



Effects of Meditation on the Soles of the Feet on the Aggressive and Destructive Behaviors of Chinese Adolescents with Autism Spectrum Disorders

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Abstract

Objectives Adolescents with autism spectrum disorder (ASD) display a variety of verbally aggressive, physically aggressive, and destructive behaviors. *Meditation on the Soles of the Feet (SoF)* as an informal mindfulness-based practice has been effective in managing aggressive behaviors in adolescents with ASD. The aim of this study was to assess its effectiveness and social validity in a Chinese context.

Methods Mothers of three Chinese adolescents with ASD were taught a basic foundational meditation practice, followed by instructions in the SoF practice. Once proficient in these two practices, the mothers taught their adolescents with ASD to use SoF for triggers of their aggressive and destructive behaviors. The mothers rated the social validity of the SoF practice.

Results Visual analysis and weighted average Tau-U scores across participants showed that the SoF practice had a very strong effect on reducing the verbally aggressive, physically aggressive, and destructive behaviors of the three adolescents.

Conclusions Data regarding effectiveness and social validity indicated that the SoF practice was effective and socially valid as a self-management practice for aggressive and destructive behavior of adolescents with ASD. Further studies of the SoF practice are needed to validate its effectiveness for Chinese children with ASD.

Keywords Meditation on the soles of the feet · Adolescents with autism spectrum disorder · Verbal aggression · Physical aggression · Destructive behaviors

Autism spectrum disorder (ASD) is a pervasive developmental disorder characterized by core deficits in social communication and repetitive and restrictive behavioral patterns, interests, or activities (American Psychiatric Association 2013). The global prevalence of ASD is estimated to be as high as 2% and is perhaps as high as 3% in some countries (i.e., 2.64% in South Korea, Wright 2018). In China, with its 1.4 billion population (Worldometers 2018), the estimated number of people with ASD might be as high as 20 to 30 million

people. This is a complex lifelong developmental disability that creates tremendous educational challenges and therapeutic difficulties for individuals with ASD.

Currently, an increasing number of Chinese adolescents with ASD have been enrolled in special education or regular schools in which aggressive and destructive behaviors are not tolerated (Xu et al. 2016). Challenging behaviors, especially aggressive or destructive behaviors, often result in a low level of academic engagement and hinder the development of independence in school, home, and community settings. According to a national survey of teachers and professionals working with adolescents with ASD, verbally aggressive or physically aggressive behaviors, and destructive behaviors are listed as the top concerns in current teaching and therapy practices (China Association of Persons with Psychiatric Disability and their Relatives 2014). Current research indicates that aggressive and destructive behaviors are related to multiple negative outcomes for children and adolescents with ASD, including impaired social skills, a lack of friends, elevated stress levels, reduced opportunities for education/

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therapy services, and negative impact on family quality of life (Fitzpatrick et al. 2017).

There are generally three types of treatment for aggressive and destructive behaviors in adolescents with ASD. First, intervention strategies derived from applied behavior analysis form the basis of behavioral treatment for aggressive and destructive behaviors and demonstrate effective outcomes (Singh et al. 2011a). These behavioral treatments normally include functional behavior assessments to understand the function of aggressive or destructive behaviors, development of multiple reinforcement strategies (e.g., a token economy, differential reinforcement techniques, non-contingent reinforcement strategies), or functional communication training to reduce aggressive or destructive behaviors (Fitzpatrick et al. 2017). However, the current literature shows that the effects of behavioral treatment vary and is difficult to maintain in the long term (Singh et al. 2011a).

Second, pharmacological treatment has long been used to deal with aggressive and destructive behaviors in adolescents with ASD. Second-generation antipsychotics (e.g., risperidone, aripiprazole, clozapine, olanzapine, quetiapine, ziprasidone, and paliperidone) have shown promise in reducing aggressive and destructive behaviors. However, evidence for the pharmacological treatment of refractory aggression is limited, and long-term maintenance effects are rare (Adler et al. 2014; Siegel and Beaulieu 2011). Moreover, the neurobiological underpinnings of aggressive and destructive behaviors in adolescents with ASD remain unclear (Singh et al. 2011a).

Third, mindfulness-based programs (MBPs), with their increasingly popular use in research and practice, offer an alternative to the two traditional interventions. Mindfulness is defined as “the awareness that emerges through paying attention, on purpose, in the present moment, nonjudgmentally, to the unfolding of experiences moment by moment” (Kabat-Zinn 2003, p. 145). For over three decades, MBPs have proven effective in the treatment of a large number of disorders and diseases (Baer 2014). Specifically, various MBPs have emerged across different clinical areas, such as the mindfulness-based stress reduction program (MBSR) for physical and mental health (Kabat-Zinn 1990, 2003), mindfulness-based cognitive therapy (MBCT) for depression (Segal et al. 2005), mindfulness-based relapse prevention (MBRP) for addictive behaviors (Bowen et al. 2011), mindfulness-based eating awareness training (MB-EAT) for eating disorders (Kristeller and Wolever 2011), and mindfulness-based positive behavior support (MBPBS) for stress and challenging behaviors (Singh et al. 2016).

