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Evaluating the Effects of Video Modeling and Visual Supports on Preschoolers' Compliance With Dental Procedures

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by
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Approval Page

This applied dissertation was submitted by Karly L. Orsi-Cordova under the direction of the persons listed below. It was submitted to the Abraham S. Fischler College of Education and approved in partial fulfillment of the requirements for the degree of Doctor of Education at Nova Southeastern University.

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Abstract

Evaluating the Effects of Video Modeling and Visual Supports on Preschoolers' Compliance With Dental Procedures. Karly L. Orsi-Cordova, 2017: Applied Dissertation, Nova Southeastern University, Abraham S. Fischler College of Education. Keywords: autism, pediatrics, dental health, visual aids, child behavior

Individuals with autism are reported to visit the dentist infrequently. Infrequent visits to the dentist may result in a higher occurrence of caries, and it is, therefore, imperative for children with autism to visit a pediatric dental practice routinely. Some basic behavior-management techniques, such as live modeling and reinforcement strategies, have been used with patients with autism. The addition of techniques derived from applied behavior analysis, such as video modeling and visual supports, may increase patients' compliance with dental procedures. Specifically, the use of visual supports and video modeling warranted further investigation on the efficacy of improving behavior during dental procedures.

This study used a group design, quantitative methods, and descriptive analysis to answer the four research questions:
1. Has patients' compliance with dental cleaning procedures improved following the use of visual supports?
2. Has patients' compliance with dental cleaning procedures improved following the use of video modeling procedures?
3. Did one of the two interventions lead to compliance with dental cleaning procedures more quickly than the other?
4. Are parents of the patients satisfied with the intervention?

Findings from this research should inform practice for dentists, pediatric dentists, special needs dentists, and behavior analysts, as well as further the findings of existing research on video modeling and visual supports. Further investigation may support generalization of teaching strategies for use in other medical professions.

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Chapter 1: Introduction

Background and Justification

During routine dental exams, young children with autism spectrum disorder (ASD) may be noncompliant with dental procedures and have higher rates of anxiety during dental visits than neurotypical children or peers with other developmental disabilities (Loo, Graham, & Hughes, 2009). During dental exams, noncompliant patients may be treated using reactive strategies, including the use of physical restraints, or protective stabilization, and chemical sedation, or conscious sedation (Loo et al., 2009). The limited use of proactive strategies during dental procedures may lead to continued noncompliance during future dental visits and reduce parent satisfaction with these dental services.

Standard pediatric dental care includes techniques such as tell-show-do, reinforcement, and modeling (American Academy of Pediatric Dentistry, 2011a). However, these techniques alone may be ineffective in improving pediatric patients' compliance with dental procedures (Hernandez & Ikkanda, 2011). The use of visual supports to provide information has been shown to support individuals with autism to learn new skills, to reduce anxiety, and to reduce inappropriate behaviors (Dauphin, Kinney, & Stromer, 2004; Dooley, Wilczenski, & Torem, 2001; Morse & Schuster, 2000; Waters, Lerman, & Hovanetz, 2009).

One form of visual support is a visual task strip. Visual task strips are line drawings, pictures, or photographs of each step in a task. These pictures are placed in a sequence representing each step the individual will complete as part of the task (Bryan & Gast, 2000). Bryan and Gast (2000) referred to visuals placed in a sequence to represent the steps in a task analysis as a visual picture prompt. Research has shown visual task strips to be effective in teaching new behaviors to children with autism, including (a) brushing their teeth (Pilebro & Backman, 2005); (b) microwaving pizza, folding laundry, and washing a table (Van Laarhoven & Van Laarhoven-Myers, 2006); (c) setting a table; and (d) arranging an art activity (West, 2008). Visual task strips are reported in the literature as being effective in teaching independent chained tasks to persons with intellectual disabilities and ASD (Bryan & Gast, 2000; Thinesen & Bryan, 1981; West, 2008).

Video modeling is another form of visual support and is a strategy that involves a patient watching a video demonstration and then imitating the behavior of the model (Charlop-Christy, Le, & Freeman, 2000). Research has shown video modeling to be effective in teaching a variety of new behaviors to people with autism and developmental disabilities (Haring, Kennedy, Adams, & Pitts-Conway, 1987; Mechling, Gast, & Fields, 2008; Norman, Collins, & Schuster, 2001; Shipley-Benamou, Lutzker, & Taubman, 2002). Video modeling also has been used in dental settings to increase compliance in the number of procedures completed by individuals with autism in a dental clinic (Altabet, 2002; Conyers et al., 2004; Luscre & Center, 1996). Some research indicates video modeling, when paired with reinforcement and a desensitization protocol, decreases anxiety and fear in children with ASD (Cuvo, Law Reagan, Ackerlund, Huckfeldt, & Kelly, 2010; Huckfeldt, 2006) and decreases uncooperative behaviors (Isong et al., 2014).

Some pediatric patients will push away dental instruments, such as the mirror or prophy cup (i.e., electric toothbrush), when presented. Other patients may close their eyes or cry upon the presentation of instruments. Numerous procedures derived from behavior analysis have been shown to reduce fear and increase compliance with medical and dental exams in individuals with autism and adults with severe intellectual disabilities, including (a) desensitization (Altabet, 2002); (b) reinforcement and prompting (Conyers et al., 2004); (c) shaping, fading, and escape extinction (Cuvo et al., 2010); (d) video modeling (Luscre & Center, 1996); and (e) video modeling in conjunction with video goggles (Isong et al., 2014).

Statement of the Problem

Autism is a neurodevelopmental disorder characterized by (a) persistent deficits in social-emotional reciprocity; (b) restricted, repetitive patterns of behavior, interests, or activities; and (c) significant impairments in social, occupational, or other important areas of functioning (American Psychiatric Association, 2013). In 2007, the Centers for Disease Control and Prevention reported a prevalence rate of 6.6 per 1,000 children in the United States. Since then, the Centers for Disease Control and Prevention (2012, 2014a, 2014b, 2016) have reported the prevalence as one in 110 in 2009, one in 88 in 2012, and one in 68 in 2014 and 2016. With the increased number of children receiving a diagnosis of ASD, dental practices have begun seeing an increase in the number of patients with ASD.

Children with ASD may show fear and anxiety during routine dental exams by exhibiting physical aggression, whining, crying, closing their eyes, or refusing to comply with dental procedures (Evans, Canavera, Kleinpeter, Maccubbin, & Taga, 2005; Stein et al., 2014). Most dentists are trained in clinical practice to use strategies such as reinforcement, modeling, and distraction, although they are not clinically trained to utilize these strategies when working with children with special needs, including ASD (Dehaitem, Ridley, Kerschbaum, Inglehart, & Habil, 2008). Dentists also may use behavior reduction strategies that are ineffective in reducing the fear and noncompliance in young children with ASD (Hernandez & Ikkanda, 2011).

Few dentists have been trained through university programs to treat children with ASD in clinical practice (Krause, Vainio, Zwetchkenbaum, Inglehart, & Habil, 2010). Dentists, therefore, may not feel confident in their clinical skills to provide dental care to children with ASD (Dehaitem et al., 2008; Vainio, Krause, Inglehart, & Habil, 2011; Waldmen & Perlman, 2002). Dentists' lack of confidence may reduce parent satisfaction with services for their child. Abbasnezhad-Ghadi (2010) found that parents are less likely to bring their child with ASD to the dentist if they perceive the dentist to have limited knowledge of ASD. Fifty percent of parents reported in a survey that their child with ASD had not been to the dentist in the past year (Stein, Polido, Malloux, Coleman, & Cermak, 2011).

Infrequent visits to the dentist may result in a higher occurrence of caries (i.e., cavities). Studies assessing the prevalence of caries in individuals with autism have had mixed results. Most research has found higher rates of caries in children with ASD (Abdullah-Jaber, 2011; DeMattei, Allen, & Goss, 2012; Kopycka-Kedzierawski & Auinger, 2008; Marshall, Sheller, & Manci, 2010; Solanki et al., 2016). However, a study by Altun et al. (2010) found no difference in rates of caries for children with autism as compared to children with other disabilities.

Setting. The pediatric autism dental clinic provides dental services to children from two sites. The first site is a preschool serving children aged 3 to 5 years old who have a diagnosis of ASD. The second site is an early intervention program for at-risk children, aged 18 months to 3 years old, whose parents have a concern about their child's development. The children from the second site may not have a diagnosis of ASD but generally show symptoms of that disorder. Because this dental clinic is funded through a Health Resources and Services grant, dental services are offered free of charge to the families it serves.

The research problem. A pediatric dental clinic providing services to young children with ASD is funded through a training grant by the Health Resources and Services. This clinic aims to develop and implement oral health education and training to pediatric dental residents who work with children with ASD, to increase access to care for young children with ASD, and to improve the oral health of children with ASD. The clinic uses a variety of treatment procedures derived from pediatric dentistry and applied behavior analysis (ABA) to teach preventative dental care, to conduct routine dental cleanings, and to treat caries. The pediatric dentist or pediatric dental resident records notes for each patient's visit, and data are collected on the patient's compliance with each dental procedure. Although anecdotal notes and compliance data are recorded for each visit, no research has been conducted comparing specific interventions to assess the efficacy. The problem this dissertation addressed was the lack of experimental evidence for each ABA strategy in the treatment delivered to patients at the pediatric dental clinic. The purpose of this study was to compare the effectiveness of visual task strips to video modeling on the compliance of its patients with ASD.

Deficiencies in the evidence. The combination of medical and behavioral needs in dental services is exacerbated by the limited training provided to dentists in courses and in clinical training. Children with ASD have been found to have high rates of caries and high rates of noncompliance during dental procedures (Abdullah-Jaber, 2011; DeMattei et al., 2012; Kopycka-Kedzierawski & Auinger, 2008; Marshall et al., 2010; Stein et al., 2014). Few researchers have studied behavior management for dental services, with even fewer studies available on behavior management in dental services for children with autism (Hernandez & Ikkanda, 2011; Waldmen & Perlman, 2002; Zaretsky, 2011). Effective behavior management and patients' compliance with dental procedures are both necessary in order to improve patients' oral health during dental cleanings and treatment of carious lesions without resorting to reactive strategies, such as physical or chemical restraints.

Audience. This research will benefit children with ASD and parents of children with ASD. This research will inform practice for dentists, pediatric dentists, special needs dentists, and behavior analysts, as well as further the finding of existing research on video modeling and visual supports. Further investigation may support generalization of teaching strategies for use in other medical professions.

