

Clinical Study on the Treatment of Idiopathic Short Stature Using Chinese Medicine Growth Plasters

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Abstract

Objective: To investigate the clinical efficacy and mechanism of growth patches in treating idiopathic short stature. **Methods:** A retrospective analysis was conducted on 120 children meeting the ISS diagnostic criteria. Based on treatment preferences and lifestyle goals recorded at the initial visit, patients were divided into two groups of 60 each. The control group received lifestyle management only: Parents supervised children to achieve balanced nutrition, complete at least one hour of daily exercise (including but not limited to reaching for height, long jump, back stretches, hanging, skipping rope, and outdoor activities), and sleep before 10 PM, fulfilling all three requirements. The treatment group combined growth patches with lifestyle management. Each treatment cycle lasted 4 weeks, with a total of three cycles administered. Clinical efficacy and adverse reactions were compared between groups post-treatment. Changes in children's height, growth velocity, and weight were assessed before treatment and at 1, 2, and 3 months post-treatment. **Results:** Pre-treatment comparisons of growth velocity and height gain showed no significant differences between groups ($P > 0.05$). After 1, 2, and 3 months of treatment, both groups showed significantly higher growth rates and height gains compared to pre-treatment levels ($P < 0.05$). At each treatment time point, the treatment group exhibited significantly higher growth rates and height gains than the control group ($P < 0.05$). Compared to the control group, the treatment group demonstrated a significantly higher overall effective rate post-treatment ($P < 0.05$). **Conclusion:** Under lifestyle management, adjunctive use of traditional Chinese medicine growth patches effectively promotes height gain and enhances growth velocity without significant adverse reactions, demonstrating clinical applicability.

Keywords

Idiopathic short stature; traditional Chinese medicine growth plaster; growth velocity

Idiopathic short stature (ISS) refers to a clinical condition where height falls below the 2SD or third percentile (-1.88 SD) of the normal mean for the same race, sex, and age group, despite normal growth hormone secretion levels and the exclusion of systemic, nutritional, endocrine disorders, chromosomal abnormalities, or other causes of short stature such as small-for-gestational-age newborns [1]. Its pathogenesis remains unclear, with potential contributions from genetic factors, dietary patterns, and growth environments. The recognition of ISS has increased in recent years, yet treatment rates remain low, severely impacting affected children's growth and psychological well-being. Due to the unknown etiology of ISS and the lack of specific treatment protocols, recombinant human growth hormone (rhGH)

remains the primary first-line therapy both domestically and internationally [2]. However, its prolonged treatment duration and high cost hinder widespread clinical application. This study analyzes the clinical efficacy of transdermal growth patches for ISS and further explores their specific mechanisms of action, as reported below.

1. Clinical Data

1.1 Diagnostic Criteria

1.1.1 Western Medical Diagnostic Criteria

Established according to the 2008 “Guidelines for Diagnosis and Treatment of Short Stature in Children” [3] developed by the Endocrinology, Genetics, and Metabolism Group of the Pediatrics Branch of the Chinese Medical Association, and the principles outlined in Pediatrics. (1) Height below 2SD below the normal mean for age and sex according to the 2005 National Height Standards, with normal intelligence; (2) Normal birth length and weight; (3) Annual height growth rate <5 cm; (4) Growth hormone stimulation test: GH peak $\geq 10 \mu\text{g/L}$.

1.1.2 Traditional Chinese Medicine (TCM) Pattern Differentiation Criteria

Refer to the diagnostic criteria for spleen-kidney deficiency pattern among the “Five Delays” in Pediatrics of Traditional Chinese Medicine. Primary manifestations include slow growth, sparse and yellowish hair, thin physique, poor appetite, and sallowness. Secondary manifestations include irregular stools, flaccid muscles, a pale tongue with a thin white coating, and a deep, slow, weak pulse. Diagnosis requires at least three primary and one secondary manifestation.