Among existing effective interventions, *Meditation on the Soles of the Feet* (SoF; Singh et al. 2003) is particularly recommended given its time and cost efficiency (Felver et al. 2017). SoF is an informal mindfulness-based practice designed for the self-management of anger and aggression. As

a single-component mindfulness-based practice, the straightforward instructions of SoF allow individuals to divert their attention from an emotionally arousing thought, situation, or event toward an emotionally neutral part of their body, the soles of the feet. Therefore, an individual will tend to take a short pause, calm themselves down, and then select a more appropriate reaction to address the situation or the event. Hence, SoF is regarded as a “top-down” self-regulatory strategy to reduce aggressive behavior and can also be practiced in various situations (e.g., sitting, standing, and walking) (Felver et al. 2014).

Considering its effectiveness, researchers have utilized SoF with children and adolescents with ASD. For example, Singh et al. (2011a) taught three adolescents with Asperger syndrome (now included in the ASD spectrum) and Singh et al. (2011b) taught three adolescents with autism to use the SoF practice for the self-management of aggressive behavior. In both studies, experienced SoF trainers taught the SoF practice to parents who then taught their adolescents. Specifically, SoF was taught to parents for five consecutive days, with 30 min of practice each day. The results demonstrated a significant decrease in aggressive behaviors among adolescents with ASD. Although the results are promising, the effectiveness of SoF in the Chinese context has not been researched. In China, one of the major treatment challenges is the shortage of professionals who can deliver effective mindfulness programs for adolescents with ASD who engage in challenging behaviors, such as aggression and property destruction.

The primary aim of the present study was to provide an initial evaluation of the effects of using the SoF practice for the self-management of aggressive behavior by Chinese children with ASD. Specifically, we aimed to assess (a) the effectiveness of SoF in reducing verbally aggressive, physically aggressive, and destructive behaviors of adolescents with ASD in China and (b) the social validity of the SoF practice in a Chinese cultural context.

Method

Participants

Three Chinese adolescents (Bai, Heng and Jun—pseudonyms), diagnosed by their family physician as presenting with mild levels of autistic behavior on the ASD spectrum, participated in this study. All three participants functioned at ASD Level 1 (requiring support; American Psychiatric Association 2013). Generally, the three adolescents showed deficits in expressive language but had reasonable skill in receptive language, demonstrated limited social interaction skills, and had problems taking turns during verbal communication. They displayed high levels of behavioral inflexibility, engaged in aggressive and destructive behaviors when their demands

were not met—especially when they could not clearly specify their needs—and were generally disorganized. They attended special schools in which they were disruptive, destructive, and aggressive in the classroom and during outside play activities. The teachers reported an inability to control the adolescents' behaviors in the school setting. The adolescents displayed similar behaviors at home, which were also beyond the parents' ability to control. The parents often resorted to physically holding them when the adolescents engaged in physical aggression and property destruction.

Bai was 14 years old and had engaged in aggressive and destructive behavior since the age of 2. A functional analysis showed mixed motivations for his aggressive and destructive behavior, including escape and avoidance of task demands, access to tangibles, and parental attention. Heng was 15 years old and had engaged in aggressive and destructive behavior since the age of three and a half. A functional analysis showed mixed motivations for his aggressive and destructive behavior, including access to tangibles and attention. Jun was 17 years old and had engaged in aggressive and destructive behavior since the age of 3. A functional analysis showed mixed motivations for his aggressive and destructive behavior, including access to tangibles, attention, escape and avoidance, and nonsocial contingencies. Functional analyses were conducted immediately prior to the beginning of the present study.

Procedure

Experimental Design We employed a multiple-baseline design across three participants to examine the effects of SoF practices on verbal aggression, physical aggression, and destructive behaviors (Ledford and Gast 2018). This design enabled an intensive investigation of the relationship between dependent variables (e.g., verbal aggression, physical aggression, destructive behavior) and an independent variable (e.g., SoF) with a small number of participants. Following training of the mothers as the SoF trainers, there were three experimental phases: baseline, SoF training and practice, and follow-up for 1 year.

Training for the Mothers The mothers of the adolescents were taught meditation practices, so they could teach their own adolescents because they know the nuances of their children's behavior better than an external therapist or meditation teacher. Additionally, this ensured that the mother and adolescent could practice together, as convenient, several times a day during the training and implementation periods.

An experienced meditation teacher individually taught the mothers a foundational meditation practice (i.e., Samatha meditation), which is a requirement for trainers of SoF (Singh et al. 2011c). This instruction was to ensure that those who provided SoF training had a personal daily meditation

practice of approximately 20 min a day. The training steps for Samatha meditation are presented in Table 1. Two 30-min sessions were required for the Samatha instruction for each mother.

After mothers had been practicing Samatha meditation for 4 weeks, the same meditation teacher individually taught the mothers the *Meditation on the Soles of the Feet* based on the Singh et al. (2011c) training manual. The mothers learned and practiced SoF meditation for two reasons: (a) to combine Samatha meditation with the SoF practice in their own lives to reduce their personal stress and (b) given that meditation practices are experiential, to have personal knowledge, so they would be in a position to informatively respond to any practice questions that their adolescents may raise during and following their training in the SoF practice. Four 30-min sessions were required for the SoF instruction of each mother.