Definition of Terms

For the purpose of this applied dissertation, the following terms are defined.

Applied behavior analysis (ABA). This term refers to "the science in which tactics derived from the principles of behavior are applied to improve socially significant behavior and experimentation is used to identify the variables responsible for the improvement in behavior" (Cooper, Heron, & Heward, 2007, p. 690).

Caries. This term refers to the decay or decalcification of a tooth (American Academy of Pediatric Dentistry, 2011b).

Generalization. This term refers to demonstrating a skill or behavior across settings, people, or environments in which the skill or behavior was not trained (Cooper et al., 2007).

Latency. This term refers to the length of time between the onset of a stimuli and the initiation of the behavior (Cooper et al., 2007). During the intervention, the dentist will present the stimuli and the patient should respond within 5 seconds.

Maintenance. This term refers to the continued performance of a skill or behavior after intervention has ceased (Cooper et al., 2007).

Reinforcement. This term refers to a stimuli presented or removed after a patient engages in a target behavior that "strengthen(s) the recurrence of those behaviors" (American Academy of Pediatric Dentistry, 2011a, p. 180). This stimuli may include social praise, preferred items, removal of dental equipment, or termination of the dental procedure (American Academy of Pediatric Dentistry, 2011a).

Social validity. This term refers to "the extent to which target behaviors are appropriate, intervention procedures are acceptable, and important and significant changes in target and collateral behaviors are produced" (Cooper et al., 2007, p. 704).

Task analysis. This term refers to the process of breaking a complex skill or series of behaviors into smaller, teachable units. Task analysis also refers to the results of this process (Cooper et al., 2007).

Tell-show-do. This term refers to a technique typically used in pediatric dentistry that includes telling the patient what will happen, showing the patient the instrument, and then doing the procedure (American Academy of Pediatric Dentistry, 2011a).

Video modeling. This term refers to a teaching strategy that involves an individual watching a model perform the targeted skill in a video. The individual is then expected to imitate the behavior of the model (Charlop-Christy et al., 2000).

Visual task strip. This term refers to a series of line drawings, pictures, or photographs that show each step in a task. These pictures are placed in a sequence representing each step the student will complete as part of the task (Bryan & Gast, 2000).

Purpose of the Study

The purpose of this study was to compare patients' compliance with dental procedures when using visual task strips versus video modeling. An additional parent satisfaction survey was disseminated to assess parent satisfaction measures.

Chapter 2: Literature Review

Dentists Receiving Training in the ASD Population

Dental care curriculum for children with special needs was new to colleges of dentistry in the 1950s (Castaldi, 1957). By the 1970s, few colleges had implemented dental care curricula for children with special needs. In the mid-1970s the Robert Wood Johnson Foundation ran a pilot program to provide dentists with curricula and education to use with special needs populations at 11 dental schools. This pilot program initiated the development of curricula in dental schools to create more dental practitioners with experience to serve the population of patients with special needs (Waldmen & Perlman, 2002).

After nearly 120 years of state-run institutions housing individuals with intellectual and developmental disabilities, social, political, and financial conditions motivated a change beginning in the mid-1960s. At this time, there was a movement to include individuals with intellectual and development disabilities in community settings (Anderson, Lakin, Mangan, & Prouty, 1998). Between 1969 and 1997, more than 157,000 individuals were discharged from state-run institutions (Anderson et al., 1998). The increase in community living led to an increased need for community services, including dental services, for these individuals (Fenton, 1993).

Dental students repeatedly report limited instruction and hands-on clinical experience with individuals with special needs. A 1993 survey of all accredited U.S. and Canadian dental schools' 4-year programs reported an average of 12.9 hours spent on curricula teaching students about dental management of individuals with special needs and an average of 17.5 hours spent in clinical instruction (Fenton, 1993). Casamassimo, Seale, and Ruehs (2004) analyzed a subset of data from a national survey of general dentists conducted in 2001 and found only one in four respondents received hands-on experience with patients with special needs. In addition to limited curricula and experience, Dao, Zwetchkenbaum, Inglehart, and Habil (2005) conducted a survey of 500 general dentists in Michigan and found 58% of respondents felt unprepared to treat patients with special needs.

Even after the Commission on Dental Accreditation adopted new standards in 2004 to provide graduate students with curriculum and experience with patients with special needs, dental students continued to receive minimal instruction and hands-on clinical experience with these individuals (Lyons, 2009; Thierer & Meyerowitz, 2005; Vainio et al., 2011; Weil, Bagramian, Inglehar, & Habil, 2011). In a recent online survey of 75 members of the Special Care Dentistry Association, only 37% of respondents reported that they felt well prepared in their professional education to treat patients with autism spectrum disorder (Weil et al., 2011).

Lack of education and experience with individuals with specials needs is reported to be one of the primary reasons general dentists do not provide services to this population (Dao et al., 2005; Weil et al., 2011). Sixty-seven percent of respondents from an online survey of two national advocacy groups for children with special needs reported the frequent barriers to treat children with special needs were lack of knowledge and an unwillingness to treat patients with special needs (Weil et al., 2011). A survey by Dao et al. (2005) found a strong correlation between the perceived quality of dental education with the percentage of special needs patients the dentists treated. Dao et al. found dentists who felt well prepared were more likely to treat patients with special needs, set up their practice to meet the needs of these patients, have a more positive attitude, and feel more confident in treating them.

Noncompliant Behavior

Dentists serving patients with special needs may have an added challenge when treating children with ASD. Rekha, Arangannal, and Shahed (2012) asserted, “Autistic children are incapable of cooperating during dental treatment” (p. 130). Children with ASD have been reported to have significantly higher rates of noncompliant behavior during dental exams (Loo et al., 2009; Stein et al., 2014) and higher rates of anxiety when compared to same-aged peers with special needs other than ASD (Evans et al., 2005), and when compared to typically developing peers (Stein et al., 2014). Stein et al. (2014) used a group design to compare cooperative behavior during an oral exam, dental cleaning, and fluoride treatment in children aged 6- to 12-years old with ASD compared to typical developing children. Stein et al. found a statistically significant decrease in cooperation, and an increase in use of restraints for the children with ASD as compared to typical developing children.

A study by Loo et al. (2009) examined factors associated with compliance of over 700 patients, aged 3 to 21 years. The compliance of 395 patients with ASD was compared to the compliance of 386 neurotypical patients via dental record review. Researchers found that patients younger than 11 years old with and without ASD were more uncooperative than older patients. The study also found that patients with ASD, or with ASD and a second diagnosis, were more uncooperative than patients with pervasive developmental disorder-not otherwise specified (PDD-NOS) and neurotypical patients.

Children with ASD have been found to have high rates of fear and anxiety (Abbasnezhad-Ghadi, 2010; Evans et al., 2005), and increased anxiety during dental procedures (Stein et al., 2014). Stein et al. (2014) compared the anxiety levels of children with ASD and neurotypical children prior to and during an oral exam, dental cleaning, and fluoride treatment. Anxiety was measured through parent report on the Child and Adolescent Symptom Inventory-Anxiety scale, through the dentist’s rating on the Anxiety and Cooperation scale, and measures of electrodermal activity through placement of electrodes on the child’s finger prior to and during treatment. Children with ASD were found to have statistically significant higher levels of anxiety across all three measures as compared to the neurotypical children in the study.

Evans et al. (2005) asked 150 parents to rate 69 fears their child may have using a Likert-type scale. Evans et al. compared rates of fear and anxiety in children with ASD, aged 7 to 11 years, to several other groups of children. Children with ASD were compared to neurotypical children of the same chronological age, to children of the same developmental age, and finally, to children with Down syndrome of the same developmental age. Evans et al. found symptoms of anxiety as the sole predictor of situational fears of children with ASD and found impulsivity as the strongest predictor of medical fears for children with ASD. When children with ASD were compared to children in the other groups, the children with ASD were found to have significantly different fears than children from the other groups.

Behavior Management

The American Academy of Pediatric Dentistry (2011a) outlines basic and advanced behavior-management strategies. Basic behavior-management strategies focus on communication between the pediatric dentist, the parents, and the pediatric patient, and are a “continuum of interaction” (p. 175) to help the patient remain compliant and relaxed. Basic behavior-management strategies include communication, tell-show-do, voice control, nonverbal communication, positive reinforcement, distraction, parent presence or absence, and nitrous oxide. No single basic behavior-management strategy is used during dental treatment. Instead, the American Academy of Pediatric Dentistry describes the use of these techniques “as much an art as a science” (p. 176). The pediatric dentist must use an array of procedures based on the patient’s temperament, developmental level, dental attitude, and the presenting problem to guide the patient to alleviate fear and anxiety and to deliver quality dental care.

Basic behavior management. Tell-show-do is the most frequently used basic behavior management technique in dentistry (Zaretsky, 2011). This technique includes telling the patient what will happen, showing the patient the instrument, and then doing the procedure. Reinforcement is defined by the American Academy of Pediatric Dentistry (2011a) as a “technique to reward desired behaviors and, thus, strengthen the recurrence of those behaviors” (p. 180). Immediate verbal reinforcement is delivered after each step in a procedure and is an integral part of tell-show-do (American Academy of Pediatric Dentistry, 2011a; Klein & Nowak, 1998; Lyons, 2009).

Reinforcement is frequently used by practitioners and is a behavior management technique preferred by parents. A survey by Weil et al. (2011) found 89% of special needs dental practitioners report using positive reinforcement often. Fields, Machen, and Goodwin Murphy (1984) found similar results by 82% of parents of children with ASD rating reinforcement as acceptable. However, surveys of parents conducted by Castro, Oliveira, Paiva Novaes, and Farreira, (2013) and Marshall, Sheller, Manci, and Williams (2008) found parents rated reinforcement with much higher acceptability at 97.5% and 100%, respectively.

Tell-show-do is frequently taught in dental schools and used by dental practitioners. An online survey of 22 dental schools across the United States and Canada found 95% of dental schools report teaching students this technique (Krause et al., 2010).

In a survey, tell-show-do was rated highest as an acceptable behavior guidance technique by both parents and pediatric dentists (Castro et al., 2013; Fields et al., 1984; Zaretsky, 2011). Fields et al. (1984) reported 88% of parents of children with ASD found tell-show-do as acceptable. Castro et al. (2013) found a higher acceptance rate of 95% by parents of children without a disability and 87.5% by parents of children with a disability. Marshall et al. (2008) reported the highest acceptance rate of tell-show-do at 100% by parents of children with ASD. Additionally, Weil et al. (2011) reported behavior shaping, reinforcement, and tell-show-do are frequently used by 97% of pediatric dentist that were surveyed.

