Application Effect of Debate-Based Teaching Method in Spine Surgery Education

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Abstract: Objective: To analyze the effect of applying the debate-based teaching method in spine surgery education. Methods: The study period spanned from December 2021 to March 2023. Sixty-four (64) interns were selected and randomly assigned into two groups using a random number table: a control group (n=32) and an observation group (n=32). The control group received conventional teaching methods, while the observation group received the debate-based teaching method. Intergroup comparisons were made for interns' rotation exam scores, teaching efficacy, and teaching satisfaction. Results: Compared with the control group, the observation group demonstrated significantly higher rotation exam scores ($P < 0.001$). For all teaching efficacy evaluation indicators — enhanced spatial thinking ability, improved self-directed learning ability, increased learning efficiency, deepened understanding of clinical theory, and heightened learning interest — the observation group scored significantly higher than the control group ($P < 0.001$). Teaching satisfaction in the observation group was also significantly higher than in the control group ($P < 0.05$). Conclusion: The application of the debate-based teaching method in spine surgery education yields significant effects and substantial value. It improves interns' rotation exam scores, enhances teaching efficacy, strengthens self-directed learning ability, increases satisfaction with teaching, and deepens understanding of spine surgery knowledge. It is worthy of widespread application.

Keywords: Debate-based teaching method; Spine surgery education; Rotation exam scores; Teaching efficacy; Satisfaction

1. Introduction

Orthopedics is one of the common clinical departments. During clinical orthopedic education, the related knowledge is complex, highly abstract, and difficult to learn, posing significant challenges to initial comprehension [1]. Within orthopedics, knowledge concerning spinal bony structures and spinal cord neurological function is particularly intricate, representing a major difficulty in clinical orthopedic learning. With the rapid development of the socioeconomy and information technology, clinical education increasingly utilizes digital medical software. This software not only analyzes hospital imaging data and enables the import of individualized data but also possesses robust image processing capabilities. Through model simulation and three-dimensional visual experiences, interns can learn orthopedic-related knowledge more intuitively, thereby enhancing perceptual understanding and improving learning quality and interest. The debate-based teaching method involves using typical clinical cases during instruction, positioning interns as the primary participants and guiding them to engage in discussions centered on these cases. This effectively stimulates their intellectual curiosity, encouraging active participation in teaching activities, fostering learning interest, and cultivating self-directed learning ability [2]. During its implementation, the debate format encourages comprehensive problem analysis while defending one's viewpoint, broadening perspectives, exercising clinical thinking skills, and facilitating a deeper understanding and consolidation of medical knowledge. Based on this rationale, this study enrolled 64 interns between December 2021 and March 2023 to analyze the clinical effects of the debate-based teaching method.

2. Materials and Methods

2.1 General Data

The study period was from December 2021 to March 2023. Sixty-four interns from the Orthopedics Department of our hospital were enrolled. They were randomly assigned using a random number table into two groups of 32 each. The control group comprised 20 male and 12 female interns, aged 20-25 years (mean 22.42 ± 1.28 years). The observation group comprised 18 male and 14 female interns, aged 21-25 years (mean 22.38 ± 1.37 years). Comparison of baseline characteristics (age, gender) between the groups showed no significant differences ($P > 0.05$).

Inclusion Criteria: ① All interns were majoring in Integrated Chinese and Western Medicine; ② Had not previously undergone spine surgery rotation; ③ Voluntarily participated in the study.

Exclusion Criteria: ① Withdrawal from the study midway; ② Poor compliance or low cooperation.

2.2 Methods

Control Group: Received conventional teaching methods. After learning theoretical knowledge, surgical procedures were explained. Instructors then led interns in watching surgical videos and presented follow-up imaging data, prompting interns to evaluate surgical outcomes based on the viewed content.

Observation Group: Received the debate-based teaching method. (1) Instructors selected specific spine surgery conditions from the case database, aligning with the syllabus and actual teaching context. During teaching, instructors elaborated on relevant content using these specific cases. (2) When teaching theoretical knowledge, instructors provided detailed explanations on topics such as the etiology, pathogenesis, diagnostic methods, treatment principles, classification, and differential diagnosis of spinal fractures. For selecting typical cases, instructors could choose AO-classified thoracolumbar fractures. Digital software was used to construct 3D digital models. Leveraging the characteristics of these models, vertebral fracture features (e.g., different angles and types) were demonstrated to interns in detail from multiple perspectives. For example: Using a typical vertebral fracture case, a debate format was adopted with the choice of treatment plan as the theme. Interns were encouraged to freely choose perspectives for debate. Questions included: Is surgical or conservative treatment preferable? If surgical, is open reduction and internal fixation superior or is minimally invasive surgery better? Interns formed groups based on their chosen stance and collected relevant materials. Before the end of the preparatory session, instructors assigned the topic, allowing interns time (typically 3 days) to gather debate materials. Subsequently, debates were conducted based on the selected viewpoints. During the debate, instructors evaluated and scored interns' presentations. Additionally, after the debate, both groups of interns used biomechanical analysis software to evaluate treatment efficacy based on the discussed plans, thereby consolidating their learning outcomes.

2.3 Observation Indicators

(1) Rotation Exam Scores: Comprising three parts: case analysis exam, basic theory exam, and total score. Both the case analysis exam and basic theory exam were scored out of 50 points each [3].

