International Journal of Turkish Education Sciences,
2026, Advanced Online Publication
https://doi.org/10.46778/goputeb.1816105

ISSN: 2148-2314

Increasing cooperation during medical examination in children with autism spectrum disorder

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ABSTRACT

This study aims to examine the effects of a shaping strategy on increasing children with autism spectrum disorder's cooperation during general medical examinations and the generalizability of the acquired adaptation to natural medical environments. The study also examined the parents' opinions of the participating children about the study. The participants of this study, which was conducted with a changing criterion design, were three boys aged 3-6 years diagnosed with autism spectrum disorder. Research findings show that the teaching package, which included a shaping strategy, improved participants' cooperation with the general medical examination. It was observed that the participants demonstrated the cooperation they had achieved during medical examinations in natural medical environments. The study's social validity findings also showed that the intervention provided significant improvements for participants and their parents.

Article Type
Research

Article Background
Received:
November 3, 2025
Accepted:
February 5, 2026
Published Online:
April 20, 2026

Keywords
Autism,
Medical Examination,
Cooperation, Shaping

To cite this article: Köse, H., İnce, G., & Ercan, S. (2026). Increasing cooperation during medical examination in children with autism spectrum disorder. *International Journal of Turkish Education Sciences.* Advanced Online Publication. https://doi.org/10.46778/goputeb.1816105

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Introduction

Based on the most recent data, it has been reported that the prevalence of autism spectrum disorder (ASD) is estimated to be 1 in 31 individuals, and this prevalence is showing an increasing trend over time. This disorder can affect people across a broad demographic spectrum (Centers for Disease Control and Prevention, 2025). Although the type and severity of symptoms differ for each individual (Thom et al., 2020), ASD often overreact to some stimuli and tend to avoid or escape from situations that they find disturbing (Elsabbagh et al., 2012; Talay-Ongan & Wood, 2000). It can make it challenging for them to access and benefit from social services and other support. Medical exams, which are crucial for their health and quality of life, can be particularly challenging. In medical settings, they mostly exhibit lower adaptive behaviors and more aggression than their typically developing peers (Cavalari et al., 2013; Cuvo et al., 2010; Kose et al., 2013; Kuhlthau et al., 2010; St. Joseph & Machalicek, 2022; Walker et al., 2022; Wolff & Symons, 2013). These behaviors could negatively impact the healthcare services they receive. For example, non-cooperation or aggressive behavior during medical examinations can make it challenging to complete medical procedures and affect the quality of the examination (Stuesser & Roscoe, 2020). Moreover, non-cooperation during medical exams may result in patients being scolded or physically restrained, making the process more stressful for everyone. Observations and measurements taken under physical restraints may not be accurate (Riviere et al., 2011; St. Joseph & Machalicek, 2022). For this reason, physicians may need to rely on historical health records or indirectly provided medical information from primary caregivers rather than collecting clinical data directly. In such situations, the individual may experience significant health issues, such as delayed medical interventions or unnecessary anesthesia use (Walker et al., 2022).

Medical exams can also be challenging for healthcare professionals. Maladaptive behaviors during medical exams can lead to a need for additional healthcare personnel, increasing stress and burnout (Riviere et al., 2011; Walker et al., 2022). This may cause physicians to avoid caring for such patients altogether (St. Joseph & Machalicek, 2022). Medical exams may also pose challenges for caregivers. Due to the challenging nature of the medical examination, primary caregivers may sometimes decide against specific medical procedures (Cuvo et al., 2010).

The number of ASD cases is on the rise, and children with ASD require more health services across various categories compared to children without ASD, mainly due to the high occurrence of comorbid conditions. It highlights the growing importance of healthcare providers and systems to address the medical requirements of children with ASD (Thom et al., 2020). Therefore, creating efficient intervention programs to promote collaboration is crucial to facilitating the process for everyone involved. Research shows that interventions involving behavioral strategies increase cooperation with medical procedures among individuals with ASD (Cavalari et al., 2013; Cuvo et al., 2010; St. Joseph & Machalicek, 2022; Walker et al., 2022). In a study, Cuvo et al. (2010) employed a behavioral intervention package that included shaping, reinforcement, and modeling to teach six children with ASD aged 3-6 to comply with medical examination procedures. After an average of 54 sessions (range: 20-93), these children could maintain the adaptive behaviors they learned one month after the intervention. They could also apply these skills to different practitioners and settings resembling medical clinics. Similarly, Cavalari et al. (2013) implemented a behavioral intervention that helped a 16-year-old child with ASD comply with a 12-step general medical examination procedure. After 57 sessions in a school setting, the participant cooperated and could generalize the skills during check-ups with nursing staff in the school's nursing suite. Lastly, Gillis et al. (2009)