Baseline This phase was the pretreatment phase during which no experimental variables were manipulated. Both parents and siblings engaged in their usual interactions with the adolescents. That is, they continued to use their typical disciplinary and management techniques to control the aggressive and destructive behaviors of the adolescents. For example, the techniques that were used when the adolescents started to engage in these behaviors included verbal redirection (e.g., “No, stop doing that! Go and play with your toys”), non-isolated timeout (e.g., sitting on a chair in the presence of

Table 1 Training steps for Samatha Meditation practice

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- Sit comfortably on your zafu and zabuton (if you are using them), on a cushion, or on a straight-backed chair. If you have a meditation practice already, assume your posture in a full-lotus, half-lotus, Burmese, or kneeling (seiza) position, or sit in a chair. In Samatha meditation, you practice focusing just on your breath, which is the object of your meditation, to the exclusion of everything else.
1. Sit comfortably with a straight spine, without slouching or stretching your shoulders.
 2. Tilt your head slightly forward, with the chin tucked in slightly toward the throat.
 3. Have your eyes slightly open, if this is comfortable, or close them lightly.
 4. Have the tip of your tongue lightly touch the upper palate, near the front teeth.
 5. Have the right hand over the left hand on the lap, with thumbs just touching each other, or your hands on your thighs.
 6. Breathe evenly and try not to either shorten or lengthen each breath.
 7. Focus your attention on the flow of your breath as it moves in through your nostrils into your body, back up, and out through your nostrils. That is, focus your attention on the sensation of breathing—from the beginning to the end of inhalation, the pause before exhalation, from the beginning to the end of exhalation, the pause before inhalation, and so on.
 8. When you realize that your mind has wandered away, gently refocus your attention on the flow of your breathing.
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the parents or the adolescents' nannies), holding the adolescents during physical aggression or property destruction until they stopped struggling (i.e., physical restraints were used for the safety of the adolescents and family members), and loss of privileges (e.g., preferred items were taken away following an aggressive or destructive event). In essence, the parents of each adolescent were instructed to continue with their daily lives as usual (except for collecting data on the adolescent's verbal and physical aggressive behavior and destructive behavior). The adolescents were randomly assigned to one of three baseline durations, which were 3, 5, and 8 weeks for Bai, Heng, and Jun, respectively.

SoF Training and Practice Following baseline, the mothers taught their adolescents the SoF procedure. They used the Singh et al. (2011c) training manual as the basis for training, modifying the language and idioms to maximize learning but not changing the actual sequence of the training steps. In general, the adolescents were seated in a comfortable chair, with their feet flat on the floor, hands resting gently on their thighs, and their eyes closed. Then, in a soft and calm voice, the mothers taught the SoF practice by taking their adolescents through the training steps outlined in Table 2, first with a happy event and then with an event that involved aggression. Once the adolescents were proficient in using the SoF procedure for aggressive incidents, the mothers taught them to use the SoF procedure with the initial trigger that led to verbal or physical aggression and destructive behavior.

The SoF training of the adolescents was scheduled for 15-min sessions. To maximize learning, two sessions were scheduled each day during the first week (i.e., 3.5 h total for the week). This amount was reduced to one daily session in the second week (1.75 h total) and three sessions (one each on Monday, Wednesday, and Friday) during the third week (0.75 h total). Thus, the total training time during the 3-week training period was 6.0 h. During the 3-week training period, the mothers emphasized how to use the SoF practice in daily life. After the fourth week, the adolescents used the SoF practice without further formal instruction. During this implementation phase, the parents informally provided prompts to the adolescent to use the SoF practice if they noticed that he was beginning to escalate his anger to verbal and physical aggression or property destruction without using it to calm down. In addition, the mothers downloaded one of their videotaped training sessions on their adolescent's smart phone, which the adolescents could use for self-practice. Whenever an incident occurred that could or did elicit aggressive or destructive behavior, the adolescents rehearsed the SoF practice with their mother. The mothers informally provided support until the adolescents could independently use the SoF practice to self-manage their challenging behaviors. The SoF training and practice phase was in effect for 37, 35, and 32 weeks for Bai, Heng, and Jun, respectively.

Table 2 Training steps for *Meditation on the Soles of the Feet* practice

- If you are standing, stand in a natural rather than an aggressive posture, with the soles of your feet flat on the floor. If you are sitting, sit comfortably with the soles of your feet flat on the floor.
1. Focus your attention on the flow of your breath as it moves in through your nostrils into your body, back up, and out through your nostrils. That is, focus your attention on the sensation of breathing—from the beginning to the end of inhalation, the pause before exhalation, from the beginning to the end of exhalation, the pause before inhalation, and so on.
 2. Now, cast your mind back to an incident that made you very angry. Stay with the anger.
 3. You are feeling angry, and angry thoughts are flowing through your mind. Let them flow naturally, without restriction. Stay with the anger. Your body may show signs of anger (e.g., rapid breathing).
 4. Now, shift all your attention fully to the soles of your feet.
 5. Slowly, move your toes, feel your shoes covering your feet, feel the texture of your socks, the curve of your arch, and the heels of your feet against the back of your shoes. If you do not have shoes on, feel the floor or carpet with the soles of your feet.
 6. Keep breathing naturally and focus on the soles of your feet until you feel calm.
 7. Practice this mindfulness exercise until you can use it wherever you are and whenever you first feel the rising anger or, as a last resort, when an incident occurs that may otherwise lead to you being verbally or physically aggressive.
 8. Remember that once you are calm, you can walk away from the incident or situation with a smile on your face because you controlled your anger. Alternatively, if you need to, you can respond to the incident or situation with a calm and clear mind without verbal threats or physical aggression.

