (LF *et al.*, 2020; Yong and Logan, 2021). Some guidelines point out (Daly *et al.*, 2019) that exercise has a positive effect on improving osteoporosis, and targeted exercise training can affect bone mass and structure in postmenopausal women and reduce the risk of fracture. A mate analysis (Liu *et al.*, 2015) proved that eight section brocade exercise can improve BMD in osteoporosis patients, but it was also suggested that the number of relevant studies was limited and high-quality randomized controlled trials were needed to confirm it.

In this study, different treatment methods were applied to postmenopausal women with bone loss. The results showed that the BMD and blood calcium levels of femoral neck and lumbar spine were significantly greater and the blood phosphorus and ALP levels were significantly below the before treatment in both groups. The findings showed that Baduanjin therapy combined with Caltrate D therapy can improve bone mass, reduce bone metabolism and bone mineral density in postmenopausal women to a greater extent. At the same time, the results also showed that life qualities scores after treatment of group B were greater compared to group A. The recurrence rate in PMOP of group B as 3.85% indicated that treatment D based on TCM Bajiejin exercise therapy could enhance the therapeutic effects and improved the quality of life of postmenopausal women. The possible reasons for the above results are as follows: (1) Caltrate D supplements calcium carbonate and vitamin D, and vitamin D can promote the absorption of calcium ions in the small intestine to increase bone salt deposition and increase bone mass, so as to prevent osteoporosis; (2) eight section brocade belongs to the traditional fitness Qigong exercise in China. As a medium and small-intensity aerobic exercise, it regulates bone mechanics and generates mechanical stress through both relaxation and tension exercise, so as to stimulate the generation and differentiation of bone cells, accelerate local blood circulation and stimulate bone metabolism. At the same time, it regulates the brain by thinking during exercise, improves the connection between body and mind, strengthens tendens and bones and increases BMD(Tian *et al.*, 2020); (3) On the basis of routine health education, the intervention of Caltrate D and eight section brocade can improve bone activity from different mechanisms, and the exercise of upper limbs and waist of eight section brocade can stimulate the increase of local BMD, so the improvement of lumbar BMD is more obvious. Under the effect of combined gain prevention, postmenopausal women with decreased bone mass can avoid bone loss to the greatest extent and effectively slow down bone mass decline.

The decrease in BMD after menopause is mainly due to the fact that the bone resorption rate exceeds the bone formation rate. Reducing bone resorption and promoting bone formation can slow down the occurrence and development of osteoporosis (Kitaura *et al.*, 2020). PINP and β-CTX are specific markers of bone formation. In a physiological state, the contents of PINP and β-CTX in the body are very small. In the early stage of osteoporosis, the level of osteocyte synthesis of PINP increases, and its degradation β-CTX also increases, but at the same time, the rate of bone resorption is greater than that of bone formation. Therefore, slowing down the reduction of bone formation factor can prevent the progression of osteoporosis (Cavalier *et al.*, 2020). In this study, it was found that serum PINP and β-CTX levels in the 2 groups were reduced after treatment, and bone formation factor was significantly less in group B versus group A, indicating that TCM eight section brocade therapy combined with Caltrate D was more effective in preventing and treating PMOP from changes in markers with high sensitivity, and eight section brocade training had mechanical stress that could not be replaced by drugs. The combined action of the two can improve the activity of bone cells, repair bone structure, increase bone formation and alleviate bone loss.

At the same time, it is suggested that when the postmenopausal female population does not meet the diagnostic criteria for osteoporosis, it can be selected to increase the monitoring of metabolic markers such as bone formation, so as to timely adjust the diet, exercise, lifestyle habits, etc., or use drugs to promote bone formation, so as to prevent the occurrence of osteoporosis.

CONCLUSION

The application of eight section brocade therapy combined with Caltrate D in postmenopausal women with bone loss can regulate the body's bone metabolism and bone formation, improve bone density, improve the quality of life of postmenopausal women and reduce the recurrence of PMOP. Affected by human and material resources, this study is a single-center sample, and the follow-up time is short and the long-term prevention effect of PMOP has not been collected. In the future, the sample source could be expanded and the duration of the study extended, along with further analyses at the image level and genetic level to explore the long-term effects of this treatment program.

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