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Research Progress of Core Training in Tennis

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Abstract. This study systematically reviewed the research status of core training in tennis at home and abroad, analyzed its main forms, development trends and effects on tennis performance, to provide reference for training practice and related research. On March 5, 2026, a systematic search was conducted in the China National Knowledge Infrastructure (CNKI), SPORTDiscus, PubMed and Web of Science databases, and experimental studies were included if the subjects were tennis players or tennis participants, core training was the main intervention, and at least one outcome indicator of core capacity, general physical fitness or tennis-specific performance was reported. A total of 18 studies published from 2007 to 2025 were included, 8 in Chinese and 10 in English. The core training in the included studies mainly included traditional core strength training, unstable core training and compound core training, showing an overall trend from basic strength and stability training toward instability, functionalization, sport specificity and combination. Existing studies showed that core training can improve general physical fitness such as balance, agility and lower-limb explosive power to a certain extent, as well as sport-specific performances such as serve velocity, serve stability, stroke velocity and stroke stability. Overall, core training has become an important part of tennis physical training, but existing studies still differ in training programs, subjects and evaluation indicators. Future studies should compare the sport-specific effects of different training modes, clarify the training dose-effect relationship, and strengthen research on high-level professional tennis players to improve the scientificity and pertinence of core training programs.

Keywords: tennis, core training, core strength, core stability, sports performance

1. Introduction

Tennis is a racket sport with obvious intermittent characteristics, including frequent acceleration, deceleration, sudden stops, changes of direction, repeated hitting and other high-intensity actions, which place high demands on players' strength, explosive power, dynamic balance and body coordination [1]. During serving and forehand and backhand strokes, force starts from the lower limbs pushing against the ground and is transmitted through the hips and trunk to the upper limbs and racket, forming a continuous kinetic chain; therefore the trunk not only needs to maintain stability during high-speed movement, but also undertakes the important role of connecting the upper and lower limbs and transmitting force [2, 3]. The core usually refers to the lumbo-pelvic-hip complex of the human body and its related muscle groups; its functions cover maintaining the

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stability of the spine and trunk, controlling body posture and transmitting force between the upper and lower limbs; core strength reflects the ability of the core muscles to produce and resist force, while core stability emphasizes the ability to maintain trunk stability under neuromuscular control [4]. Existing intervention studies have shown that core training can improve the physical function performance of tennis players: Majewska et al. conducted 6 weeks of core training on 160 adult tennis players, and their total Functional Movement Screen (FMS) score and core stability indicators such as trunk lateral flexion, abdominal and trunk extensor endurance all improved significantly ($p<0.001$) [5]; domestic studies also found that core training can improve core strength indicators and increase serve velocity [2, 6, 7], and some studies also observed improvements in balance, agility and stroke-related indicators [8-10].

Although existing studies have provided some empirical evidence for the relationship between core training and tennis performance, there are still limitations: the research subjects cover multiple groups such as adolescents, college athletes and professional athletes, while studies on high-level professional athletes are relatively few [4, 8, 11-13]; training programs lack unified standards, and training methods, cycles (5–16 weeks), frequencies and load arrangements vary greatly [9, 13-15]; evaluation indicators are relatively scattered, covering general fitness indicators such as balance, agility and lower-limb explosive power and sport-specific indicators such as serve velocity, stroke velocity, serve accuracy and stroke stability [2, 6, 10, 11], with inconsistent testing methods and evaluation dimensions, making it difficult to directly compare the results of different studies, and it is still difficult to form operational training guidance. On this basis, this study systematically reviewed the existing literature on tennis core training, summarized the evidence in terms of training forms, development trends and sports performance, so as to clarify the research progress and provide reference for training practice and research.

2. Methods

This study conducted a systematic literature search on March 5, 2026 in the databases of China National Knowledge Infrastructure (CNKI), SPORTDiscus, PubMed and Web of Science. According to the principle of Boolean logic retrieval, the search terms were divided into two core concepts, "tennis" and "core training": the Chinese databases used subject terms such as tennis, tennis player, racket sports, core training, core stability, core strength and trunk stability; the English databases used subject terms such as Tennis, tennis player, racket sports, core training, core stability, core strength and trunk stability, with synonym expansion retrieval.