Follow-Up Once the formal intervention had concluded at the end of the 40th week of the study, data were collected on the durability of the adolescents' use of the SoF practice to control their verbal and physical aggression and destructive behavior for 1 year. No experimental variables were manipulated during the follow-up phase.

Fidelity of Training

The fidelity of training the mothers in Samatha meditation was assessed using a checklist based on the eight items specified in Table 1. Both training sessions were videotaped, and an independent meditation trainer assessed the fidelity of the training. The fidelity was assessed at 100% for each of the three mothers for each session. The fidelity of training the mothers in the SoF practice was assessed using a 40-item trainer monitoring form based on the fidelity checklist provided in the Singh et al. (2011c) training manual. The four training sessions were videotaped, and an independent SoF trainer assessed the fidelity of training. The fidelity was assessed at 100% for each of the three mothers for each of the four sessions. In addition, the fidelity of the mothers' training of their adolescents in the SoF practice was assessed using the same

40-item trainer monitoring form that was used to assess the training of the mothers. All 24 training sessions were videotaped, and the same independent SoF trainer as was used with the training of the mothers randomly selected eight training sessions (i.e., 33.33%) and rated them for procedural fidelity. The average fidelity rating for the three mothers was 93% (range = 85 to 96%). The trainer for Samatha meditation and the SoF practice had a long-standing personal meditation practice spanning over 10 years. The independent fidelity assessment rater had a personal meditation practice for 7 years and extensive experience in training instructors in the SoF practice for over 5 years.

Measures

Target Behaviors The dependent variables were verbal aggression, physical aggression, and destructive behavior. Verbal aggression included yelling, cursing, threatening physical harm, or screaming at others. Physical aggression included hitting, biting, scratching, punching, kicking, slapping, and pinching. Destructive behavior included volitionally damaging, breaking, or destroying personal or family property. These examples accounted for the breadth of challenging behaviors exhibited by the adolescents, although the specific exhibited behaviors varied within and between the adolescents during the 12 months prior to the initiation of the study.

Data Collection The mothers were the primary data collectors. They collected data on the target behaviors when the adolescents were at home and present with family members (i.e., not when the adolescents were in their own room, at school, or out of the family home). Typically, the mothers were able to collect data for 4 to 5 h daily. The adolescents' nannies were the secondary data collectors. For interrater reliability checks, the nannies collected the data for an hour each day at the same time, but independently of the mother. Interrater agreement between the primary and secondary data collectors was defined as both recording each of the target behaviors as occurring within ± 2 min of each other's recording. Interrater agreement was calculated by dividing agreements by agreements plus disagreements and multiplying by 100. The overall mean agreement between the three mothers and their secondary data collectors was 95% (range = 91 to 100%).

Social Validity The mothers of the adolescents rated the social validity of the SoF practice on a five-item measure using a 5-point Likert-type scale (1 = strongly disagree, 5 = strongly agree). The mothers rated the items in terms of how much they agreed or disagreed with statements regarding the acceptability, effectiveness, unintended effects, likelihood of recommendation for use by others, and ease of implementing the SoF procedure. The ratings by each mother were summed, with higher scores indicating higher social validation. The

mothers completed the social validity ratings on the last day of SoF implementation for each adolescent in the 40th week of the study.

Data Analysis

The data were analyzed in two ways. First, standard behavioral analytical procedures were used to visually examine the trends between adjacent phases for each participant and each target behavior (Ledford and Gast 2018). Second, the trends between baseline and SoF training and practice were examined quantitatively using the Tau-U statistic (Parker et al. 2011). The Tau-U statistic combines non-overlap between phases in ABAB designs with trends from within the intervention phase. This method can also be used for statistically analyzing the baseline and intervention phases in multiple baseline designs. Parker et al. (2011) have suggested Tau-U as an alternative to both regression-based and non-overlap models. The Tau-U statistic was calculated using a web-based application (<http://www.singlecaseresearch.org>) to assess the effect size of the intervention for each participant. An effect size of 0.80 or above indicated a very large effect; 0.60–0.80, a large effect; 0.20–0.60, a moderate effect; and less than 0.20, a small effect (Vannest and Ninci 2015).

Results

Figures 1, 2, and 3 depict the data for total verbal aggression, physical aggression, and destructive behaviors across conditions for three participants, respectively. Overall, the data showed that verbal aggression, physical aggression, and destructive behaviors were at a high level during baseline but decreased to a relatively low level, with a descending trend, under the intervention conditions and follow-up sessions for the three adolescents. The data clearly indicated a functional relationship between the SoF intervention and the aggressive behaviors and destructive behaviors of adolescents with ASD. Moreover, the adolescents had low levels of verbal aggression, physical aggression, and destructive behaviors during the follow-up sessions.

Verbal Aggression

Figure 1 presents the baseline, intervention, and maintenance data of SoF practices for verbal aggression for the three adolescents. During baseline, Bai, Heng, and Jun demonstrated an average of 12.67 (range 11–14), 12.6 (range 11–14), and 13.88 (range 12–15) instances of verbal aggression per week, respectively. As the intervention was introduced, all three adolescents started to display a decreasing trend to an average of 3.54 (range: 0–12), 3.11 (range 0–11), and 3.88 (range 0–12) instances of verbal aggression per week. Visual inspections

also indicated that during follow-up sessions, the data for displayed verbal aggression continuously decreased as the intervention sessions were withdrawn ($M = 2.00$, range 1–3 for Bai and Heng, $M = 1.5$, range 1–2 for Jun). The Tau-U scores fell within the highly effective range and suggested a strong treatment effect (Tau-U = -0.98 ; $p = 0.00$).