Although tell-show-do was rated the most frequently used technique of all behavior-management techniques in a survey of 789 pediatric dental practitioners in Canada and the United States (Weil et al., 2011), Zaretsky (2011) found tell-show-do was not rated as the most effective behavior-management strategy. Zaretsky conducted his master's thesis on behavior management techniques used by pediatric dentists serving patients with autism. Zaretsky used a Likert-type scale to quantify the frequency of behavior management techniques used and a separate Likert-type scale to assess the perceived effectiveness of each behavior management technique. Data showed tell-show-do was the second most effective method, with general anesthesia reported as the most effective technique. Similarly, a survey of 75 members of the Special Care Dentistry Association found 86% of special needs dental practitioners report using tell-show-do often with patients with ASD (Weil et al., 2011).

Tell-show-do has been studied only once to test its efficacy, although numerous surveys of parents and practitioners have been conducted since the 1990s (Farhat-McHayleh, Harfouche, & Souaid, 2009; Wilson & Cody, 2005). Farhat-McHayleh et al.

(2009) compared anxiety and fear of 155 neurotypical children aged 5 to 9 years when receiving dental instruction using live modeling versus tell-show-do. Each child was randomly assigned to one of three groups: live modeling by his or her mother, live modeling by his or her father, or tell-show-do by the dentist. Each child's heart rate was recorded every 30 seconds throughout a single 6-minute oral exam and cleaning by a pediatric dentist. An increased heart rate was used as an indicator of fear and anxiety. Data showed the group receiving tell-show-do to have the highest heart rate. Children receiving modeling by their father had lower mean heart rates, and children receiving modeling by their mother had the lowest heart rates. Based on the findings of Farhat-McHayleh et al., show-tell-do is not as effective when utilized by the dentist as by the parents.

Advanced behavior management. The guidelines of the American Academy of Pediatric Dentistry (2013) on the use of advanced behavior-management techniques include the use of protective stabilization (i.e., physical restraint or mechanical restraint), sedation, and general anesthesia. Advanced behavior-management procedures are recommended only after less restrictive interventions have been ineffective in getting the patient to comply with procedures. Advanced behavior procedures come with risks greater than those of basic behavior management, such as physical or psychological trauma, parental distress, restraint-related injuries (e.g., bruises and scratches), overheating, and a compromised airway (American Academy of Pediatric Dentistry, 2013; Shin, Seunghoon, Kim, Kim, & Kim, 2016). There is no research that indicates whether the use of basic behavior-management procedures prevent the use of advanced behavior-management procedures, although Klein and Nowak (1998) suggested the use of the papoose board may protect the patient and dental staff and allow dental procedures to be completed without resorting to more restrictive measures.

Because of the rationale for the use of restraints (i.e., patient and dental personnel safety), it may be difficult to conduct a study using scientifically based procedures such as a placebo group. Most articles on behavior management are opinion based, descriptive, or surveys. There is minimal evidence derived from clinical studies on techniques used to control children’s behaviors published in dental journals. Many questions remain regarding the effectiveness and efficiency of clinical protocols associated with behavior management (Wilson & Cody, 2005).

A recent article published by Chen, Yang, Chi, and Chen (2014) studied the heart rate of 19 adult patients with disabilities at a dental hospital in Taiwan. The study included a baseline heart rate measure, heart rate after applying the papoose, and heart rate during a dental cleaning while restrained with the papoose. Chen et al. found some participants had a reduced heart rate with the use of a papoose board, and some remained stable. Chen et al. also had caregivers report on the patients’ anxiety level during the procedure. Results of the caregiver report, although, were contrary to the participants’ heart rate measure. Chen et al. reported the use of the papoose as controversial considering its calming effects on the autonomic nervous system due to its deep touch pressure acting as a calming agent and suggest that, for some patients, the use of the papoose board acts as such. The Chen et al. study is the only clinical assessment to test the effects of the papoose board on patients’ anxiety.

General anesthesia and protective stabilization are reported to be the most frequently used advanced behavior-management strategies to treat patients with ASD (Loo et al., 2009; Zaretsky, 2011). In the Zaretsky (2011) survey of 789 dental practitioners in Canada and the United States, participants were asked to rate the behavior-management strategies with patients with ASD on a Likert-type scale ranging from 1 to 5. Participants rated general anesthesia as the most effective strategy with an average score of 4.34, and they rated protective stabilization with an average score of 2.66. Loo et al. (2009) found similar results, with general anesthesia (36%) as the primary advanced behavior guidance technique used and protective stabilization (20%) as the second most frequently used advanced behavior-management strategy for patients with ASD. Additionally, Loo et al. found protective stabilization was never used in his study on patients without ASD.

Patients with ASD were found to require longer general anesthesia than patients with a diagnosis of PDD-NOS and neurotypical patients (Loo et al., 2009) due to “behavioral challenges in the dental office” (Rada, 2013, p. 247). In a review of patient records, Rada (2013) found the average length of sedation for children aged 0 to 10 years to be 2.27 hours long. Tooth extractions and cleanings occurred under general anesthesia due to the inability to perform these procedures in the dental office because of disruptive behaviors. A file review conducted by Loo et al. (2009) of 395 patients with ASD found that general anesthesia was used more frequently with patients with ASD than patients without ASD and that general anesthesia was used as the primary advance behavior-management strategy for patients with ASD. A review of patient records by Shin et al. (2016) found a large number of parents choose general anesthesia for their child with a disability due to dental anxiety and poor cooperation.

Behavior guidance of the patient with special health care needs can be challenging. Children with ASD and other disabilities may exhibit noncompliant behaviors, and these behaviors can interfere with the safe delivery of dental treatment (Cordova & Padilla, 2012). To gain body control for dental procedures, a variety of protective stabilization methods can be used. However, for "better working conditions and a more predictable patient response, the use of parental assistance, pharmacological aids, and immobilization was applied" (McDonald, Avery, & Dean, 2004, p. 534).

A survey by Marshall et al. (2008) found parents rated protective stabilization as more acceptable if the procedure had been used with their child. Marshall et al. reported 54% of parents found protective stabilization as acceptable; however, parents of children who had protective stabilization used during their dental procedure rated the technique as 90% acceptable. Conversely, Castro et al. (2013) found a lower acceptance rate of 27% by parents. Castro et al. described each behavior management procedure and showed a picture of each procedure to two groups of parents: 40 parents of children with disabilities, and 40 parents of children without disabilities. Parents then immediately rated each procedure on a Likert-type scale. A statistical difference was found between the acceptability of the use of protective stabilization between parents of children without a disability (17.5%) versus the acceptability by parents of children with disabilities (27.5%).

Parent Satisfaction

Parent satisfaction is an important component of a pediatric dental practice. Parents report a number of reasons for being dissatisfied with dental treatment for their child with ASD. Of those reasons, parents report that providers do not have adequate knowledge of behavior management for children with ASD (Abbasnezhad-Ghadi, 2010). Lyons (2009) asserted, "Dentistry's lack of proficiency with behavioral support techniques may be the biggest barrier to access to oral health care for people with special needs" (p. 48).

Parents rate advanced behavior guidance techniques less favorably than basic behavior guidance techniques. In a study by Fields et al. (1984), 67 parents rated 10 different behavior guidance techniques after viewing a video of each procedure. Parents found several behavior guidance techniques unacceptable with the ASD population. The greatest number of parents found the use of a papoose board always unacceptable. The rating of the papoose board was statistically significant at the .05 level compared to the other techniques rated as unacceptable. Other techniques included the use of general anesthesia, hand over mouth, and physical restraint.

Use of the papoose board and general anesthesia were consistently rated as unacceptable by parents except in emergency situations (Fields et al., 1984), although these two techniques are the two most commonly used for behavior management during dental treatment with individuals with ASD (Loo et al., 2009; Zaretsky, 2011). A survey administered by Capozza and Bimstein (2012) of 56 parents of neurotypical children and children with ASD support these findings. Parents of both groups of children reported that they would likely consent to anesthesia in the operating room, although less than 20% of parents would agree to general anesthesia for other procedures.

Procedures and Treatments

Some procedures and treatments have been used to increase compliance and reduce anxiety in patients with special needs and ASD during routine dental care. Procedures derived from ABA have “the potential to improve traditional behavior management strategies in dentistry” (Hernandez & Ikkanda, 2011, p. 286). Researchers across multiple disciplines (e.g., dentistry, psychology, and behavior analysis) have investigated procedures that have shown success in reducing fear and anxiety in patients with ASD and increasing compliance with dental procedures. Individual treatments such as visual supports, video modeling, and a combination of treatment procedures have decreased anxiety and improved compliance with dental procedures (Altabet, 2002; Conyers et al., 2004; Huckfeldt, 2006; Luscre & Center, 1996; Melamed, Hawes, Heiby, & Glick, 1975).

Visual Supports

One research-based strategy for those with ASD is the use of visual supports. Visual supports are “any visual display that supports the learner engaging in a desired behavior or skills independent of prompts” (Wong et al., 2013, p. 22). Visual supports have been a component of the Division TEACCH (Treatment and Education of Autistic and related Communication handicapped CHildren) model for many years (Bryan & Gast, 2000; Mesibov & Shea, 2010). Examples of visual supports include “pictures, written words, objects within the environment, arrangement of the environment or visual boundaries, schedules, maps, labels, organization systems, and timelines” (Wong et al., 2013, p. 22). A variety of TEACCH visual supports have been used to assist individuals with autism, including writing text on a white board, using pictures and written text to recall completed activities (Murdock & Hobbs, 2011), and using text paired with pictures to initiate communication (Krantz & McClannahan, 1998). Visual supports offer additional assistance beyond only auditory stimuli by providing concrete representations of concepts. Two- and three-dimensional stimuli are reported to assist the learner with ASD to follow schedules when delivered visually versus aurally (Quill, 1995).

Wong et al. (2013) assessed the use of story maps, a type of graphic organizer that cues the reader to record specific information from a story, to enhance story recall of three boys aged 8 to 11 years with high functioning autism. The authors employed a multiple baseline design within a school setting to use a story map using a specific four-step least-to-most prompting hierarchy. After completing the story map, the participants took a reading test on the corresponding story. Participants quickly acquired story recall skills, with the first participant reaching 100% independence following the first session using the story map. Maintenance data were collected up to 2 weeks after intervention, and all three participants maintained accurate reading recall between 80% and 100%.