2.1. Inclusion and exclusion criteria of literature

To improve the standardization and repeatability of the literature screening process, this study formulated the inclusion and exclusion criteria according to the PICOS (Population, Intervention, Comparator, Outcome, Study Design) framework. The inclusion criteria are as follows:

(1) The subjects were tennis players, tennis-major students or tennis participants with certain tennis training experience, regardless of age, sex and competitive level.

(2) The studies adopted core training as the main intervention, including core strength training, core stability training, core endurance training, core training under unstable support conditions, and compound training with core training as the main component.

(3) The studies set up control groups or conventional training groups, or adopted before-after self-comparison for comparison.

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(4) At least one outcome indicator related to core capacity, general physical fitness or tennis-specific performance was reported, including core strength or stability, balance, agility, explosive power, serve velocity, stroke velocity, stroke accuracy, stroke stability or other tennis-specific performance indicators.

(5) The full text could be obtained, and basic information such as research subjects, training content, training cycle, training frequency and main results could be extracted.

The exclusion criteria are as follows:

(1) The research subjects did not meet the above inclusion criteria;

(2) Core training was not the main intervention or the intervention content could not be clarified;

(3) Non-original studies such as cross-sectional analyses, reviews, meta-analyses, conference abstracts, study protocols and expert comments;

(4) The full text could not be obtained or the information was insufficient to extract key data.

3. Results

According to the established literature search strategy, 2013 records were obtained in the initial search; after deduplication, preliminary screening was carried out according to titles and abstracts, and then full-text re-examination was carried out according to the pre-established inclusion and exclusion criteria. Finally, 18 qualified studies were included; the literature search and screening process is shown in Figure 1, and the participant and core training characteristics of the included studies are shown in Table 1.

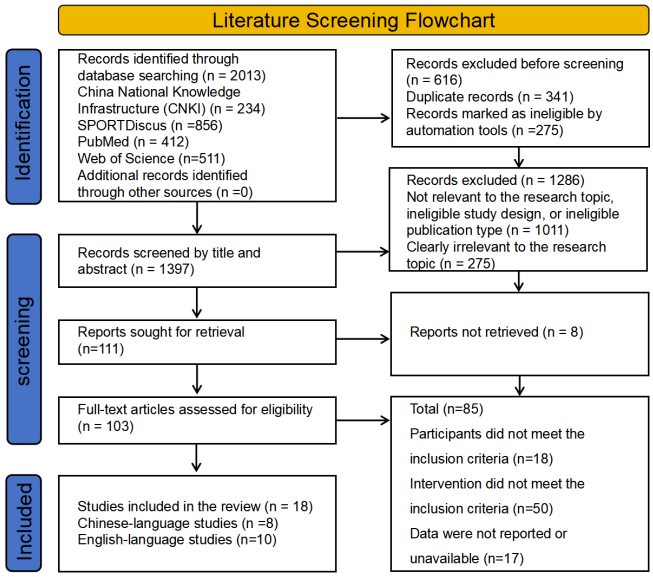


Figure 1. Flow chart of the literature screening process

The 18 included studies were published from 2007 to 2025, including 8 in Chinese [2, 6-9, 13, 16, 17] and 10 in English [5, 10-12, 14, 15, 18-21]; the research designs included 10 randomized controlled trials [5, 7, 9, 10, 12, 13, 18-21], 5 non-randomized controlled trials [2, 6, 8, 15, 16] and 3 pre-post experimental designs [11, 14, 17]. 17 studies reported sample sizes, with a total of about 600 subjects, covering males and females, aged 10–53 years [5-8, 10-12, 15, 19-21], with competitive levels from junior amateurs to high-level groups such as national first/second-grade athletes, provincial team and university athletes [5-8, 10-13, 15, 18, 19], involving 6 countries: the United States, China, Spain, India, Turkey and Poland [5-15, 18-21].