Physical Aggression

Figure 2 depicts the baseline, intervention, and maintenance data of SoF practices for physical aggression for the three adolescents. During baseline, the data for the three adolescents demonstrated a high level of physical aggression. Bai, Heng, and Jun exhibited an average of 3.33 (range: 3–4), 4.6 (range: 3–6), and 6.25 (range: 4–8) instances of physical aggression per week, respectively. Visual inspection clearly demonstrated immediate effectiveness as the intervention commenced and displayed lowered physical aggression. Bai's average instances of physical aggression were 0.73 (range: 0–3) and reached zero instances at the 16th week and then remained at a very low level of physical aggression for the following weeks. The immediate effect of intervention for Heng was obvious, decreasing from six instances at the fifth week of baseline ($M = 4.6$, range: 3–6) to one instance of physical aggression at the sixth week. Heng continuously maintained a stable, non-fluctuating and low level of physical aggression during the intervention ($M = 0.91$, range 0–4). After the 34th week, Heng did not display any physical aggression and remained at zero occurrences for the entire follow-up session. Jun also demonstrated a high level of 6.25 instances of physical aggression (range: 4–8) per week at baseline. Similar to Bai and Heng, Jun's level of physical aggression immediately decreased and reached an average of 1.5 instances (range: 0–6) per week during the intervention. Although Jun had two fluctuations, he reached a stable level of physical aggression after the 17th week. It is noted that all three adolescents displayed no physical aggression during follow-up. The effect size calculations showed a strong treatment effect (Tau-U = -0.96 ; $p = 0.00$), indicating that the decreasing trend in physical aggression between baseline and the intervention condition was significant.

Destructive Behavior

Figure 3 illustrates the baseline, intervention, and maintenance data of SoF for destructive behavior across the three participants. Bai displayed an increasing trend during baseline ($M = 13.67$, range 11–17), but immediately, these behaviors decreased to a low level as the intervention was introduced ($M = 3.97$, range 0–11). His destructive behaviors continuously decreased to zero during the follow-up session ($M = 0.75$, range 0–2). Compared to Bai, Heng exhibited a lower level of destructive behaviors during baseline ($M = 8.8$, range 7–10). Heng demonstrated a clear pattern of gradual decrease when

the intervention was introduced, with an average instance rate of 2.6 (range 0–9). Furthermore, this decreased level of destructive behavior was maintained at a level of 0.5 instances per week (range 0–1) during follow-up. Jun's average number of instances was similar to Bai's high level of destructive behaviors ($M = 14.64$, range 11–17) during baseline. Although Jun had three fluctuations and a lower average number of destructive behaviors than the other two adolescents, in the later part of the intervention, he reached a much lower level ($M = 3.94$, range 0–10). It was also noted that he maintained a low and stable level during follow-up ($M = 1.5$, range 0–3). The Tau-U scores suggest that the intervention had a very strong effect on improving the participants' destructive behaviors (Tau-U = -0.98 ; $p = 0.00$).