1.2 Inclusion Criteria

(1) Meets the above Western medical diagnostic criteria and TCM pattern differentiation criteria; (2) Age 6-16 years; (3) Informed consent obtained from both the child and parents, with parental signed consent form; (4) Bone age examination indicates open epiphyses; (5) No prior growth hormone therapy.

1.3 Exclusion Criteria

(1) Concurrent allergic constitution, precocious puberty, skin diseases, or thyroid dysfunction; (2) Presence of congenital/genetic disorders, neoplastic diseases, or psychiatric conditions; (3) Growth hormone therapy within the past month; (4) Incomplete clinical documentation.

1.4 General Information

All cases in this study were children meeting ISS diagnostic criteria who visited the Traditional Chinese Medicine Department outpatient clinic at Liuzhou People’s Hospital between February 2023 and June 2025. The above study was approved by the Ethics Committee of Liuzhou People’s Hospital. (Approval No.: KY2023-104-02). A retrospective analysis of 120 patients divided them into a treatment group and a control group, each comprising 60 cases. The treatment group included 34 male children and 26 female children. Age ranged from 6 years 6 months to 16 years, with a mean of (12.4 ± 3.1) years. Body weight ranged from 9 to 65 kg, with a mean of (26.5 ± 12.2) kg. The control group comprised 33 male children and 27 female children, with ages ranging from 6 years 5 months to 17 years, mean age (12.6 ± 3.2) years; body weights ranged from 10.5 to 79 kg, mean weight (27.2 ± 13.7) kg. Pre-treatment comparisons showed no significant differences between groups in gender, age, or body weight ($P > 0.05$), indicating comparability (see Table 1).

Table 1. Analysis of General Data for Both Groups

| Group | n | Gender | | Age | Body Mass Index |
|-----------------|----|--------|--------|----------------|-----------------|
| | | Male | Female | | |
| Treatment Group | 60 | 34 | 26 | 12.4 ± 3.1 | 26.5 ± 12.2 |
| Control group | 60 | 33 | 27 | 12.6 ± 3.2 | 27.2 ± 13.7 |
| χ^2/F | | | 0.034 | 0.032 | 0.779 |
| P | | | >0.05 | >0.05 | >0.05 |

2. Treatment Methods

2.1 Control Group

Received lifestyle management only. This involved parents supervising children to achieve balanced nutrition, complete at least one hour of daily exercise (including but not limited to reaching for height, long jump, back stretching, hanging, skipping rope, and outdoor activities), and sleep before 10 PM. All three requirements were fulfilled. Treatment lasted 3 months.

2.2 Observation Group

In addition to lifestyle management, growth patches were applied. The composition and preparation method of our department's growth patches: Cuscuta seed, Bupleurum root, Taxillus chinensis, Ligusticum root, and Mulberry branch. The mixture is sieved through a 100-mesh screen, then blended into a paste with honey water. A 2 cm diameter circle of this paste is applied to a 6 x 7 cm sterile medical patch to form one patch. Acupoint selection: Bilateral Shenshu (BL23), Bilateral Ganshu (BL18), Bilateral Zusanli (ST36) (or Bilateral Yongquan (KI1)), Zhongwan (CV12), and Shenque (CV8). Children with chronic sleep issues may substitute Bilateral Yongquan for Bilateral Zusanli. Application method: Apply patches to all eight locations. Each patch remains in place for 4-8 hours, once weekly, for a total treatment duration of 3 months.

3. Observation Indicators and Statistical Methods

3.1 Observation Indicators

(1) Compare clinical efficacy between the treatment group and the control group post-treatment. Assess changes in children's height and growth velocity before treatment and at 1, 2, and 3 months post-treatment. (2) Compare adverse reactions (e.g., skin itching, blisters) between groups after treatment.

3.2 Statistical Methods

Statistical analysis was performed using SPSS 23.0 software. For continuous variables meeting normal distribution, data were expressed as mean \pm standard deviation ($\bar{x} \pm s$) and analyzed using t-tests. For data not meeting the homogeneity of variance or normal distribution, nonparametric tests were applied. The count data were analyzed using chi-square tests. $P < 0.05$ indicated a statistically significant difference between groups, while $P > 0.05$ suggested no significant difference.