DOI: 10.54254/2753-7048/2027.39236

Table 1. Participant and core training characteristics of the included studies

Author/ (Year)	Country	Participant age	Participant sex	Sample size	Participant training level	Core training content	Training parameters	Outcome indicators
Samson (2007)	United States	Not specified	Not specified	Not specified	College tennis players (Division III)	5-week core stabilization training (three-level progression, including Swiss ball, medicine ball, elastic band)	3 times/week, low-load progression (isometric contraction → unstable resistance)	SEBT dynamic balance (8 directions)
Zhiwu Zhang (2010)	China	Not specified	Not specified	20	College tennis-major students (second grade or above)	12 core strength training exercises (Swiss ball, balance disc, etc.)	14 weeks, 3 times/week, 30 min/session, moderate intensity	Serve velocity, forehand stroke velocity
Barber-Westin (2010)	United States	13.0±1.5 years (11-16 years)	10 females/5 males	15	Junior competitive tennis players (≥2 years of experience)	6-week neuromuscular training (core + plyometric + agility)	3 times/week, 90 min/session, abdominal repetitions progressing from 150 to 300	Single-leg hop, moving stroke count, shuttle run, abdominal endurance
Qiang Shao (2011)	China	Not specified	Not specified	24	College tennis team in Xi'an (first grade or above)	6-week balance + core muscle group training (bodyweight exercises, elastic ball)	4 times/week, 60 min/session, relatively high intensity	Stroke stability (serve, forehand and backhand)
Fernandez-Fernandez (2013)	Spain	14.2±0.5 years	Male	30	Junior male national ranking (training 8-10 h/week)	6-week core (crunch/plank) + elastic band + medicine ball throwing	3 times/week, 60-70 min, 2 sets × 20 reps or 20 s	Serve velocity, serve accuracy, shoulder range of motion
Changxi Fu (2014)	China	Target group 18.5±1.5 years	Male	16	Provincial team males (Jiangsu Team 2, first grade, about 13.5 years)	12-week sling exercise training (SET, 10 exercises, 4 circuits)	2 times/week, based on completed sets, progressive difficulty	Static balance (sway velocity), trunk core stability, standing triple jump

DOI: 10.54254/2753-7048/2027.39236

Table 1. (continued)

Hongxin Chen (2015)	China	Experimental group 18.2±1.9 years; control group 17.9±2.2 years	Males and females (number unclear)	23	College tennis majors (second grade)	9-week three-stage core (stable → unstable → complex unstable)	3 times/week, about 30 min, progressive difficulty	Core strength indicators (supine leg raise, etc.), serve accuracy, ball velocity, volley
Yun Fan (2018)	China	C group 22.3±2.2 years; CR group 22.6±3.2 years; CON group 21.9±2.9 years	Female	24	High-level female tennis players (first grade, playing >8 years)	6-week core training (C group) or core + resistance (CR group)	3 extra sessions/week, 90 min in total, progressive load (balance disc, barbell, etc.)	ITN five tests (depth, accuracy, volley, serve, mobility) and ITN total score
Bashir (2019)	India	Experimental group 15.2±0.41 years; control group 15.53±1.06 years	Not specified	30	Indian adolescents (≥1 year of experience, national/ international level)	5-week core training (4 levels, Swiss ball, medicine ball, elastic band)	3 times/week, based on completed sets/repetitions, progressive load	T-test (agility), SEBT (8 directions)
Min Ni (2021)	China	Experimental group 15.54±0.71 years; control group 15.48±0.61 years	16 males/8 females	24	College tennis team (about 6 years, second grade)	Core strength training (Swiss ball, etc.)	16 weeks, 3 times/week, 45 min, moderate intensity	Eight-level abdominal bridge, maximal strength of upper and l ower limbs, SEBT, forehandvelocity and placement control
Egesoy (2021)	Turkey	10-14 years (mean 11.75)	21 males/15 females	36	Adolescents (≥3 years of experience, regular training)	8-week static or dynamic core (plank, Russian twist, etc.)	2 times/week, 25-30 min, increasing in three stages (20 → 40 s)	Vertical jump, flexibility, grip strength, 10 m sprint, Y balance, medicine ballthrow, serve velocity
Jian Wang (2022)	China	Experimental group 24.72±3.16 years;	Not specified	40	College tennis team	12-week progressive core (three stages,	3 days/week, based on completing 5 sets,	Serve velocity,