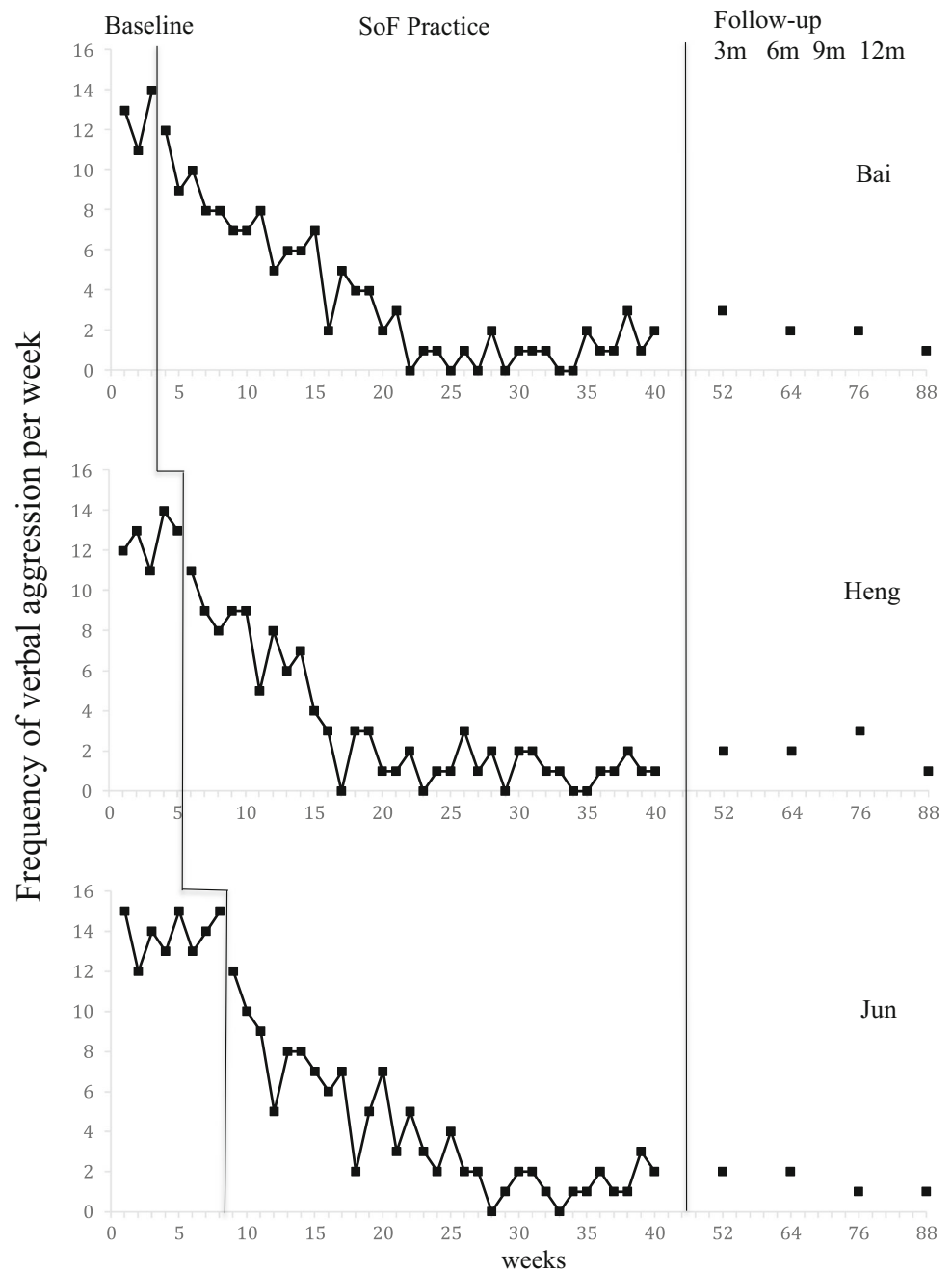
Social Validity Ratings The three mothers rated the social validity of the SoF practice on the last day of the 40th week of the study. The five items were rated on a 5-point scale, with higher ratings indicating higher social validity. Table 3 presents the mother's individual ratings. Across the three mothers, the average rating for acceptability was 4.67, effectiveness was 5.00, unintended effects was 5.00, ease of implementing the SoF practice was 2.67, and recommend for use by others was 5.00. The overall social acceptability ratings of the mothers of Bai, Heng, and Jun were 4.6, 4.2, and 4.6, respectively.

Discussion

Aggressive and destructive behaviors in adolescents with ASD can bring significant harm to the individuals themselves, as well as marked distress for their families. There are currently several informal mindfulness-based practices that can be used in daily life to self-control and address aggressive behaviors: the Soles on the Feet (Singh et al. 2003, 2011c), Shenpa and calm abiding (Singh et al. 2013), sober breathing space (Singh et al. 2018), and surfing the urge (Singh et al. 2019) practices. The aim of this study was to evaluate the effectiveness of the SoF practice to reduce the aggressive and destructive problems of Chinese children with ASD. This study provides evidence that the SoF practice can be successfully used for self-regulatory behaviors among ASD adolescents in a Chinese cultural context.

Overall, the data from this study demonstrate that in the Chinese context, adolescents with ASD reduced aggressive and destructive behaviors after they mastered an informal mindfulness practice. This study extends previous research by demonstrating the effectiveness of the SoF practice in the self-management of both aggression and destructive behaviors. Three adolescents exhibited various degrees of verbal aggression, physical aggression, and destructive behaviors. These behaviors usually occurred in their special education schools

Fig. 1 Frequency of verbal aggression per week across the three students during baseline, SoF practice, and follow-up