Marshall et al. (2008) used a treatment package of visual prompts in the form of a written response on a white board in conjunction with reinforcement along with the model, lead, and test procedure to teach a 13-year-old boy with autism and echolalia to answer, “Where are you?” The model, lead, and test procedure was developed as part of Direct Instruction and includes the teacher modeling the correct response, reviewing the targeted response, and then testing the student. During the intervention, the researcher took the participant on a “where walk” in which the participant was taken to five targeted locations around the school. The treatment package was effective in teaching the participant to answer, “Where are you?” The skill maintained after prompting was removed and generalized when asked by different school staff members and across other untrained locations around the school.

Murdock and Hobbs (2011) also taught younger children with ASD to answer a question using visual supports. Murdock and Hobbs taught three 5-year-olds to respond when told, “Tell me what you did today,” using nine Mayer-Johnson pictures with typed text beneath each picture set in a 3 x 3 grid. A line was adjacent to the grid in which the teacher would draw a picture and write a sentence about one thematic activity the student engaged in during the day. Unlike the study by Marshall et al. (2008), all participants spoke at the sentence level prior to intervention. During intervention, all participants quickly increased the number of responses given when asked, “What did you do today?” Due to time constraints, the fading condition in the study was shortened to only two data points above baseline before entering the generalization phase. Even with the limited fading, two participants maintained responding when only the 3 x 3 grid was present. During the generalization phase, all three participants told parents what they did at school while using the visual cues and included expanded comments beyond the visual information.

Researchers have also taught communication skills within a school by using cartoon characters with speech bubbles as a template for each participant to identify specific words and phrases to be used to communicate with peers on a variety of topics. Embedded within the topics, giving compliments, requesting actions/objects, and requesting information were targeted for skill acquisition. This intervention package included training two classmates for each of the five participants to create five triads. Participants were five children with PDD-NOS aged 6 to 9 years. Using a multiple baseline design, each triad began the intervention phase by engaging in 10 minutes of instruction, 10 minutes of the social activity with the trained peers, and 5 minutes of adult feedback. The intervention included textual and visual cues, a token board, and gestural, verbal, and physical prompts. Results showed that each participant increased initiations in at least two of the three targeted communication categories.

Visual schedules. Visual schedules are one type of visual support system consisting of photographs, images, or drawings depicting a specific sequence of events (Banda, Grimmett, & Hart, 2009; Bryan & Gast, 2000). Visual schedules are also referred to as visual picture prompts, activity schedules, photographic activity schedules (Bryan & Gast, 2000), and picture schedules (Prelock, 2006). Visual schedules also may include a sequence of objects or written text in place of pictures to cue the learner to the next activity in the sequence (Ganz & Flores, 2008; Mesibov, Browder, & Kirkland, 2002).

Visual schedules are commonly used as a support for people with autism because they provide assistance in deficit areas of auditory processing by capitalizing on the common visual-spatial strength of individuals with ASD (Banda et al., 2009; Dooley et al., 2001; McClannahan & Krantz, 1999; Quill, 1995). Visual schedules often are used to teach steps within an activity (i.e., visual task strip; Bryan & Gast, 2000) or teach transitions between activities, although visual schedules also have been used to teach communication, daily living skills, academics, and reduce inappropriate behaviors (Banda et al., 2009). However, "the ultimate goal of an activity schedule is to increase independen[ce]" (Banda et al., 2009, p. 20).

To teach an individual to use a visual schedule, each picture, word, or object is first created by an adult and placed in a sequence and then presented to the individual prior to the start of the activity. The visuals are placed in a central location on a Velcro strip, within a portable binder, or on a written paper or white board (Banda et al., 2009). A cue is then delivered to direct the individual to the first item on the schedule. Initially, physical guidance or gestural prompts may be needed to teach the individual to use the visual schedule (McClannahan & Krantz, 1999) by guiding the individual to remove the picture or cross off the activity listed, then to begin the next activity on the schedule (Banda et al., 2009). Prompts should be faded quickly, as a weakness of this strategy is the reliance on additional support (i.e., prompt dependency or adult support) beyond the visual information (Bryan & Gast, 2000).

Researchers used a visual schedule to teach three children with autism to play Guitar Hero, an interactive video game. The children were aged 9 to 12 years and had prior experience with visual schedules and video games. Additionally, two participants had prior experience with video modeling. Prior exposure, therefore, limited the validity of this intervention package. On-task data and task completion data were recorded. Graduated guidance was used during the intervention to assist pressing the buttons on the guitar. Additional reinforcement was not used. The picture “Play Guitar Hero” was on each participant’s visual schedule with a visual task strip for the procedure. The visual task strip was faded similarly to a fading procedure when using total task chaining such that as each step in the task analysis was mastered, the visual picture was removed from the task strip. Maintenance was sustained during a single 30-day assessment following intervention.

Although some studies use visual supports as a component of play, the following is the only study that directly taught a new play skill without additional prompting. Dauphin et al. (2004) examined the use of visual schedules to teach dramatic play to a 3-year-old boy with autism in a home setting. Using a multiple baseline design across play sequences, the student was directly taught three play sequences in each phase of the study. In the first phase, the elementary student was presented with three play sequences in picture and video format on the computer. Each video or picture slide was forwarded to the next step in the play sequence by clicking on the slide.

The second phase of the study used photos from a new, unlearned, play sequence that were arranged as a visual schedule in a photo album. The third phase combined both video and photos of a third new sequence of play skills presented in the PowerPoint format. The student learned all of the play sequences and generalized the sequences to create new socio-dramatic play sequences that were not directly taught by combining aspects of learned play skills. Additionally, this study incorporated computer technology to expand the common use of visual schedules as printed photo, picture, or word schedules to include the visuals in a PowerPoint format that was manipulated by the participant (not an instructor).

Socialization. Researchers have assessed joint activity schedules to promote peer engagement of three dyads of preschool children with autism using visual schedules in a three-ring binder. Each page of the schedule contained a picture of one of the participants from the dyad, a script saying "Let's play __," and a picture of a preselected game. The final two pages of the activity were designated as free choice, although four specific games were available. Data on engagement and teacher prompting were collected using a 20-second momentary time-sampling. All three dyads slowly but steadily increased independence and engagement following the implementation of the joint activity schedules. All three dyads maintained high levels of engagement during generalization. Two of the three dyads maintained high levels of engagement when activities were resequenced on the schedule. One dyad maintained engagement initially after the resequencing, but then engagement quickly waned during each subsequent data collection session. Intervention was withdrawn for one dyad and engagement for that dyad immediately reduced to 0% engagement when the visual schedule was removed. A weakness of this study is that each participant had prior exposure to individual activity schedules that they used independently prior to the study.

Krantz and McClannahan (1998) taught social interaction to three boys with autism aged 4 and 5 years in this seminal article. Prior to the study, all three participants used single words to request items, although they never used language to initiate attention. Additionally, all three participants independently used a 5-step activity schedule and could read the words *look* and *watch me* when presented as a flash card. The intervention used a 16-page activity schedule in the form of a book with one picture on each page. Ten of the 16 pages had both a picture and an attention phrase. During baseline, errorless teaching in the form of graduated guidance was used to teach the participants to use the activity book. The intervention included both the use of the activity book and the additional scripted phrases on some of the pages. Two of the participants increased unscripted initiations. All three participants increased scripted initiations and elaborated beyond the script. Participants generalized initiations across settings and people. During the intervention, graduated guidance, verbal prompts, and script fading were used in addition to the visual activity book. A limitation of this study was that the data collection procedure was not sensitive to imitative language versus novel language during initiations following the intervention and therefore did not capture the specificity of the language gains.

Hughes et al. (2011) studied the effects of a social skills intervention with five participants aged 15 to 21 years. Participants had a range of verbal skills from nonverbal to short sentences and were identified as having a variety of disabilities, including ASD, attention deficit hyperactivity disorder, and Down syndrome. Each participant was taught to use a visual communication book. The communication book contained between nine and 30 pages. Each page had a Picture Communication Symbol and a social initiation phrase under the picture. Verbal participants would read the phrase to a high school student who was trained to be the communication partner.

The study took place across the lunch room and two general education enrichment classes. Data were collected on interaction and initiating using a 10-second partial interval system. All five participants increased interaction and initiations immediately and sustained high levels throughout the intervention and across locations in the school. A limitation to this study was the extensive training for use of the communication book within the intervention phase. Training ranged from 12 to 57 sessions for the participants.

Additionally, interobserver agreement had a vast and low range, often near 50%, meaning data collectors had poor accuracy, therefore limiting validity of the data of the dependent variable.

Behavior. Pierce and Schreibman (1994) were the first to conduct a study using visual schedules as a self-management strategy. This seminal article is important to the research literature because, until this time, visual schedules were only being used with an older population. Pierce and Shreibman taught three students with autism, aged 6 to 8 years, to engage in a variety of daily living skills, including setting the table, making lunch, doing laundry, making a drink, and making a bed using visual schedules in a photo album. Each of the three participants was taught three daily living skills. This study measured on-task behavior, the length of time it took to learn a daily living skill, and the length of time to learn each picture in the sequence of steps within the daily living skill.

Although students were taught to use a visual schedule to complete a variety of daily living skills, data were only collected prior to and following training. This data showed a significant increase in independent completion of the daily living skills for two of the three participants with the visual schedules present. Pierce and Schreibman (1994) found participants unable to complete the skills when the visual schedules were removed, and considered this a weakness of their study, although current research identifies the addition of visual supports in an environment as an evidence-based practice for individuals with autism (National Autism Center, 2009, 2015; Wong et al., 2013).

Visual schedules were described by Mesibov et al. (2002) as a predictor strategy in which immediate antecedents modify the occurrence of problem behavior. The authors stated, “Individualized schedules may act as a form of antecedent intervention to reduce challenging behavior as they may limit the impact of various setting events (e.g., stressful activities, unpredictable transitions) on such behaviors" (p. 73). They measured self-injurious behaviors and on-task behaviors for a 12-year-old male student with autism while following a schedule derived from the finding of a functional analysis compared to no schedule. Data were collected for 30 minutes once each week. Data showed increased on-task behavior and decreased self-injury during the schedule condition compared to the no-schedule condition. These gains maintained at 3- and 5-month follow-ups and continued to improve beyond the intervention phase.