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Table 1. (continued)

Jian Wang (2022)	China	control group 23.15±2.94 years	Not specified	40	(training about 7 years)	more than 20 exercises)	sets to exhaustion, 60 s between sets	integrated EMG values (5 muscles)
Wenyi Xia (2022)	China	Not specified	Not specified	20	Second-grade tennis players in Shandong Province	Core strength training (small barbell, rubber bands, etc.)	Not specified (only described as combined with traditional strength training)	Core stability, forehand stroke power, coordination
Majewska (2022)	Poland	20.27±1.68 years (18-23)	74 females/86 males	160	Adult amateurs (regional/ national level, 1-3 or more than 4 years)	6-week core stability training (daily, squat, plank, burpee, etc.)	Daily, based on completion, no quantified load	FMS total and individual scores, core endurance (side bridge, abdominal, back extension)
Huang (2023)	China	Experimental group 21.5±2.3 years; control group 22.3±1.4 years	Male	30	Male college students (training about 5 years)	8-week core strength (two stages, 16 exercises in total)	3 times/week, 60 min, 3 sets × 15-20 reps, 180 s rest between sets	Stroke accuracy (stationary/moving /serve) and velocity
Gergüz (2023)	Turkey	Yoga group 12.10±3.54 years; control group 11.95±3.54 years	20 males/20 females	40	Adolescents (≥1 year, ≥4 h/week)	8-week telerehabilitation yoga (Zoom, sun salutation, core poses, balance poses)	2 times/week, 50 min, moderate intensity	Eight-level abdominal bridge, flexibility, flamingo balance, Y balance, upper limb stability, body awareness, SF-36
Esrever (2024)	United States	Core group 43.2±9.66 years; control group 42.0±6.69 years	Core group 13 males and 7 females; control group 11 males and 10 females	41	Tennis players (>5 years, ≥3 times/week, ≥1.5 h/session)	8-week core stability training (isometric activation, side bridge, superman, plank, etc.)	3 times/week, completed by sets/repetitions, moderate intensity	VAS pain, shoulder isokinetic strength, core endurance, supraspinatus ultrasound (thickness/ fiber length)
Bangari (2025)	India	Experimental group 12.8±0.6 years;	Male	17	Junior male national ranking	12-week integrated core and plyometric training (6 stages,	3 times/week, progressive sets/repetitions,	ITN score, Pro-Agility, squat jump/ countermovement

DOI: 10.54254/2753-7048/2027.39236

Table 1. (continued)

Bangari (2025)	India	control group 13.1±0.7 years	Male	17	(≥2 years, local tournaments)	Swiss ball, medicine ball, box jump, etc.)	medicine ball 2-6 kg, rest 45 s-3 min	jump, SEBT composite score

Note: SEBT, Star Excursion Balance Test; SET, Sling Exercise Training; C, Core Training Group; CR, Core and Resistance Training Group; CON, Control Group; ITN, International Tennis Number; FMS, Functional Movement Screen; SF-36, 36-Item Short Form Health Survey; VAS, Visual Analog Scale.

3.1. Main forms and measurement indicators of core training in tennis

The training content and implementation characteristics of the included studies are shown in Table 2. All 18 studies used core strength/stability training as the intervention, which can be divided into three types according to the training environment and movement characteristics: traditional core training (static/dynamic movements with bare hands or simple equipment, focusing on the strength and endurance of superficial large muscle groups) [5, 7, 10, 19, 21], unstable training (creating unstable environments with Swiss balls, balance discs, sling devices, etc., focusing on the activation of deep stabilizing muscle groups and neuromuscular control) [9, 14, 18, 20] and compound/sport-specific core training (combined with plyometrics, resistance, medicine balls or tennis-specific movements) [6, 12, 13, 15, 16]. The training cycles were mostly 6–12 weeks (ranging from 5 to 16 weeks), the frequencies were mostly 2–3 times per week, and the intensity mostly adopted progressive load design from stable to unstable, from static to dynamic, and from basic to sport-specific [7].