(2) Teaching Efficacy: Evaluated using indicators (each scored out of 10 points): enhanced spatial thinking ability, improved self-directed learning ability, increased learning efficiency, deepened understanding of clinical theory, and heightened learning interest. Higher scores indicated better teaching efficacy.

(3) Teaching Satisfaction: Assessed using a self-designed satisfaction survey scale (total score: 100 points). Scores ≥90 indicated "very satisfied," scores between 70-89 indicated "satisfied," and scores ≤69 indicated "dissatisfied." Teaching satisfaction rate = (very satisfied rate + satisfied rate).

2.4 Statistical Analysis

Statistical analysis was performed using SPSS 25.0 software. Continuous variables conforming to a normal distribution are expressed as mean ± standard deviation ($\bar{x}\pm s$) and compared using the t-test. Categorical data are expressed as frequency (percentage) (n, %) and compared using the chi-square (x^2) test. A P-value < 0.05 was considered statistically significant.

3. Results

3.1 Comparison of Rotation Exam Scores Between Groups

Compared with the control group, the observation group demonstrated significantly higher scores in all components of the rotation exam (P < 0.001). Table 1.

Table 1. Comparison of Rotation Exam Scores Between Groups [x̄±s, score]

Group	N	Case analysis exam	Basic theory exam	Total score
Control	32	40.03±3.59	40.09±3.93	80.13±4.17
Observation	32	47.09±1.67	47.00±1.10	94.09±2.06
t-value	-	10.073	9.569	16.969
P-value	-	<0.001	<0.001	<0.001

3.2 Comparison of Teaching Efficacy Between Groups

For all teaching efficacy evaluation indicators, the observation group scored significantly higher than the control group

(P < 0.001). Table 2.

Table 2. Comparison of Teaching Efficacy Between Groups [x̄±s, score]

Group	N	Spatial thinking ability	Self- learning ability	Learning efficiency	Under standing of clinical theory	Learning interest
Control	32	7.21±0.49	7.26±0.41	7.32±0.66	7.60±0.35	7.41±0.37
Observation	32	9.03±0.53	8.67±0.57	9.00±0.63	8.79±0.52	8.81±0.63
t-value	-	14.180	11.279	10.334	10.608	10.763
P-value	-	<0.001	<0.001	<0.001	<0.001	<0.001

3.3 Comparison of Teaching Satisfaction Between Groups

Teaching satisfaction was significantly higher in the observation group than in the control group (P < 0.05). Table 3.

Table 3. Comparison of Teaching Satisfaction Between Groups [n (%)]

Group	N	Dissatisfied	Satisfied	Very satisfied	Satisfaction
Control	32	8 (25.00)	14 (43.75)	10 (31.25)	24 (75.00)
Observation	32	2 (6.25)	10 (31.25)	20 (62.50)	30 (93.75)
x2-value	-	-	-	-	7.600
P-value	-	-	-	-	<0.05

4. Discussion

Spine surgery diseases involve multiple disciplines, including anatomy, pathology, imaging, and biomechanics. The related knowledge is abstract and specialized. For interns encountering this knowledge for the first time, it can be obscure and challenging to learn. Traditional teaching methods, predominantly didactic lectures, have historically been used in spine surgery education. These methods often rely on cadavers, anatomical atlases, physical models, and multimedia slides. Interns lack a strong intuitive sense during learning, and these tools have poor operability, making it difficult to accurately represent the complex structures of the spine and spinal cord. Consequently, interns struggle to grasp theoretical knowledge of spine surgery diseases through these tools, potentially dampening learning motivation and interest. With the rapid development of education, more teaching methods are being applied in clinical education, such as Problem-Based Learning (PBL). While PBL can enhance learning interest, it often remains a form of one-way instruction, neglecting the central role of interns and failing to fully mobilize their initiative.

The results of this study indicate that the observation group had significantly higher rotation exam scores compared to the control group (P < 0.001). For all teaching efficacy evaluation indicators, the observation group scored significantly higher than the control group (P < 0.001). Teaching satisfaction was also significantly higher in the observation group (P < 0.05). This demonstrates that the application of the debate-based teaching method in spine surgery education yields significant effects and substantial value: it improves interns' rotation exam scores, enhances teaching efficacy, strengthens self-directed learning ability, increases teaching satisfaction, and deepens understanding of spine surgery knowledge. Analysis of the reasons: The debate-based teaching method is a novel pedagogical approach. Teaching through debate effectively replicates the specific procedures of clinical work within educational activities, allowing interns to comprehend theoretical knowledge through practice in a simulated scenario, thereby improving learning effectiveness. Furthermore, during the implementation of this method, instructors can gauge interns' learning levels and identify practical shortcomings during the debates, ensuring targeted subsequent teaching. Therefore, employing the debate-based teaching method in spine surgery education, combined with digital software to explain theoretical knowledge, and then using the choice of different treatment plans as debate topics allows interns to select their preferred approach and gather supporting evidence. Following the debate, instructors use digital software to verify and simulate each treatment plan, enabling interns to objectively analyze each option through biomechanical analysis.

5. Conclusion

In conclusion, the debate-based teaching method demonstrates significant effectiveness in spine surgery education. It improves interns' rotation exam scores, enhances self-directed learning ability, deepens understanding of spine surgery knowledge, increases teaching efficacy, and boosts satisfaction. It is worthy of widespread application.

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