4. Efficacy Criteria and Treatment Outcomes

4.1 Efficacy Criteria

Efficacy criteria were established in reference to the "Guidelines for Clinical Research of New Traditional Chinese Medicines (Trial Implementation)" and categorized into three levels: marked improvement, improvement, and no improvement. Marked improvement: Monthly average growth rate > 0.66 cm. Improvement: 0.5 cm $<$ monthly average growth rate ≤ 0.66 cm. No improvement: Monthly average growth rate ≤ 0.5 cm.

4.2 Comparison of Clinical Efficacy Between Groups Before and After Treatment

The overall response rate in the treatment group was 88.33%, compared to 73.33% in the control group, representing a significant difference between groups ($P < 0.05$) (see Table 2).

Table 2. Comparison of Treatment Efficacy Before and After Therapy (n%)

| Group | Number of Cases | Marked Improvement | Effective | No Effect | Overall Efficacy Rate (%) |
|-----------------|-----------------|--------------------|-----------|-----------|---------------------------|
| Control Group | 60 | 30 | 14 | 16 | 73.33% |
| Treatment group | 60 | 39 | 14 | 7 | 88.33% ^① |

Note. Compared with the control group, ^① $P=0.037$

Before treatment, no statistically significant differences were observed in growth velocity or height between the two groups ($P > 0.05$). At months 1, 2, and 3 of the treatment course, both groups showed significantly higher height gain values and growth rates within their respective groups compared to pre-treatment levels ($P < 0.05$). Furthermore, when comparing height gain values and growth rates between the two groups at the same time points, the treatment group consistently exceeded the control group ($P < 0.05$).

Table 3. Comparison of Height and Height Gain Between Groups Before and After Treatment ($\bar{x} \pm s$)

| Group | n | Ht (cm) | | <i>t</i> | <i>P</i> | HGV (cm) |
|-----------------|----|------------------|-----------------|----------|----------|-------------|
| | | Before Treatment | After Treatment | | | |
| Control group | 60 | 118.39 ± 16.94 | 120.66 ± 16.89 | -17.45 | 0.00 | 2.27 ± 1.01 |
| Treatment group | 60 | 117.29 ± 18.24 | 120.77 ± 18.37 | -17.84 | 0.00 | 3.49 ± 1.51 |
| <i>F</i> | | 0.418 | 0.51 | | | -5.068 |
| <i>P</i> | | 0.73 | 0.97 | | | 0.00 |

Table 4. Comparison of Growth Rates Before and After Treatment Between Two Groups ($\bar{x} \pm s$)

| Group | n | Ht (cm) | | | |
|-----------------|----|------------------|-------------------------|--------------------------|--------------------------|
| | | Before Treatment | 1 month after treatment | 2 months after treatment | 3 months after treatment |
| Control group | 60 | 5.03 ± 0.36 | 11.26 ± 8.96 | 10.01 ± 5.73 | 9.07 ± 4.03 |
| Treatment Group | 60 | 5.00 ± 0.54 | 15.60 ± 11.68 | 14.66 ± 8.16 | 13.94 ± 6.05 |
| Z-value | | 1.86 | -2.274 | -3.475 | -5.068 |
| <i>P</i> | | 0.70 | 0.023 | 0.001 | 0.000 |

4.3 Adverse Reactions

No significant adverse reactions occurred in either group during the treatment period.

5. Discussion

ISS holds a significant position among the various causes of short stature in children and is one of the common etiological factors. Children with ISS may exhibit negative psychological tendencies such as introversion, inferiority, and depression due to their short stature, which can further lead to severe physical and mental health issues. Timely and effective psychosocial intervention has a positive impact on promoting children's mental health and height growth, as well as improving medication adherence and efficacy [4]. The etiology of ISS remains unclear, but current understanding suggests its pathogenesis involves multifactorial, polygenic influences, including genetics, certain regulatory genes, and other factors such as cell cycle inflammation and diet [5]. Research indicates that genetic defects associated with ISS are primarily localized in genes regulating endochondral ossification in the growth plate and those related to the GH-IGF-1 axis [6-8]. Current clinical treatment approaches include pharmacological interventions such as vitamin D, calcium gluconate, recombinant human growth hormone, and compound gamma-aminobutyric acid; surgical interventions like tibial lengthening and periosteal traction of the lower leg; and psychological therapy. While these methods demonstrate some efficacy, overall treatment outcomes remain below expectations.