The outcome indicators were mainly divided into five categories: core strength/endurance indicators (eight-level abdominal bridge, side bridge, abdominal and back extensor muscle endurance tests) [5, 6]; tennis-specific performance indicators (serve velocity, forehand stroke velocity, serve accuracy, stroke placement control and ITN skill test scores) [2, 10, 13]; balance and stability indicators (SEBT, Y balance, flamingo balance test) [8, 14, 18, 20]; general fitness indicators (T-test, vertical jump, 10 m sprint, medicine ball throw distance, FMS) [5, 11, 15]; and other auxiliary indicators (shoulder rotator strength, supraspinatus ultrasound structure, VAS pain score, integrated EMG value, body awareness questionnaire, SF-36 scale) [7, 20, 21].

Table 2. Main forms and implementation characteristics of core training

Indicator	Traditional core strength training	Unstable platform training	Compound training
Common exercises	Crunch, plank, side bridge, superman, bird-dog	Swiss ball support/crunch, sling side bridge/push-up, balance board single-leg squat	Core exercises + depth jump/medicine ball throw/elastic band resistance/agility ladder
Cycle and frequency	5-16 weeks; 2-3 times/week	5-14 weeks; 2-3 times/week	6-12 weeks; 3 times/week
Equipment requirements	Mainly bodyweight, dumbbells and elastic bands can be added for progression	Requires special equipment such as Swiss balls, sling devices, balance discs/BOSU balls	Requires various combinations of Swiss balls, medicine balls, elastic bands, boxes, etc.
Training results	① Serve velocity ↑5%-23.1%; ② Static anti-flexion/anti-rotation stability;	① Activating deep muscle groups to optimize force transmission;	① Best for explosive power, ITN level ↑32%;

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Table 2. (continued)

Training results	③ Muscle endurance ≥137 s	② Dynamic balance ↑15%, left-right difference ↓71%; ③ Dynamic anti-disturbance stabilizing the spine	② Sport-specific dynamic stability ↑6.1 points; ③ Endurance ↑76%, simulating competition rhythm
Selection suggestions	Limited budget/beginners/rapid strength gain	Targeting balance, proprioception, deep stability	High competitive level/sufficient training time/pursuing comprehensive transfer

Note: ITN, International Tennis Number

3.2. Effects of core training on tennis performance

3.2.1. Effects of core training on general physical fitness

In terms of balance ability, after 5 weeks of progressive core stability training, Samson et al. found that the SEBT scores in all 8 directions of the experimental group were significantly improved compared with before training [14]; Changxi Fu et al. conducted 12 weeks of sling training on male provincial team tennis players, and the static balance ability of the dominant leg and the non-dominant leg improved by 12.7% and 23.6% respectively (both $p<0.01$), and the difference in bilateral sway velocity decreased by 71% [8]; after 5 weeks of core training on Indian adolescents, Bashir et al. found that all 7 directions of SEBT in the experimental group were significantly improved ($p<0.05$) [18]. Studies using unstable training such as Swiss balls, balance discs and single-leg support also obtained similar results [6, 9].

In terms of agility, multiple studies adopted traditional core training, unstable core training and compound core training as interventions, and the results all showed improvement in athletes' agility run performance [11, 15, 18], indicating that core training has a positive effect on fast changes of direction and body control ability. Bangari et al. found that after 12 weeks of integrated core and plyometric training, the Pro-Agility test performance of adolescent tennis players improved significantly (-0.23 s, $p=0.004$), and the improvement of ITN skills was moderately positively correlated with the improvement of agility ($r=-0.52$) [15].

In terms of lower-limb explosive power, most studies adopted medicine ball training, multi-joint functional training and compound core training as interventions, and the results showed improvements in athletes' vertical jump height, standing long jump and lower-limb explosive capacity [11, 19], suggesting that core training can promote the improvement of lower-limb strength performance.