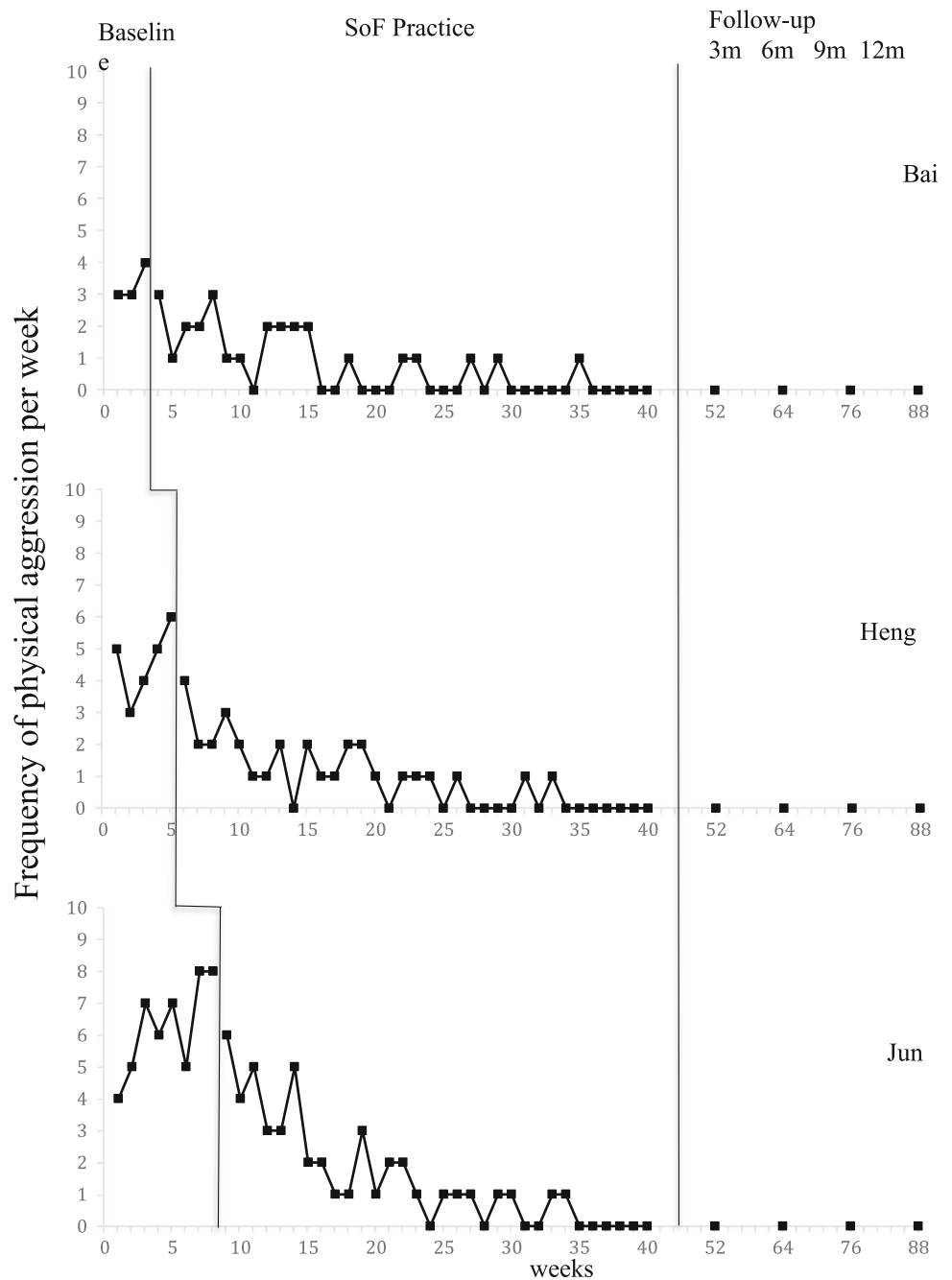


and family home, which took tremendous effort on the part of their teachers and parents to control. The mothers of the three adolescents were able to learn the SoF practice, and then they taught their children to master the skill. The results showed that the SoF practice significantly reduced the verbally aggressive, physically aggressive, and destructive behaviors of the three adolescents. These results are in line with studies showing that SoF can play a positive role in regulating aggressive behaviors in children with developmental disabilities, including ASD (Singh et al. 2003, 2011a, b, c, d, 2019). The present study extended the research evidence showing that SoF can be used

for effectively self-regulating the destructive behavior of adolescents with ASD. This effect might also be due to the underpinnings of mindfulness-based programs (i.e., attention and self-awareness), which are consistent with Buddhism, the primary religious belief of Chinese citizens. Our study demonstrated that Chinese parents were enthusiastic to collaborate with researchers and mastered SoF with high efficiency.

Traditionally, interventions for aggressive or destructive problems usually focused on clinical and nonclinical populations through formal intervention, as well as through medical treatments. In formal practice, the time commitment and

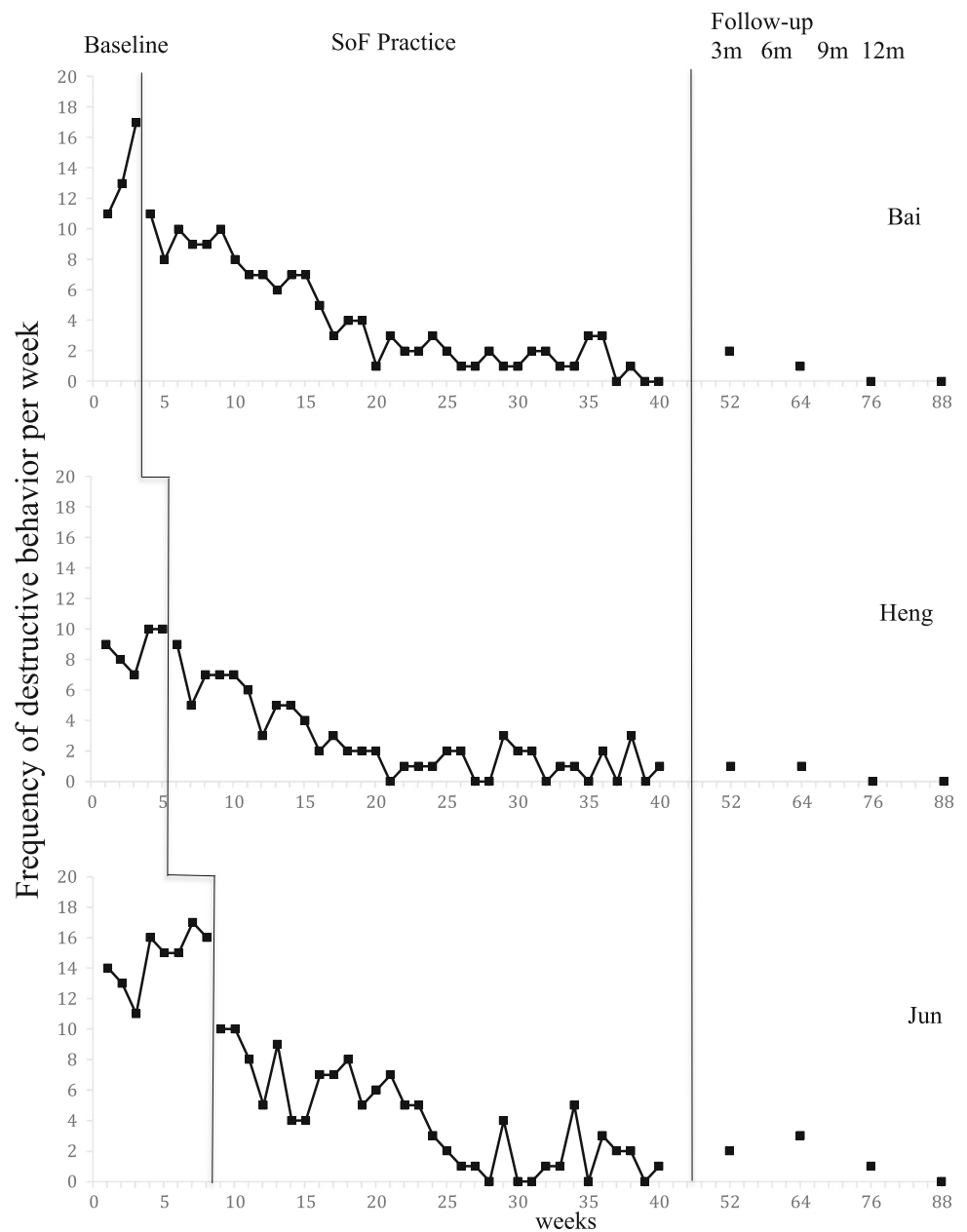
Fig. 2 Frequency of physical aggression per week across the three adolescents during baseline, SoF practice, and follow-up