aimed to facilitate cooperation with a 17-step general medical examination procedure for 18 children with ASD aged 2-14. After 25 sessions, 15 children showed criterion-level cooperation and could maintain their skills on average ten months later. These studies indicate that while behavioral interventions can help improve cooperation, they do not provide information about cooperation in natural medical settings. In all three studies, researchers recommended further research to determine whether individuals with ASD can apply the cooperation skills learned during a physician's visit (Cavalari et al., 2013; Cuvo et al., 2010; Gillis et al., 2009). Focusing on improving real medical examination experiences is essential to supporting children with ASD, their families, and health professionals. In this respect, such generalization data would provide valuable insights into the effectiveness of the interventions (Gillis et al., 2009; Walker et al., 2022). Furthermore, it is also important to gather perspectives about the intervention's impact from individuals with ASD, their primary caregivers, and healthcare professionals who are the consumers of the intervention. It can be done by assessing the social validity of the intervention through subjective evaluation. Social validity assessments provide direct feedback on the intervention's acceptability, applicability, and impact on the target population (Schwartz & Baer, 1991).

This study examines the effectiveness of an intervention incorporating a shaping strategy to increase cooperation during general medical examinations for children with ASD. In addition, the generalization of the acquired cooperative behaviors to real medical settings and across different medical contexts was evaluated. Furthermore, the social validity of the intervention was examined through the subjective evaluations of its outcomes provided by the participants' primary caregivers.

Method

Participants

Three boys with ASD participated in this study. All participants receive 10-20 hours of specialized education weekly at an institution for children with ASD. To participate in the study, the boys had to meet specific criteria, which included having a formal ASD diagnosis from an authorized health institution, being in early childhood, and exhibiting non-cooperation behavior during medical exams. Before the research, we interviewed the children's parents and teachers to confirm the "exhibiting non-cooperation behavior including disregard for given instructions, attempts to escape from the examination environment, or attempts to physically interfere with the physician during medical exams" criteria. We obtained written informed consent from the participants' parents to initiate the study. The participants' characteristics and Modified Autism Behavior Checklist (M-ABC) scores are outlined in Table 1.

Table 1

Participant Characteristics

Participants	Age	Gender	Age at diagnosis	M-ABC score
Ayhan	5 years, 6 months	Male	3 years	20
Toygun	3 years, 6 months	Male	23 months	8
Okan	5 years	Male	2 years, 6 months	24

Ayhan, a 5.5-year-old boy, got his autism diagnosis at three and started receiving early childhood special education services. His weekly routine includes ten individual special education sessions and ten kindergarten sessions. He also joins a mainstream kindergarten class every afternoon. Ayhan has mastered basic skills such as imitation, matching, and following instructions. He knows concepts appropriate for his age, like colors and numbers, can form three-word sentences, and responds to basic questions. He can express his needs, and he seldom initiates interactions independently.

Toygun, a 3.5-year-old boy, received his autism diagnosis at 23 months. His weekly schedule includes ten special education sessions and one speech therapy session. Toygun has essential learning skills and can express himself with single words and respond to basic questions. His education plan concentrates on developing expressive language skills, such as labeling, recognizing actions, forming sentences, and identifying pictures of objects.

Okan, a 5-year-old boy, received his autism diagnosis at 2.5 years old and has been in special education since. He attends 20 individual special education sessions each week. Okan can use three-word sentences but faces challenges initiating and maintaining communication due to pronounced echolalia. He also faces anxiety and behavioral issues when his routines change.

Ethics committee approval for this study was obtained from the Anadolu University Social and Human Sciences Scientific Research and Publication Ethics Committee, with decision number 455849 dated December 14, 2022. Written informed consent was obtained from the parents of all participants prior to the initiation of the study.