Waters et al. (2009) conducted the only study in this analysis that directly measures and seeks to identify the efficacy of reducing disruptive behaviors by using only a visual schedule. This multiple baseline design across two 6-year-old boys with autism measured disruptive behaviors at the start of a transition and at the stop of an activity. This study had three conditions: first, with the visual schedule present; second, without a visual schedule present; and third, with both conditions repeated while reinforcing other nondisruptive behavior as the final condition. This study found no change in disruptive behavior by only providing the visual schedule. No change in disruptive behavior was seen until the reinforcement condition was added. During this condition, disruptive behaviors were reduced for both participants, but not eliminated. This study did not result in an increase in the desired/targeted behavior. In this study, a visual schedule alone was not effective in reducing behaviors during transitions for either participant.

Whatley, Gast, and Hammond (2009) used visual schedules to provide structure and guidance as a predictor strategy to inform students which activity came next. Both studies provided visual cues to students to identify the current activity and the next activity in the sequence. The authors used visual schedules to teach two children with autism to transition to sequential activities. This study used two types of schedules: a stationary daily schedule and a portable schedule carried in a small photo album. This study also measured the latency of each child from checking his or her schedule to the initial movement to the next activity. The researchers taught four adolescent boys with moderate intellectual disabilities to manage their leisure time effectively via visual schedule using a portable schedule. This study measured the percentage of transitions independently completed by each student. There was a significant increase in independent transitions while utilizing visual schedules and showed a return to low rates of independent transitioning when the visual schedules were removed.

A second measure in the study by Whatley et al. (2009) was of on-task behavior. On-task behavior was measured as present or absent using a time sampling procedure at 1-minute intervals over 20 minutes of leisure time for four adolescent boys with moderate intellectual disabilities. The definition of on-task behavior was identical to that in a study by Bryan and Gast (2000) in which on-task behavior was measured using time sampling each minute for 40 minutes during language arts. The study also provided the visual schedule within a portable three-ring binder for its four teenage participants with ASD and found the use of visual schedules led to rapid on-task engagement in leisure skills and corresponded to decreased off-task behavior. Unlike the findings of Waters et al. (2009), Whatley et al. found an increase of engagement and learning the pictures and words on the schedule without reinforcement.

MacDuff, Krantz, and McClannahan (1993) taught four 9- to 14-year-old boys with autism to use a six-picture activity schedule within the group home in which they lived. Each participant engaged in aggression, tantrums, and elopement. Additionally, each participant had severe language deficits. MacDuff et al. taught participants to follow a schedule of preferred activities to reduce reliance on staff's verbal interaction to prompt participants' on-task behavior. MacDuff et al. recorded on-task and on-schedule behavior using momentary time sampling each minute over 60 minutes. MacDuff et al., like Whatley et al. (2009), found a rapid increase of on-task behaviors after implementing the visual schedule.

Bryan and Gast (2000) replicated a study by MacDuff et al. (1993) to teach on-task and on-schedule behaviors to four students with autism aged 7 and 8 years. Unlike the participants in the study by MacDuff et al. that took place in a group home, these participants learned to follow a schedule in school, and on-task behavior was recorded over 40 minutes of reading centers versus 60 minutes of leisure time. When teaching the participants to use the visual schedule model prompts (MacDuff et al., 1993), graduated guidance (Bryan & Gast, 2000) and verbal praise were used at the start of the study. After initial instruction, all participants significantly and rapidly increased the number of independent steps completed while following a visual schedule. Additionally, all participants maintained near or at 100% during maintenance and generalization probes for following the schedule and maintained high rates when the schedules were re-sequenced.

A study by Hume and Odom (2007) measured on-task behavior using the same definition as that of Bryan and Gast (2000) for three participants with autism. Hume and Odom used a multiple baseline to assess on-task behavior and work completion of the participants by utilizing visual schedules and work systems. The two younger participants, ages 5 and 6, followed a stationary visual schedule set up in a TEACCH work station in their classroom. The use of the visual schedule increased appropriate and functional play during their classroom rotation in the play center. The older participant, aged 20 years, increased independence in scanning library documents at his office job utilizing the same TEACCH organizational systems. All three participants showed improvements when the TEACCH treatment was implemented, decreased when treatment was removed, and increased independence again when the work system was reimplemented. This study showed significant change in participants' on-task behavior while the TEACCH visual schedules were present and a reduction when the visuals were removed.

Angell, Nicholson, Watts, and Blum (2011) assessed the use of a Power Card and social praise to decrease the latency of transitions between classroom activities. The Power Card strategy was developed by Ganon (as cited in Angell et al., 2011) and uses a person's interest in characters or heroes to create an image on a card. The card also includes text directing or listing a desired behavior of the individual. In this study, the participants were given a Power Card, then were issued the instruction to "Check your schedule." Participants were given social praise after checking their schedule. Using an alternating treatment design, Angell et al. found all three participants significantly and immediately reduced the latency of their transition time to less than half of baseline during each intervention phase. Two participants remained at baseline during withdrawal phases, and one participant's latency decreased gradually during withdrawal phases. Neither maintenance nor generalization was assessed in this study. Interobserver agreement was strong with a range from 86%–100% and was collected across 47% of all phases.

Cale, Carr, Blakeley-Smith, and Owen-DeSchryver (2009) assessed the use of visual schedules to reduce problem behaviors during transitions of two 5-year-old girls with PDD-NOS and one 8-year-old boy with Asperger disorder. Cale et al. used antecedent strategies (i.e., shorter duration of transitions, accompanied by preferred peers), in addition to visual schedules in a three-ring binder, and provided each student with a “What did I miss?” cue card. Cale et al. recorded the number of steps completed in the transition following a task analysis and found all three participants completed 100% of the steps after the first implementation of the intervention and also rapidly increased time on task.

Vocational. One of the three participants in the Hume and Odom (2007) study was a 20-year-old male with autism who followed a visual schedule at his work setting. This aspect of the study focused on the participant scanning a set number of book pages as part of an individual work system; one component of the work system was the inclusion of a visual schedule. This study used a withdrawal design by first collecting baseline data, then providing the supports inclusive to an individual work system, and finally withdrawing these supports. This aspect of the study collected data by counting the number of pages independently scanned by the participant at his work setting. This research design demonstrated experimental control and showed an increase in the number of pages independently scanned by the participant while the visual supports and work system were present.

Also at a job site, Carson, Gast, and Ayres (2008) used visual schedules to sequence four activities for three participants with mild and moderate intellectual disabilities aged 18 to 20 years. This study examined both the number of materials produced within each job activity over 40 minutes and on-task behavior through the participants’ time at the job site. Visual schedules were used in a photo album format to sequence four work activities for each participant. A single-subject withdrawal design was used in this study, and data were collected and calculated as rate (i.e., number of materials produced/time). As in the Hume and Odom (2007) study, all participants increased material production when visual schedules were present.

Daily living skills. Morse and Schuster (2000) conducted a study with eight participants aged 5 to 12 years to teach grocery shopping skills. Two different visual schedules were used. The first was a visual schedule to rehearse shopping within the classroom. The second visual schedule was used in the grocery store and included visuals of the aisle and the item to select from that aisle. Additionally, an in-vivo constant time delay procedure was used to teach grocery shopping skills. A task analysis was developed for the grocery shopping, and data were collected on each step in the sequence. Each participant made rapid improvement by the third training session. Six of the participants met the 100% mastery criteria. The remaining two participants likely would have met the criteria, but the study was stopped due to the end of the school year. Morse and Schuster found constant time delay to be an effective teaching strategy in conjunction with visual schedules to teach a functional life skill in the community setting.

Alberto, Cihak, and Gama (2005) and Cihak, Alberto, Taber-Doughty, and Gama (2006) compared visual cues to video prompting. Both studies taught middle school students with moderate intellectual disabilities to use an ATM and purchase two items in a grocery store. Differences in the two studies included the study designs. Alberto et al. used an alternating treatment design, and Cihak et al. used an alternating treatment design within a group with three students in each group. Although both pictures and video depicted person point-of-view images, the presentation of the visual stimuli varied between studies. Alberto et al. showed the 7- and 8-minute video on a screen and 3- by 5-inch visual cues in an album. Conversely, Cihak et al. showed both visual stimuli on a 5-foot screen, each for 4 seconds. That is, visual cues were shown for 4 seconds, and the video clips were 4 seconds in length. Both Alberto et al. and Cihak et al. found their strategies to be effective and efficient. Alberto et al. noted that one participant who did not attend to the video prompting did better in the visual cueing condition. Cihak et al. supported these findings in that the two participants with poor focus in the video prompting condition acquired the skill faster and had fewer errors in the visual cueing condition, suggesting that individuals with poor attention may benefit from visual cues more than video modeling to acquire new skills.

A study by West (2008) compared the use of verbal instructions to the use of visual cues to teach chained tasks to four young children with ASD. West found visual cues to be the preferred method of instruction when teaching setting a table and arranging an art activity. Visual cues were found to reduce the need for direct supervision and provided students access to less restrictive environments, which resulted in fewer errors in responding and increased maintenance and generalization. West found verbal cues led to high error rates, led to dependency on caregivers, and limited the maintenance of skills as was seen.

Dental. Visual task strips have been recommended as an intervention for dental visits (Harnois, 2016) and have been used to teach children with ASD to brush their teeth, although findings on the efficacy of the intervention are varied (Pilebro & Backman, 2005; Sallam, Badr, & Rashed, 2013). Pilebro and Backman (2005) examined the effects of visual task strips to teach 14 children with autism aged 5 to 13 years to brush their teeth. In this study, a 13-step visual task strip was created by the researchers and sent home for parents to use with their children. All parents completed a survey prior to using the visual task strip and rated the difficulty of brushing their children’s teeth. Parents were then instructed how to use the visual task strips with their children through verbal and written instructions. At the conclusion of the study, all parents reported, via phone survey, that their children had less difficulty brushing their teeth after using the visual task strips. Children had oral exams prior to the study, both 8 months and 12 months later. Oral exams showed less plaque on all the patients' teeth.