3.2.2. Effects of core training on tennis-specific performance

The main training effects corresponding to different training methods are shown in Table 3. In terms of serve velocity, multiple intervention studies reported significant improvements: after 14 weeks of core strength training, Zhiwu Zhang et al. found that the experimental group's serve velocity increased by 9.26% and forehand stroke velocity increased by 8.24%, superior to the traditional physical fitness training group [2]; Fernandez-Fernandez et al. conducted 6 weeks of combined core, elastic band and medicine ball training on junior male players, and serve velocity increased by 4.9% ($p=0.0001$) [12]; after 12 weeks of progressive core training, Jian Wang et al. increased serve velocity from 108.45±11.23 km/h to 133.73±15.62 km/h (an increase of 23.31%, $p<0.05$) [7];

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Egesoy et al. found that the serve velocity of the static and dynamic core training groups increased by 5.96% and 6.24% respectively, both superior to the control group (0.72%) [19]. In terms of stability, after 6 weeks of balance and core muscle training, Qiang Shao et al. found that the serve stability of both left and right sides improved significantly ($p<0.05$), but the forehand and backhand stroke stability showed no significant improvement [16]; Hongxin Chen also found that core training can significantly improve serve accuracy and forehand and backhand drive and volley performance [9].

In addition, other studies found that core training can improve stroke stability, stroke accuracy and the quality of sport-specific movements [6, 10]. Huang et al. conducted 8 weeks of core strength training on male college tennis players, and the experimental group was significantly superior to the control group in the accuracy and velocity of multiple skills such as stationary backhand crosscourt, moving forehand crosscourt and down-the-line, moving backhand crosscourt and down-the-line, and serving ($p<0.05$) [10]. Studies also found that the effect of combined core and resistance training was superior to core training alone [13], and core training also had positive effects on pain relief and muscle structure repair in athletes with rotator cuff injuries [21].

Overall, existing studies are fairly consistent on the improvement of tennis players' performance by core training; balance ability, serve velocity and serve and stroke stability are the effect indicators most concentrated in current research; agility and lower-limb explosive power have also been reported to improve in many studies.

Table 3. Effects of core training on the performance of tennis players

Performance category	Main evaluation indicators	Main training methods	Main research results
General fitness	Balance ability	Core stability training, unstable platform training, single-leg support	Improvement in indicators such as SEBT and Y balance
General fitness	Agility	Traditional core training, unstable core training, compound training	Improvement in T-test, agility run and other results
General fitness	Lower-limb explosive power	Medicine ball training, multi-joint functional training, core + plyometric training	Improvement in vertical jump, standing long jump and other indicators
Sport-specific performance	Serve velocity	Unstable core training, sport-specific core training, core + resistance training	Serve velocity improved
Sport-specific performance	Serve/stroke stability	Core stability training, core + balance training, compound training	Improvement in serve accuracy, stroke stability, etc.
Sport-specific performance	Stroke velocity	Core strength training, compound/sport-specific training	Improvement in forehand stroke velocity and sport-specific technique performance

Note: SEBT, Star Excursion Balance Test

4. Discussion

This study systematically reviewed and analyzed 18 studies on tennis core training published from 2007 to 2025, and summarized the main findings from the three dimensions of training forms, development context and sports performance. The included studies show that tennis core training has gradually developed from the early focus on traditional core strength training to a multi-type training pattern in which traditional core training, unstable platform training and compound training coexist; the training concept has gradually shifted from simply pursuing the strength of core muscle groups to emphasizing neuromuscular control, dynamic stability and sport-specific movement transfer. In terms of training effects, research generally supports that core training has improving

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effects on general fitness indicators of tennis players such as balance, agility and lower-limb explosive power, and also has positive effects on sport-specific performances such as serve velocity, stroke velocity and stroke stability. These findings indicate that core training has become an indispensable part of the tennis physical training system, and also provide a reference basis for formulating targeted core training programs for athletes of different competitive levels.