persistence required were too challenging for both the parents and the adolescents (Lunsky et al. 2018). However, using drugs might have negative long-term outcomes (Deb 2016). In contrast, informal brief mindfulness-based practices, such as SoF used in this study, may lead to effective reduction in maladaptive behaviors. With consistent practice, the adolescents with ASD probably had a calm and clear mind as a result, which is the purpose of mindfulness (Baer et al. 2006), and then they perceived the negative emotions without reacting to them (Hill and Updegraff 2012). Correspondingly, the participants might

avoid causing verbal or physical harm to people (e.g., aggression) or objects (e.g., destruction) around them. Furthermore, another strength of SoF practice was that the self-management strategy was not complicated, and adolescents with ASD could learn and utilize it. Therefore, with its straightforward instruction, short duration, and convenient operation, mindfulness-based SoF practice offered a viable strategy to calm inappropriate emotions and then avert or lessen aggressive and destructive behaviors. In addition, the data from the follow-up period indicated the stability of the effects of the SoF intervention.

Fig. 3 Frequency of destructive behavior per week across the three adolescents during baseline, SoF practice, and follow-up



The social validity of SoF in our study was rated by the mother of each adolescent. Their ratings provided compelling

evidence for the acceptability, effectiveness, and unintended effects of the SoF practice. The mothers' ratings were highest

Table 3 Social validity ratings by the mother of each adolescent

Items	Bai	Heng	Jun
Compared to other treatments, I found the SoF practice to be very acceptable	5	4	5
The SoF practice was effective	5	5	5
I did not see any unintended effects of using the SoF practice	5	5	5
The SoF practice was easy to use	3	2	3
I would recommend the SoF practice to others	5	5	5

1 = strongly disagree, 3 = neutral, 5 = strongly agree

on the item related to recommending the practice to others. This indicated that meditation on the SoF was suitable for these Chinese participants. Although this study was not intended to clarify the underlying mechanism of SoF, it is worthwhile to note that several studies have verified this informal meditation practice for different participants targeting various behaviors (Singh et al. 2017; Wilson et al. 2015). For example, Felver et al. (2017) reported the effectiveness of SoF with four exceptional children who were attempting to escape from activities and were disturbing teachers and classmates. Moreover, this approach could also be used for younger general education students (Felver et al. 2014).

Limitations and Future Research

Several limitations of the present study need to be considered. First, mothers' changes in behaviors and even psychopathological factors were not considered. *Meditation on the SoF* was taught to adolescents' mothers primarily and was then transmitted to children via mothers in our study. Based on this, mothers were likely to alter their own behavior via the guidance of mindfulness, which might come to influence their parenting practices (i.e., mindful parenting) and then impact the children's outcomes. In addition, compared to parents of generally developing children, parents of children with ASD face extraordinary stress, especially if their children engage in challenging behaviors (Totsika et al. 2011). Thus, whether the role of SoF could buffer mothers' pressure or related psychological distress should also be explored in future research. Second, the sample used for the current intervention study was relatively small. To confirm the social validity of the *Meditation on the SoF*, the findings should be replicated with larger sample sizes, longer study durations, diverse populations (e.g., clinical and nonclinical), and various maladaptive outcomes in children and adolescents. Third, in terms of the research design, an active treatment control group or randomized controlled trial, as in the Singh et al. (2013) study, should be considered within the Chinese context.

Author Contributions NA designed and executed the study, wrote the first draft, and finalized the paper. XH wrote the paper and edited the final draft. XY analyzed the data and ZRH edited the whole manuscript.

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Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflicts of interest.

Ethical Statement All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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