Settings and Materials

The educational institution for children provides a room for training and probe sessions. The room is about 10 square meters and has a table, chair, sink, stretcher, and computer. There is also a small cabinet for medical supplies and a wardrobe with a lab coat. We used a lab coat, stethoscope, tongue depressors, and a video camera for recording during the training sessions. For the generalization sessions, we conducted them in real clinics during medical exams, without modifying the examination rooms. These clinics had standard features such as desk, chair, computer, stretcher, cabinet, privacy screen, washbowl, and mirror.

Dependent and Independent Variables

The study's dependent variable was the level of cooperation during the general medical examination. Cooperation refers to participants following the instructions for the examination steps listed in Table 2 and completing the target behavior associated with each instruction. We collaborated with a family physician to establish a comprehensive medical examination procedure and determine the duration as a criterion required for each examination step to be successful. This procedure consists of "waiting in the examination room," "sitting and waiting on a stretcher," "oral and throat examination," "back examination," and "abdominal and chest examination." The family physician suggested waiting in the examination room for 60 seconds. In line with the information obtained from the families and teachers of the children, we found it appropriate to divide this stage (steps 2, 3, 4, and 5) with a waiting time of 60 seconds into sub-intermediate criteria. The medical examination procedure consisted of ten steps, as shown in Table 2.

The independent variable of the study was the shaping strategy. Shaping involves reinforcing

successive approximations of the target behavior, gradually leading to the desired behavior (Gajić et al., 2021). It means that behaviors close to the target behavior are reinforced, and as individuals master successful behaviors, the reinforcement is gradually reduced. Instead, new approximations closer to the target behavior are reinforced (Kaymak, 2021).

Response Measurements

The examination procedure consisted of 10 steps. We considered the child's completion of the target behavior in a given step as cooperation and marked that step as "+" on the data recording form. If the child refused to cooperate, cried, resisted the examination steps, or tried to escape from the room, we marked the step and all subsequent steps with "-".

Table 2

Examination Stages, Steps, Instructions, and Reinforcement Procedures

Stages	Instruction	Steps and the target behaviors
Waiting in the examination room	"Wait for the doctor"	1. Waiting for 30 seconds in the environment without problem behaviors. *(In the presence of a physician without a lab coat)*
Sitting and waiting on a stretcher	"Sit on the stretcher and wait"	2. Waiting for 10 seconds while sitting on the stretcher. *(In the presence of a physician without a lab coat)*
	"Sit on the stretcher and wait"	3. Waiting for 30 seconds while sitting on the stretcher. *(In the presence of a physician without a lab coat)*
	"Sit on the stretcher and wait"	4. Waiting for 60 seconds while sitting on the stretcher. *(In the presence of a physician without a lab coat)*
	"Sit on the stretcher and wait"	5. Waiting for 60 seconds while sitting on the stretcher. *(In the presence of a physician wearing a lab coat. The physician continues to wear a coat from this step)*
Oral and throat examination	"Open your mouth"	6. While sitting on the stretcher, he opens his mouth for five seconds and allows the physician to look at his throat using an abeslang stick and an otoscope.
	"Open your mouth"	7. While sitting on the stretcher, he opens his mouth for 10 seconds and allows the physician to look at his throat using an abeslang stick and an otoscope.
Back examination	"Take a breath" "Cough"	8. While sitting on the stretcher, he allows the physician to listen to his back with a stethoscope for 10 seconds and follows his instructions.
	"Lie face down" "Take a breath" "Cough"	9. Follows the physician's instructions while lying face down on the stretcher for 10 seconds and allows him to listen to his back with a stethoscope.
Abdominal and chest examination	"Lay on your back"	10. He follows the physician's instructions as he lies on his back on the stretcher for 10 seconds, allowing him to examine his abdomen and listen to his heartbeat with a stethoscope.

Inter-Observer Agreement and Procedural Integrity

We recorded all sessions with audio and video. A second observer independently reviewed a random selection of at least 30% of these recordings. Inter-observer reliability was calculated using the formula "Agreement / (Agreement + Disagreement) x 100." We calculated implementation reliability to determine whether the instruction and probe sessions were organized as planned. To analyze the implementation reliability data, we used the formula "Number of Observed Practitioner Behaviors / Number of Planned Practitioner Behaviors x 100." The inter-observer agreement was 100%, and the procedural integrity averaged 98% (ranging from 83% to 100%).