4.1. Development trends and characteristics of tennis core training research

From the publication time and content of the included studies, domestic and foreign research on tennis core training shows a clear evolutionary path: from isolated strengthening of core muscle group strength, gradually developing to controlling trunk stability under unstable conditions, and then moving toward integrated training that embeds core function into the kinetic chain and tennis-specific movements [2, 14]. Early studies focused on traditional core strength and stability training with basic movements such as bridges and crunches, emphasizing the absolute strength and static holding capacity of core muscle groups [2, 14]; with the deepening of understanding, unstable training with Swiss balls, balance discs, sling devices and so on gradually became a hot spot, the training goal shifted from increasing strength to maintaining stability under dynamic unstable conditions, and researchers began to pay attention to the neuromuscular control of core muscle groups and its influence on balance and dynamic postural control [8, 9, 11-13, 18]; in recent years, core training has further developed toward functionalization, sport specificity and combination, and through combination with plyometric training, medicine ball throwing, multi-joint resistance and tennis-specific movements [6, 10, 15, 21], pursues the effective transfer of core function to sport-specific performances such as serving, stroking and moving [20]. This evolution reflects that the training concept has shifted from focusing on the core muscle groups themselves to focusing on their role in actual sports situations: in the early stage, the core was regarded as an independent whole, and isolated exercises were used to enhance absolute strength [13, 19]; later it was recognized that the main function of the core is to maintain stability and transmit force during dynamic movement [20]; compound training further integrates core function into complete movement patterns, consistent with the direction of sports training science from "segmented training" to "integrated training" [15].

4.2. Intervention effects of tennis core training and related mechanisms

Through the review of the included studies, it can be found that domestic and foreign research generally believes that core training can promote the improvement of tennis players' performance [2, 6-8, 10, 15]. Most studies believe that after 6–12 weeks of core training intervention, athletes' balance, agility and lower-limb explosive power are improved to varying degrees [5, 11, 14, 18], and serve velocity, stroke stability and sport-specific technique performance are also improved [12, 19, 21]; traditional core training, unstable core training and compound/sport-specific core training have all achieved certain effects, among which unstable and sport-specific core training are increasingly widely used [6, 8, 9, 14, 20]. But there are still differences between studies: some studies showed that core training can significantly improve serve velocity and sport-specific performance [2, 7, 10, 12], while a few studies did not find significant improvement in some sport-specific indicators [16]; this difference may be related to differences in subject level, training cycle, training content and evaluation indicators, so the optimal training program for different training methods cannot yet be fully determined.

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Based on existing research results, it can be considered that the core muscle groups are located at the center of the human kinetic chain and play an important role in the transmission of force between the upper and lower limbs [1, 3]. Core training can improve trunk stability and enhance body control ability, so that the force generated by the lower limbs can be transmitted to the upper limbs more effectively, thereby improving the quality of movement completion [6, 17].

In addition, unstable training can increase the participation of deep core muscle groups, improve neuromuscular control ability and proprioception level [8], and enable athletes to maintain better body posture during fast changes of direction and stroking [18], which may be an important reason for the improvement of balance ability and sport-specific performance.

5. Summary and outlook

Overall, existing evidence has preliminarily shown that core training is an effective means to improve tennis players' general fitness and sport-specific performance, and the training methods are developing toward instability, sport specificity and combination. However, current research still has shortcomings: first, sample sizes are generally small; most experiments included only 10–30 subjects, and the sample representativeness and the generalizability of conclusions are limited [8, 15, 18]; second, the reporting of age and sex characteristics is insufficient; some studies described age in general terms, or did not clearly report sex composition or analyze sex differences [2, 7, 14, 16-18]; third, the training cycles are short, mostly concentrated in 6–12 weeks, lacking long-term follow-up [11, 12, 19, 21]; fourth, the research subjects are mainly adolescents and college tennis-major students, and the representation of high-level professional athletes is insufficient [2, 6, 7, 9, 10]; fifth, the training content, frequency and evaluation indicators vary greatly, affecting horizontal comparison [11, 14].

Future studies should expand sample sizes, standardize the reporting of age and sex and conduct stratified studies, explore the differential effects of different training modes, cycles and doses on sport-specific performance, strengthen the combination of core training with sport-specific movements such as serving, stroking and moving, extend the intervention period and carry out long-term follow-up, and at the same time pay attention to the comprehensive application of core training in injury prevention, fatigue recovery and competitive performance improvement, so as to form more operational training programs.

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