A study by Sallam et al. (2013) compared the effects of a demonstration on a model of upper and lower teeth, a 12-step visual task strip, and video modeling on independent brushing of teeth of 36 children with ASD. Children aged 6 to 12 years were randomly assigned to one of the three groups. All children had 20 exposures over 4 weeks to the assigned treatment, and brushing teeth was rated as follows: independent, accepting with minimal assistance, needed effort, or totally refused. No child in the study independently brushed his or her teeth during baseline. In the demonstration group, no child demonstrated independence at the end of the study. However, two children improved by brushing their teeth with minimal assistance, and three fewer children completely refused brushing at the end of the study. Sallam et al. found the group of children receiving instruction through visual task strips to improve minimally, although statistically significant. One child independently brushed his or her own teeth at the end of the study. Six children improved by brushing their teeth with minimal assistance, and five fewer children completely refused treatment. The group that was instructed using video modeling made the greatest improvement. Three children independently brushed their teeth at the end of the study. Five children improved by brushing their teeth with minimal assistance, and six fewer children completely refused treatment. These findings may indicate that visual task strips may be an ineffective strategy to teach children to comply with dental procedures.

Visuals, using real pictures, of 32 steps in a dental visit were shown to eight teens with ASD aged 12- to 17-years old. This qualitative study by Wibisono et al. (2016) asked open-ended questions about each of the pictures. Results varied across pictures, with some pictures being identified by all participants, and some pictures being identified by few participants. Although Wibisono et al. reported, "Dental visit pictures could be used as useful communication tools for children with ASD" (p. 359), the real-life application was not assessed, nor was the validity of the participants' responses across pictures convincing.

Summary of visual supports. Research suggests visual schedules are a useful strategy to teach transitions to and between activities. Visual schedules act as a cue to increase on-task behavior for play skills, leisure skills, job tasks, and self-management. Inappropriate behaviors are reduced when visual schedules are paired with reinforcement. Across studies, a variety of methods were used to display the visual information: central location, portable book, and computer format. Though no pattern of a superior delivery method was identified, all were found to be effective.

All of the studies contained in this analysis showed significant improvement in areas of common skill deficits for those with autism, such as managing self and increasing autonomy. Because there is a desire for those with autism for predictability, order, and consistency, visual supports are a useful strategy. Only two studies, Waters et al. (2009) and Whatley et al. (2009), directly measured the inclusion of reinforcement on the efficacy of visual task strips, and found opposing results. Reinforcement was provided in a variety of forms, including social praise, tokens, and tangibles though social praise was most readily used. Alberto et al. (2005) and Cihak (2011) asserted that visual schedules may facilitate learning better for students who are easily distracted due to the picture cue constant availability. Other individuals who attend and show interest in a video prompt may have a greater benefit in using video modeling as a teaching strategy. However, no study has assessed the use of visual supports within the dental setting. Therefore, further research of this application is warranted.

Video modeling. Video modeling is a strategy involving individuals watching a video demonstration of an adult, peer, or themselves engaging in a target skill or behavior and then imitating the behavior of the model (Charlop-Christy et al., 2000). Video modeling is also referred to in literature as video priming (Schreibman, Whalen, & Stahmer, 2000), video rehearsal (Van Laarhoven & Van Laarhoven Myers, 2006), or filmed modeling (Melamed et al., 1975). Video modeling is considered an evidence-based practice by both the National Professional Development Center on Autism (Wong et al., 2013) and the National Standards Report (National Autism Center, 2009, 2015), in studies that applied rigorous standards to the review of research on a variety of strategies for people with autism from birth to 22 years old (National Autism Center, 2009, 2015).

Variations of video modeling include adult modeling, in which an adult is videotaped engaging in the targeted skill or behavior; peer modeling, where a peer is recorded engaging in the targeted skill or behavior; and self-modeling in which a video of the person is recorded and then edited to show the person accurately or effectively engaging the targeted skill or behavior (Charlop-Christy et al., 2000). Video modeling is recorded from the third-person point of view, or the perspective of a person watching the individual engage in the targeted skill or behavior. This perspective is also called spectator view (Cannella-Malone et al., 2006). Person point of view is a variation in which the video is recorded from the perspective of the individual engaging in the targeted skill or behavior and is also referred to as subjective point of view (Mechling et al., 2008). Person point of view can be used with self-modeling or peer modeling. Video prompting often is used to teach skills that include multiple steps, such as preparing a meal. Video prompting shows short clips of videos, each depicting one step in the task, after which the individual immediately performs the task (Sigafoos et al., 2005). Often person point of view is used in video prompting (Cannella-Malone et al., 2006).

Video modeling was used as early as 1974 to effectively teach dental compliance with preschool children (Machen & Johnson, 1974) and teach adolescents with intellectual disabilities to imitate actions (Stephens & Ludy, 1975). Video modeling has been shown to be effective in teaching a variety of new behaviors to people with ASD and developmental disabilities, such as social-communication, play skills, daily living skills, vocational tasks, academics, and reducing disruptive behaviors (Apple, Billingsley, Schwartz, & Carr, 2005; D'Ateno, Mangiapanello, & Taylor, 2003; Decker & Buggey, 2012; Schreibman et al., 2000; Shipley-Benamou et al., 2002).

Social communication. Apple et al. (2005) conducted two experiments to teach compliment-giving and initiations through video modeling to two 5-year-old boys with autism who had average to high language skills. In the first experiment, the participants were shown a video of a known peer being shown a preferred toy or item, selecting the toy or item, then playing for 15 minutes in the school's integrated preschool classroom. In the second experiment, the participants were shown a video of a peer initiating a compliment to a classmate. Using a multiple baseline design across participants, Apple et al. conducted multiple phases of the study. Phase 1 included video modeling for both compliment-giving and initiating. During this phase, one participant increased compliment-giving immediately. The second participant gradually improved compliment-giving, meeting 100% by the third training session. However, neither participant initiated during this phase.

During Phase 2, reinforcement was added to the video modeling intervention, and both participants responded at 100% the first day of intervention. Phase 3 intervention included reinforcement only. During this phase, the first participant initially decreased initiating but then regained the skill and maintained responding. Conversely, the second participant increased initiating during this phase and then decreased responding. During the final phase, return to baseline, the first participant’s responding maintained, although initiating fell to zero. The second participant maintained both initiating and responding. Interobserver data were recorded across a sufficient number of sessions and had strong reliability at 100% across all phases. Overall, this study had weak external validity, as it included only two participants, and each participant had varied results.

Sherer et al. (2001) compared video self-modeling to video peer modeling on the acquisition of answering and reciprocating social questions with five boys with autism aged 3 to 11 years. Peers shown in the video were the same gender and age as the participants. A multiple baseline design with an alternating treatment design was used. During the treatment condition, each participant viewed the video three times at home by the caregiver prior to going to sleep. The sessions were held the following day in the participants’ homes by the researcher. Data showed video self-modeling and video peer modeling to be effective in teaching responses and reciprocity of social questions for three participants. One participant showed greater improvement in the video self-modeling condition. One participant showed greater improvement with the video peer modeling. Maintenance data were collected for four of the five participants 2 months following the end of intervention. Similar to the study by Apple et al. (2005), results varied and found two participants maintained the skill and two participants demonstrated zero rates of answering and reciprocating questions. Generalization across untrained questions and with an unknown peer and family members was successful for one participant. One participant showed generalization across people, but not to new questions. Generalization was not assessed with the other participants.

The study by Reeve, Reeve, Townsend, and Poulson (2007) varies from other video modeling studies in that the video modeling was used as a consequential strategy after the student did not imitate from a live model. Reeve et al. assessed video peer modeling with four children with autism aged 5 and 6 years to teach helping responses. Each participant in the study had prior exposure to informal video modeling. During the training session, a set of three discriminative stimuli were delivered: a nonverbal cue, such as wiping the table; a verbal cue, such as “This table is dirty”; and an affective cue, such as sighing or rolling eyes. If the participant emitted both a verbal and a motor helping response (e.g., “Can I help?” and then wiping the table), tokens and verbal praise were delivered. If no response or an incorrect response was emitted, a video showing the experimenter delivering the same set of discriminative stimuli and the targeted helping response by a peer model were shown.

If after viewing the video the participant did not emit the targeted helping response, verbal and physical prompts were used. No prompts were used during any other condition in the study. All four participants demonstrated helping responses on 15 of 16 opportunities within 14 sessions. Maintenance was assessed 60 days after the conclusion of the study. Three participants maintained helping responses at 100%, and one participant maintained helping responses at 95%. All four participants demonstrated generalization across settings, people, and stimuli. Interobserver data were collected from videotaped sessions and seemed reliable, and generalization was robust, ranging between 96% and 100% when presented with 116 opportunities.

Marzullo-Kerth, Reeve, Reeve, and Townsend (2011) assessed the use of reinforcement and video modeling on the sharing of four boys aged 7 to 8 years old with autism. Six video clips were recorded using three sharing phrases across three groups of items: art materials, toys, and food. During the training sessions, participants were given a set of materials and told to engage with the materials. The researcher then approached. If the participant offered motorically (e.g., reaching, handing, or giving) and verbally (saying “here,” “take it,” “have a turn,”) within 5 seconds to share, the researcher engaged with the materials that were offered by the participant. If the participant only shared using one mode (e.g., motorically but not verbally) or did not offer to share at all, the participant was shown one of the video modeling clips.

Like the study by Reeve et al. (2007), the video modeling intervention (Marzullo-Kerth et al., 2011) was used as a consequence strategy rather than an antecedent strategy. The video created by Marzullo-Kerth et al. (2011) showed two 7-year-old boys sharing. The training session, however, targeted the child sharing with the adult researcher. The materials presented in the training session did not necessarily correspond to the materials viewed in the training video. After viewing the video, the materials were represented to the participants. A correct sharing response resulted in the researcher playing with the materials; an incorrect response or no response resulted in a physical and verbal prompt.

Interobserver agreement was adequate, results showed all four participants reached at least 80% independent sharing between four and eight sessions, and sharing was maintained at 1-, 2-, and 3-week follow-ups. Both participants showed generalization with similar materials, although not with novel materials, and demonstrated with a peer approach instead of a researcher. Additionally, the video depicted two children, although the targeted response was with an adult and generalization was measured with a child.

Finally, the materials in the video did not necessarily correspond to the material used during the training session. These factors may have contributed to the slower acquisition of the targeted skills than findings in other video modeling studies in which skills were acquired within a few sessions.

Plavnick and Ferreri (2011) assessed requesting using the Picture Exchange Communication System using video modeling with four children aged 4.5 to 6.5 years with autism. No participant used vocal speech or any alternative communication system. Using an alternating treatment design and multiple baseline design, participants viewed a video of a peer requesting for a preferred item and the researcher delivering the item. Three specific phrases were taught across video clips ranging from 15 to 27 seconds. If participants imitated the video within 20 seconds, the participant was given access to the item or activity for 20 seconds. If there was no request or an incorrect request, it was ignored and a new trial was presented after 10 seconds. No prompts or reinforcement, other than the item or activity requested, were delivered during the study, with the exception of two participants who received reinforcement for sitting and attending to the video.