Experimental Design and General Procedure

In this study, a changing criterion design, one of the single-subject research methods, was employed. Prior to the intervention, a baseline phase was conducted to evaluate participants' levels of cooperation during medical examinations. However, due to participants' intense avoidance and problem behaviors when entering the examination environment, the baseline phase was limited to a single probe session for ethical and clinical considerations, and the intervention phase was initiated.

During the intervention phase, participants attended three instructional sessions per week. A shaping strategy was implemented during training sessions to increase cooperation during medical examinations. The intervention was based on a ten-step procedure representing general medical examination stages (see Table 2). Instructions for the first four steps were delivered by the teacher, whereas instructions for the subsequent steps were provided by an adult assuming the role of a physician. The intervention process was initiated with training on the first step. Participants were provided with the instructions for the targeted step and were expected to meet the predetermined criterion (see Table 2). When the criterion was met across three consecutive sessions at a given step, the intervention progressed to the subsequent step. At each step, potential reinforcement was delivered only following cooperation with the newly targeted step, while reinforcement for previously mastered steps was systematically withdrawn. This procedure was consistently implemented across all steps, and the intervention phase was terminated upon completion of training for the tenth step. Potential reinforcers to be used during training sessions were identified collaboratively with teachers and parents, based on participants' Individualized Education Programs (IEPs), and consisted of edible items and praise.

In the study, baseline and generalization data were collected during probe sessions, whereas intervention-phase data were collected during training sessions. To support the generalization of the target skill, a teach-in simulation environment strategy was adopted. Accordingly, intervention was implemented in a clinic-simulated environment, while generalization data were collected in real clinical settings. When participants failed to meet the criterion during generalization sessions, additional training was provided in the corresponding clinic. When additional training was provided, an extra generalization session was conducted at a second clinic to evaluate the skill's transfer to a different healthcare setting.

Probe Sessions

During a probe session, the teacher invited the child to the examining room, saying, "Let's go to the doctor." Participants were expected to cooperate with the examination steps in Table 2. The teacher presented the instructions for the first four steps, which required the patient to wait in the

environment (e.g., "wait" or "sit down on the stretcher"). From the fifth step onwards, an adult acting like a physician gave instructions such as "open your mouth," "take a breath," or "cough." If the participant followed the instruction and cooperated with that step, we moved on to the next. After completing the tenth step, the session ended. However, if a participant did not follow an instruction for any step, refused, or tried to escape, we waited for the criterion duration of that step to end the session. Across all probe sessions, we do not use any prompts or potential reinforcements.

Training Sessions

The procedure in the training sessions was quite similar to the probe sessions, with one crucial difference. In training sessions, the teacher offered praise and edible items to the participants for their cooperation in the training step.

Generalization

After participants had met the criteria, we proceeded with the first generalization session. During this session, each participant, accompanied by their teacher, visited a healthcare facility where a physician conducted a real medical examination. The second generalization session occurred one month later, with each participant visiting their family physician for a general medical examination without their teacher but accompanied by their parents. In this way, we evaluated generalization across two clinics and with two physicians.

Social Validity

Following the second generalization session, we conducted semi-structured interviews with parents to collect social validity data and assess the importance of the target skill and the significance of the results. While defining the interview questions, we sought input from two academics experienced in educating children with ASD. We analyzed this data descriptively.