Traditional Chinese Medicine (TCM) offers unique advantages in treating ISS. TCM classifies ISS based on its clinical manifestations and characteristics under categories documented in classical texts, including "Five Delays," "Five Weaknesses," "Fetal Debility," "Fetal Fragility," and "Dwarfism" [9]. Etiology encompasses both congenital and acquired factors. Congenital causes primarily involve fetal weakness and growth retardation due to prenatal disorders, advanced maternal age, or parental deficiencies in qi, blood, and essence. Acquired factors mainly include adverse intrapartum events like difficult labor or birth injuries, or inadequate postnatal care. Pathological localization primarily involves the spleen and kidney, with collateral involvement of the heart, liver, and lung. The disease pattern is fundamentally deficient, though it may also present with intermingled excess. Therefore, treatment of ISS emphasizes tonifying deficiency while concurrently addressing excess, adhering to the principle of syndrome differentiation.

Research [10, 11] has demonstrated that acupoint plaster therapy (stimulating points such as Shenque, Guanyuan, Zusanli, and Shenshu) elevates serum IGFBP-3 and IGF-1 levels to varying degrees in pediatric patients. This approach stimulates endogenous growth hormone synthesis and accelerates skeletal growth, thereby effectively promoting height increase. Cai Chengsi [12] and colleagues formulated the same prescription into both topical patches and oral Chinese herbal medicine for the combined treatment of ISS. For spleen deficiency cases, modified Shenling Baizhu San was administered orally while also applied as patches to acupoints like Shenque and Zhongwan. For other patterns like kidney yin deficiency or spleen-kidney deficiency, appropriate formulas were similarly selected for oral administration and topical application at corresponding acupoints. Results demonstrated effective improvement in children's body mass and height. Additional studies confirm that oral Chinese herbal decoctions [13], medicinal paste treatments [14], massage therapy [15, 16], acupuncture [17, 18], and bamboo-ring salt moxibustion [19] can all promote pediatric growth and development.

As an external treatment method in traditional Chinese medicine, acupoint plaster application offers unique advantages for managing this condition. Its simplicity, effectiveness, comfort, ease of use, high compliance, safety without toxic side effects, and low cost make it popular among parents and children. When treating ISS with acupoint plaster therapy, medications are absorbed through the skin, delivering therapeutic effects directly to the affected area. This therapy has minimal toxicity and side effects, with sustained drug release that reduces adverse reactions. It compensates for the shortcomings of oral medication, is suitable for specific pediatric populations, and effectively improves treatment compliance in children. Combined with lifestyle guidance, it promotes the development of healthy dietary, exercise, and sleep habits in children. This multidimensional, multi-level regulation facilitates balanced body composition and height growth in pediatric patients.

Results indicate that at observation points after 1, 2, and 3 months of treatment, the treatment group exhibited significantly higher height gains and growth rates than the control group ($P < 0.05$). For children with ISS, adding TCM growth patches to lifestyle management effectively promotes height increase and accelerates growth rate without notable adverse reactions, demonstrating clinical applicability.

The study identified the following limitations: Current TCM treatment for ISS primarily relies on clinical efficacy observations, lacking evaluation through laboratory indicators. Further investigation is needed to explore changes in serum IGFBP-3, IGF-1, and related pathways following TCM treatment. Additionally, the small sample size for clinical observations, coupled with the absence of evidence-based support from large-scale, multi-center, long-term follow-up studies, introduces potential bias in the final results. Future research should focus on enhancing the clinical efficacy of growth patches in treating idiopathic short stature.

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