All participants significantly increased requesting between the second and fourth session while learning the first and second phrase. However, all participants took longer to achieve the mastery criteria while learning the third phrase. Generalization was assessed with three of the four participants in their classrooms with classroom teachers or classroom assistants. Two participants demonstrated weak generalization initially, although all three participants demonstrated generalization 90% to 100% across subsequent sessions. Follow-up data were, collected on two of the participants at 1, 2, and 4 weeks. Both participants demonstrated 100% maintenance of the targeted requests.

Wert and Neisworth (2003) used a multiple baseline design across four boys with autism aged 4 and 5 years to assess spontaneous requests using video self-modeling. All participants had previous training in making requests through discrete trial training and made minimal requests, although no independent requests were made at school. Videos showed an adult asking the participant to play and asking what they wanted to play with. Participants viewed 5-minute videos each morning within 1 hour of attending school. While at school, the participants engaged in three 10-minute play sessions with a behavior therapist. Ten opportunities for requesting items were contrived during each play session. As in the Plavnick and Ferreri (2011) study, data showed a marked increase in spontaneous requests between three and four sessions for all participants. Participants' requests ranged from 19 to 26 times during three 10-minute play sessions. All three participants increased the mean number of spontaneous requests at 2 and 6 weeks following the conclusion of the intervention. Generalization was not assessed in this study.

Wilson (2013) studied in-vivo modeling compared to video modeling to teach three preschoolers to request and one preschooler to share attention. Using an alternating treatment design, each participant was exposed to a 3-minute video or 3-minute live model. One participant showed a decline in requesting during both in vivo and video modeling. The youngest participant, 3 years 9 months, showed improvement with video modeling at session 15 and showed no improvement in requesting with a live model. One participant improved equally with both interventions. One participant improved slightly more with video modeling than with in vivo modeling. Though interobserver agreement was strong and fidelity measures high, results varied considerably between participants. The lack of progress with a particular treatment may be related to the preference of the individual or the skill of the individual rather than the efficacy of the intervention itself.

Researchers have shown that video modeling can be used with children in preschool and early primary grades to teach a variety of social skills. Plavnick and Ferreri (2011) and Wert and Neisworth (2003) both effectively taught children aged 4 to 6 years to request preferred items within four training sessions, although Wilson (2013) had varied results across participants. Marzullo-Kerth et al. (2011) and Reeve et al. (2007) taught school-aged children to respond to cues both motorically and verbally, although mastery criteria took longer to reach than studies that taught requesting only. Apple et al. (2005) and Sherer et al. (2001) both taught children to respond to questions, although video modeling was ineffective in teaching the children to initiate, a common language deficit seen in children with autism.

Communication play. Charlop, Dennis, Carpenter, and Greenberg (2010) conducted a study with three boys with autism aged 7 to 11 years. Using a multiple baseline design, Charlop et al. tested the effects of video modeling on the verbal response, intonation, gesture, and facial expression of each participant across nine scenarios. Each participant engaged in a training session by entering a play room and watching the video scenario twice. The experimenter then presented the stimulus that was represented in the video. Each participant engaged in 10-minute training sessions, in which nine scenarios were probed. Researchers found video modeling improved verbal responses to 100% after one session for all participants. Intonation improved to 100% for two participants after one session, and 100% for the third participant after three sessions. Generalization probes were conducted across settings and people. Interobserver agreement was conducted by video review by an independent rater resulting in 90% agreement across all four response categories: verbal response, intonation, gesture, and facial expression. All three participants demonstrated generalization across people, settings, stimuli, and response generalization. This study did not assess maintenance of skills.

Buggey, Hoomes, Sherberger, and Williams (2011) studied video self-modeling on social initiations of four preschool children with PDD-NOS. Frequency data were collected over 15-minute observations at the preschool playground. Each participant's self-modeling video included preferred play equipment, activities, and vocalizations within each participant's respective repertoire. Each video was 2.5 to 3.5 minutes in length and was viewed by the participant 1 hour before playground time. Three of the four participants showed rapid improvement in initiations and increased in the mean frequency of initiations during maintenance checks. The other participant did not show any improvement in initiating throughout the study or maintenance checks. Maintenance phases were staggered for participants following their placement in the multiple baseline design ranging from 2 to 8 weeks. Two participants maintained the same rates of social initiations, and the other participant declined in the mean number of initiations, although remained above baseline. Generalization of skills was not assessed.

Kroeger, Schultz, and Newsom (2007) compared the acquisition of social skills taught in a group format via video modeling to play instruction for 25 children with autism aged 4 to 6 years. Only children with autism diagnoses were included in this study. Children with diagnoses of Asperger disorder, Rett syndrome, and PDD-NOS were excluded from the study. Groups were matched by functioning level as determined by the Gilliam Autism Quotient. Groups met for 5 weeks, three times per week, for 1-hour sessions. The group receiving video modeling instruction viewed a video and then immediately had free play. Staff prompted the targeted skill during free play, and repeated practice was elicited during this time. Each week a different skill was targeted. Week 1 focused on gross motor imitation (e.g., clapping hands, placing block in cup, rolling car). Week 2 focused on ball play (e.g., rolling, throwing, kicking, playing with a partner, soccer, and T-ball). Week 3 stressed joint play focused on turn taking (e.g., block building, coloring, completing puzzle, Memory, Connect Four). Week 4 focused on pretend play (e.g., sleep, feed baby doll, policemen, firemen, builders).

During Week 5, the intervention was withdrawn and students followed a visual schedule to play in a variety of play centers (e.g., ball play, pretend play, game play, arts and crafts). Reinforcement in the form of social praise was provided for eye contact, smiling, and interactive play to all children in the study. Edible reinforcement was used with the video modeling group during the video modeling training sessions for attending to the video. Kroeger et al. measured the frequency, duration, and nature of social interactions using the Social Interaction Observation Code for each child through video review of preintervention play and postintervention play. Kroeger et al. (2007) found an increase in social skills in both groups, although the video modeling group improved significantly more compared to the play group.

Taylor, Levin, and Jasper (1999) conducted two studies using a multiple baseline design across three play scripts with two boys with autism aged 6 and 9 years. During the first study, the participant viewed the video three times. The researcher then initiated play and followed the same script viewed from the video. If no responses were made by the participant, the participant viewed the video one additional time. Imitating scripted play comments were reinforced with praise and an edible. The second phase of the study followed the same procedure. However, the participant’s sibling followed the script and participated in the play session instead of the researcher. The participants met the 80%

criterion gradually in all three phases, with a range of four to nine sessions. Play comments were maintained between 70% and 94% across the three play scripts, although the length of time following the study maintenance was assessed but was not reported.

D'Ateno et al. (2003) extended the work of Taylor et al. (1999) by assessing the effects of video modeling without additional prompts or reinforcement on the acquisition of motor and verbal solitary pretend play sequences of a 3-year-old girl with autism. Three video vignettes were recorded of an adult reading a script and manipulating the materials for each play sequence. Ranges of 10 to 12 statements and motor movements were included in each video. Using a multiple baseline design across play vignettes, D'Ateno et al. measured scripted and unscripted verbal statements and motor movements after viewing the scripted video. The child played with the corresponding toys after a minimum of 1 hour after viewing the video. Data showed a steady increase in both verbal statements and motor movements corresponding to the video vignettes, although novel untrained responses did not increase. Neither maintenance nor generalization was assessed in this study.

Like D'Ateno et al. (2003), Hine and Wolery (2006) also taught pretend play skills using person point-of-view video modeling to two young girls with autism. This study had the youngest participants in this review at ages 30 months and 43 months. Two videos were created. One showed six play movements in the sensory bin using three different types of gardening tools. The second video showed five play movements in the sensory bin using three different types of cooking materials. Each video clip was less than 2 minutes in length. Using a multiple-probe design across behavior and two students, each student participated in three phases for each of the two targeted play skills: baseline, daily treatment probes, and daily practice sessions. During daily treatment probes, each student was placed in front of the sensory bin containing one set of the selected toys and told to play with the toys. Students were given 2 minutes to play. Students were then shown a preferred cartoon unrelated to the treatment for 3 minutes. After the cartoon, the video created for intervention was shown. After the intervention video, the cartoon video was shown again for 60 seconds. The investigator then provided the materials shown in the video and told the student to play. Baseline data for both students ranged from zero to two play movements per play set (i.e., gardening and cooking). One student imitated all six movements following the first viewing of the gardening video model. However, subsequent training sessions resulted in varied and descending imitation.

Imitation of the gardening video did not increase above baseline until materials in the sensory bin were changed from potting soil to colored rice and reinforcement and prompting were added. After that point, all five play movements were independently demonstrated after the third training session. The other student never imitated all six play movements for the gardening video but did imitate five of the six after the third training session. This student showed variable imitation following the cooking video model and imitated all five play movements after the eighth training session. Both students showed generalization across materials and settings using the gardening materials in their classroom. However, both students showed no generalization using the cooking materials in their classrooms. Interobserver data were collected across an adequate number of sessions and had strong interobserver agreement ranging from 98% to 100%.

The second part of the study by Taylor et al. (1999) used a forward chaining procedure and a video prompting procedure to teach longer play scripts. The second participant was shown a video of a single verbal play script between a child and an adult.

Data were collected on the number of scripted and unscripted verbal play responses the participant made. The participant met criteria by responding with scripted or unscripted play statements equivalent to the number of statements viewed on the video. After meeting the criteria, the participant would then view one additional play script. Data showed scripted and unscripted play responses were acquired between six to eight play sessions across play routines. Interobserver data were recorded for an adequate number of sessions, although agreement had a wide range with 70% to 100%. However, the mean agreement was 97%.

Maione and Mirenda (2006) also evaluated the use of video modeling to teach play scripts to a 5-year-old boy with autism. Three play sets were chosen: Play Doh, cars, and Caillou's tree house. Nine videos were created, three for each playset, in which two adults talked to each other while playing with the targeted toy set. Each video lasted 1 minute 10 seconds to 1 minute 27 seconds in length. The participant viewed the video each day. Training sessions were held 2 to 3 times per week in the participant's home and consisted of viewing the video 30 to 60 minutes prior to a play session. Using a multiple baseline design across activities, the first three videos depicted play routines with one play set shown. When teaching the second play routine, the participant viewed six videos: three from the first play routine and three from the second play routine. When teaching the third play routine, the participant viewed nine videos: three from each play routine. The total number of scripted and unscripted verbalizations was measured while playing with the targeted toys.