Findings

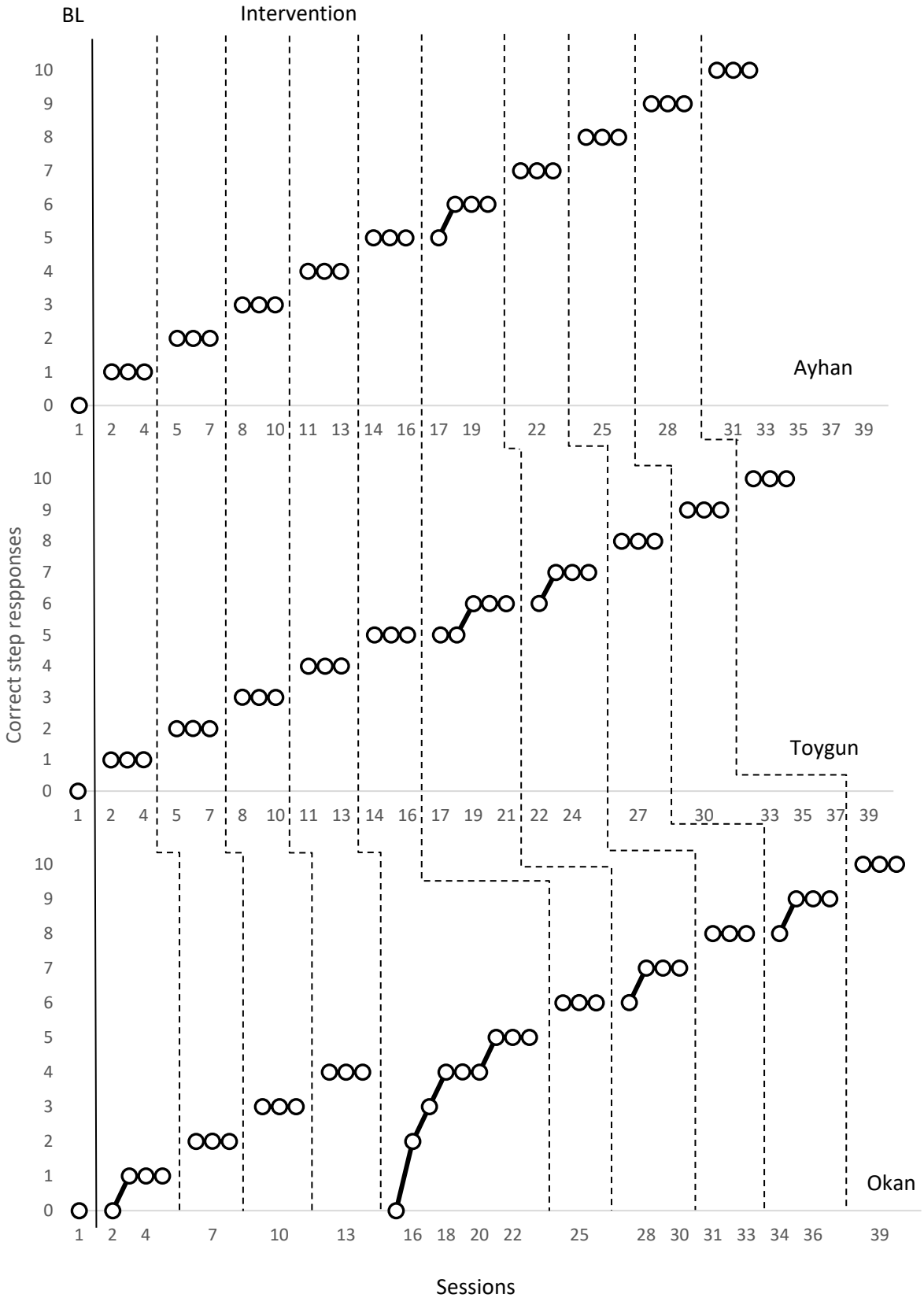
Effectiveness Findings

Figure 1 presents the baseline and intervention phase data. Initially, none of the participants responded correctly to any of the steps. They all exhibited avoidance behaviors, such as crying when entering the instructional setting. However, as the intervention began, the number of steps participants complied with gradually increased.

Ayhan mastered the target skill in 31 sessions. He consistently demonstrated correct responses in all steps except the sixth step. He had to attend the subsequent four sessions to achieve the criterion for the sixth step. Toygun mastered the target skill in 33 sessions. He consistently responded correctly in consecutive sessions except for the sixth and seventh steps. He faced challenges with steps six and seven, which involved an adult simulating a doctor's role by controlling her mouth with a tongue depressor. Therefore, it took longer to train these two steps. Okan's intervention consisted of 39 sessions. In the intervention with Okan, we made two adaptations. The first adaptation was applied from the first step. Okan had struggled to cooperate during the first session and encouraged us to adjust our reinforcement approach. In addition to praise and edible items, we allowed Okan to watch a video he liked if he cooperated with the taught step. For example, in a session where step six was taught, no potential reinforcement was presented to the participant until step six. When the sixth step was reached, we allowed Okan to watch the video for as long as he cooperated.

Figure 1

Correct Step Responses During Baseline and Intervention Sessions



At the end of the step, we offered praise and an edible item. Following this modification, Okan began

to participate in the teaching sessions. However, we had to make a second adaptation to teach the fifth step due to Okan's strong aversion to physicians in lab coats. From step 5 onwards, the adult in the doctor's role was supposed to wear a doctor's coat, but we adapted and continued without it. The lab coat was only introduced during the tenth-step training sessions.

Generalization Findings

Ayhan and Toygun demonstrated complete cooperation during the first generalization session. However, Okan displayed problematic behavior and achieved only a 70% success rate by failing to cooperate during the eighth step. To address this, we conducted two additional training sessions in the real clinic. Following the training, we had another generalization session in a different real clinic with a different physician to evaluate Okan's ability to generalize the skill in a new setting. In this session, Okan showed 100% cooperation. Four weeks after the interventions, we held the second generalization session at the participants' regular healthcare facilities, with their parents present, but without teachers. During this session, all participants demonstrated 100% cooperation.

Social Validity Findings

During interviews to collect social validity data, we asked parents: “What kind of sensory problems did you experience when your child was being medically examined before participating in this program?” All parents reported problematic behaviors such as crying, screaming, and throwing tantrums when faced with medical examinations before the program. For example, Ayhan's father mentioned significant challenges in entering a healthcare facility. He said, “Before joining this program, he would not even enter the doctor's room. Even opening the door to the room would make him uneasy. He would never lie on the stretcher or open his mouth.” The other parents also described a range of challenging behaviors during medical examinations before interventions, especially during stethoscopes and oral throat checks. However, the feedback we received after the intervention was quite positive, with parents noting a significant improvement in their children's cooperation during medical visits.

As the second question, we asked the parents whether they took their children for a real examination after the interventions. All parents reported taking their children to at least one medical examination after the interventions, which was not part of the research. One other question we ask parents is, "Can your child tolerate sensory sensitivities while being examined after participating in the examination program?" In response to the question, all parents answered positively. Ayhan's father highlighted a successful dental procedure, while Toygun's mother expressed relief at her child's newfound tolerance for examinations and blood tests. Okan's mother said, "Yes, he is better now. He is lying on the stretcher and letting a doctor check his back with a stethoscope. He was screaming a lot before the intervention, and he is much better now.”

When asked to evaluate the transfer of acquired skills to naturalistic settings, parents expressed satisfaction, affirming the intervention's effectiveness. For example, Okan's mother expressed satisfaction: "Before, we could not even enter a hospital, but now Okan is taking blood after an examination." All parents recommended this kind of instruction, indicating its necessity for children who struggle with medical examinations. Toygun’s mother said, "Of course, I would recommend this program to the families of children with a doctor's phobia and fear."

Discussion and Conclusion

The study found that all participants were able to adapt to medical examinations after the intervention. The study's findings overlap with similar studies' findings (Cavalari et al., 2013; Cuvo et al., 2010; Gillis et al., 2009). Therefore, the findings support the existing literature on the effectiveness of shaping in improving cooperation during medical procedures for children with ASD. Although this and previous studies included the same stages, such as the mouth, nose, abdomen, and chest, the examination procedures and the number of steps differed. Therefore, the direct comparative discussion of our findings regarding effectiveness is limited. Although direct comparisons across studies are limited by methodological differences, the fact that criterion-level performance was achieved in a maximum of 39 sessions in the present study is noteworthy compared with the 53–57 sessions reported in previous research (Cavalari et al., 2013; Cuvo et al., 2010). This difference may be related to the systematic implementation of the shaping procedure with clearly defined performance criteria and to the delivery of instruction in clinical simulations that closely resemble actual medical settings. In addition, the participants' younger age and prior exposure to early intervention services may have facilitated a more rapid acquisition of cooperative behaviors.

Previous research has suggested studies to explore whether individuals with ASD can effectively cooperate during authentic medical visits (Cavalari et al., 2013; Cuvo et al., 2010; Gillis et al., 2009). Enhancing the real-life experiences of medical examinations is crucial for supporting children with ASD, their families, and healthcare providers (Gillis et al., 2009; Walker et al., 2022). The findings of this study show that the participants could apply their improved cooperation levels to real-life medical settings.

Collecting insights from individuals with ASD, their primary caregivers, and healthcare professionals regarding the intervention's effects is essential. This can be achieved by measuring the intervention's social validity through subjective assessments that provide direct feedback on its acceptability, relevance, and impact on the target audience. This study provides evidence that such interventions can enhance their ability to engage with society, improving children's and their parents' lives.

We observed that participants had difficulties cooperating during the oral examination in the interventions. Therefore, it would be helpful to break down the specific steps, such as the sixth step, which involves oral examination, into smaller, more manageable steps for teaching. Individual adaptations were also necessary for Okan, who showed significant resistance. These adaptations facilitate his learning.

During the first generalization probe, Ayhan and Toygun demonstrated 100% accuracy, while Okan achieved a 70% success rate. However, Okan's performance improved after additional training sessions in the generalization environment. These differences may be associated with the nature of participants' prior experiences related to medical examination procedures. Individuals who have previously experienced intense anxiety, avoidance, or other negative experiences during medical procedures may demonstrate lower levels of cooperation when re-exposed to similar settings (Bijttebier & Vertommen, 1998). In this context, Okan's difficulties observed during the first generalization session may be linked to avoidance responses conditioned by aversive stimuli associated with prior medical examinations. Nevertheless, the additional instruction and repeated exposure provided within the generalization environment may have contributed to an increase in

cooperative behaviors by attenuating the effects of this negative learning history. During the second generalization session, conducted four weeks later, all participants demonstrated 100% accuracy in cooperation during examinations by their family physicians, confirming the durability of the acquired skills.

There are two important differences between the two generalization sessions. While the first generalization session was conducted at a clinic selected by the researchers, the second took place at the participants' family physicians' clinics. Also, participants were accompanied by their parents during the second generalization session. This finding indicates that the intervention successfully generalizes cooperation in medical examinations to both familiar and unfamiliar healthcare settings.

The social validity findings further support the intervention's effectiveness by indicating that parents are satisfied with the behavioral improvements observed in their children during medical examinations. Following the intervention, parents also reported that their children were able to cooperate in other medical contexts, such as dental procedures and blood tests, without exhibiting severe problem behaviors. This generalization of cooperative behavior across medical settings can be considered an important indicator of the intervention's social validity.

Despite these positive findings, the results of the study should be interpreted with consideration that only a single data point was obtained during the baseline phase. Interviews conducted with participants' teachers and parents prior to the study indicated that all participants exhibited intense problem behaviors during medical examinations, which was also observed during the initial baseline probe session. To avoid repeatedly exposing participants to this highly aversive context, the baseline phase was intentionally limited to a single probe session, as exposure to consecutive probe sessions without prior adaptation instruction in challenging environments may delay or prevent the acquisition of target skills (Birkan et al., 2011). Although this decision was ethically and clinically justified, it limits conclusions regarding the stability of pre-intervention responding.

Limitations

The study has several critical limitations worth noting. Firstly, we collected data from only one baseline session to avoid negative experiences for participants. No generalization pretest was conducted for the same reason, another critical limitation. Therefore, we could not make a pretest-posttest comparison for generalization findings. However, the parents reported a clear improvement in their children's cooperation during medical examinations before and after the study. Despite this limitation, the significant improvements reported by parents after the research suggest that any potential effect of this limitation might be low. Lastly, more data must be collected regarding the long-term maintenance of the skills acquired during the interventions. However, the positive outcomes observed four weeks after the interventions suggest that the skills were retained.

Suggestions

It may be helpful to break down specific medical examination procedures, especially those that require physical intervention in the mouth, into smaller segments to increase cooperation among children with ASD. Video modeling can help children follow challenging steps and improve their cooperation. Therefore, further research could examine the effects of combining shaping and video modeling. Also, the effects of social stories and visual supports on the acquisition of cooperation can be investigated.

Declarations

Ethics statement: Ethics committee approval was obtained from the Anadolu University Social and Human Sciences Scientific Research and Publication Ethics Committee (Decision No. 455849, dated December 14, 2022). All procedures were conducted in accordance with institutional and national ethical guidelines, and informed consent was obtained from all participants.

Author Contributions (CRediT): H. Köse: Conceptualization, Methodology, Data Curation, Formal Analysis, Writing – Original Draft, Writing – Review & Editing, G. İnce: Conceptualization, Methodology, Data Curation, Formal Analysis, Writing – Original Draft, S. Ercan: Data Curation, Investigation

Funding: This research received no specific grant from any funding agency.

Conflict of Interest: The authors declare no conflict of interest.

AI Tools Disclosure: The authors used ChatGPT (OpenAI) solely for language refinement and grammar correction during the revision process. No AI tool was used to generate research ideas, theoretical content, data, analysis, or interpretations. All substantive intellectual contributions were made by the authors.

Data Availability Statement: Data cannot be shared due to ethical restrictions.

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