Maione and Mirenda (2006) found video modeling alone led to an immediate increase of unscripted verbalizations in two play routines: Play Doh and Caillou's tree house. Video modeling and video feedback led to a small increase in verbalizations in the third play routine (i.e., toy cars). An additional prompting condition in addition to video modeling and video feedback immediately increased unscripted verbalizations to levels comparable to the other two play routines. Maione and Mirenda reported that the participant engaged in perseverative language while playing with the toy cars, which may have limited the acquisition of verbalizations with these materials. Generalization was not formally assessed. Follow-up data were recorded 18 days after the study ended and showed similar levels of verbalizations as during the study across all three targeted toys.

Like Maione and Mirenda (2006), Dupere, MacDonald, and Ahearn (2013) taught three play scripts to three children aged 5 and 6 years. Play scripts included a range of 14 to 16 vocalizations and 15 actions across three play scripts. Using a multiple baseline design, each video was viewed twice before playing with the materials depicted in the video. No additional prompts or reinforcement was used in the intervention. Interobserver data were collected over a reasonable number of sessions and found to be reliable. The data showed two participants learned two of the three play scripts rapidly and the third play script gradually. The third participant gradually met criteria on one play script and never met criteria on the other two play scripts. Like the findings of Maione and Mirenda, the lack of progress on a particular play set may be related to the preference of the individual rather than the skill of the individual or the efficacy of the intervention itself.

Nikopoulos and Keenan (2003) were the first to assess social initiations for individuals with autism using video modeling. Nikopoulos and Keenan measured the latency of social initiation and duration of play using video modeling with seven children aged 9 to 15 years. The children all had autism diagnoses and severe language impairments, with the exception of one who had an Asperger Disorder diagnosis and spoke fluently. Participants viewed the video once in a training room and then immediately moved to another room to imitate the video. Training was conducted 2 to 5 times per day. Children were assigned to one of three video modeling conditions: familiar adult, unfamiliar adult, or peer model. Data were collected on latency of initiation and duration of play with the targeted toy.

Data showed three participants never initiated interaction with the researcher. Two improved the latency of initiating interaction, although variable to start, and one participant made rapid gains in the latency of interaction. Data for the duration of play showed no improvement for the same three participants that lacked improvement with initiating. These three participants had severely limited receptive language and narrowed interest in only one item or activity. These three participants also had the lowest percentage of time spent attending to the video. The other four participants all improved the mean duration of playing, although all had highly variable durations of play.

Nikopoulos and Keenan (2004) studied the effects of video modeling on social initiations and reciprocal play using a multiple baseline design across participants without the use of additional prompts or reinforcement. Three boys with autism aged 7 to 9 years were shown a 35-second video of a child initiating play with the experimenter and engaging in reciprocal play with a set of toys. The participant was then brought to a room containing the same items viewed on the video. If the participant did not initiate interaction with the experimenter after four sessions, a modified video was shown depicting only the social initiation and not the reciprocal play.

Results varied across participants. The first participant showed the duration of reciprocal play increased during the first session and then decreased over the following two sessions. This pattern of responding was consistent for this participant across treatment conditions and during the 1- and 3-month maintenance check. The second participant gradually increased reciprocal play across sessions and during the 3-month maintenance check, although lower durations of play were displayed during the 1-month maintenance check. The third participant showed a marked increase in initiating during the fifth session and demonstrated this skill across sessions and maintained it across the 1- and 3-month maintenance check.

Play. Buggey, Toombs, Gardener, and Cervetti (1999) were the first to assess the effects of video self-modeling with children with autism as participants. Using a multiple baseline design, this study assessed responses to questions during a play session of three participants aged 8 to 11 years. Buggey et al. created a list of 17 questions that were pertinent to play. Self-modeling videos were created for each participant showing them responding to a variety of questions related to play. During each play session, experimenters would embed these questions in the play, although not all questions were asked during each session. Buggey et al. found some participants never answered particular questions, although they did improve significantly in responding to other questions.

Additionally, Buggey et al. (1999) reported that not all 17 responses were contained on the video; discussion and data analysis do not reveal if the omitted responses from the video were correlated with the lack of progress on responding to that particular question. Each participant viewed the 3- to 5-minute video at least once prior to the start of his or her play session. Some participants would request to watch the video additional times and were allowed. One participant paid little attention to watching the video, had infrequent verbalizations and with poor clarity, making data collection difficult, and exhibited tantrums. This participant had an interobserver agreement of 80% due to disagreement on her verbal responses. Interobserver agreement was calculated across all sessions with 94% agreement for the other two participants. All participants showed steady improvement in responding during the intervention, with participants doubling mean responses from baseline to intervention. Maintenance checks showed the skill was maintained, although maintenance checks appear to have been conducted 1 to 2 weeks after the intervention. Generalization was not assessed.

Kleeberger and Mirenda (2010) used a multiple baseline design to assess the effectiveness of video modeling to teach songs and play with toys to a 4-year-old boy with autism. Nine video clips were created depicting three examples for each: gross motor imitative song movements (e.g., Head and Shoulders, Wheels on the Bus, Slippery Fish), finger play songs (e.g., Open Them, Shut Them; Five Green and Speckled Frogs; Itsy Bitsy Spider), and toy play (e.g., caring for a baby doll, playing with a carnival play set, playing with a construction play set). Video modeling sessions were held daily. During the first phase of the study, three video examples were shown for the targeted skill. Videos for the songs lasted 1 to 2 minutes. The video for the toy play lasted 3 to 4 minutes. Data were collected using a 4-point scale ranging from 0 (*did not imitate*), to 3 (*exact imitation*). After three sessions of video modeling, no increase in imitation was seen.

An additional treatment condition including verbal praise by the parent was added during two subsequent sessions. No increase in imitation was seen, and in vivo modeling and social praise were added. All additional interventions were then withdrawn, and the final three sessions used only video modeling as the intervention. Kleeberger and Mirenda (2010) found the targeted behaviors only improved after adding in vivo modeling and reinforcement following video modeling. After withdrawing the additional interventions, the imitation remained at a higher level than baseline, although not at mastery level. Generalization was tested across people for all three skills and was seen only in gross motor imitation.

Studies on video modeling to teach play included the youngest participant in this literature review at the age of 30 months. Video modeling to teach communication-play skills includes research with children with autism up to the age of 15 years. Results varied across studies from ineffective to highly effective. Research by Nikopoulos and Keenan (2003) showed no change in the latency of initiation or duration of play in three of the seven participants, nor did Buggey et al. (1999) show change in initiation by one of the three participants. Conversely, Charlop et al. (2010) and Nikopoulos and Keenan (2004) found targeted skills improved to 100% after the first video modeling session.

Many variations exist in the implementation of video modeling, including viewing the video once before intervention (Nikopoulos & Keenan, 2003, 2004) and up to four times (Taylor et al., 1999), with all variations showing gains in the targeted skills. Finally, research on the implementation of video modeling to teach communication-play skills has variations of immediate imitation of the skill after viewing the video up to a delay of 1 hour. No study has directly measured the efficacy of the intervention to teach communication-play based on the delay of imitation, and results vary across studies using a delayed imitation with at least one participant making no gains and one participant making immediate gains (Buggey et al., 1999; Maione & Mirenda, 2006).

Perspective. Charlop-Christy and Daneshvar (2003) used a multiple baseline design across tasks and participants to test video modeling on responding to theory of mind scenarios. The study included two boys with autism aged 6 years and one boy aged 9 years. Pretest and posttest measures were taken using an adapted Sally-Anne test. During training, participants were shown a video twice of an adult completing the task and then were tested three times. Pass or fail scores were recorded during training. Each participant continued within the condition until two out of the possible three responses, were emitted correctly. Subsequently, the next perspective task was taught using the same procedure. Participants were taught five perspective tasks and two generalized perspective-taking tasks. Videos of the participants' responses were recorded and coded by blind observers.

Interobserver agreement was strong and findings robust at 100% for all videos. Results showed one of the 6-year-old participants and the 9-year-old participant learned all five tasks rapidly (i.e., one-to-two sessions of video modeling) and generalized the theory of mind skill across two tasks. Additionally, both participants maintained the skill, although the length of time following the study in which maintenance was assessed was not indicated. The second 6-year-old participant learned four of the five perspective tasks and the generalized tasks rapidly. This participant never met the criteria for one of the perspective tasks even with further instruction and did not maintain the perspective-taking skill.

LeBlanc et al. (2003) assessed the use of video modeling to teach perspective-taking to three boys aged 7 to 10 years with autism. The assessment, like Charlop-Christy and Daneshvar (2003), included the use of the Sally-Anne test (Baron-Cohen, Leslie, & Frith, 1985) as a pretest and posttest. Training sessions included viewing a video of an adult completing perspective-taking tasks. The video was paused to allow the participant to respond to perspective-taking questions immediately after viewing the response on the video. Unlike Charlop-Christy and Daneshvar, correct answers were reinforced; incorrect responses resulted in the video being shown again. A training session consisted of three correct responses to the questions related to the video. Variations of two perspective-taking tasks were trained through video modeling. A pass or fail was recorded for each training session.

Like the results found in Charlop-Christy and Daneshvar (2003), participants passed the training sessions quickly. The participants passed the first training after 1, 3, and 5 sessions, respectively. Each participant passed the second training after 1, 4, and 3 sessions, respectively. A 1-month follow-up was assessed without showing the video prior to testing and found two of the three participants passed the 1-month follow-up, and the third participant passed after one review of the video. Assessment of generalization using the Sally-Anne post perspective-taking assessment resulted in the first two participants passing, suggesting generalization of perspective-taking skills. The third participant did not pass the pretest or posttest. Interobserver data were collected an adequate number of sessions and had strong agreement at 100% across all participants.

Studies by Charlop-Christy and Daneshvar (2003) and LeBlanc et al. (2003) both taught two out of three participants in each of their studies to demonstrate perspective taking using a variety of scenarios and materials. LeBlanc et al. reinforced participants for correct responding, whereas Charlop-Christy and Daneshvar did not provide any response after participants' responses. At least one participant in each study demonstrated perspective taking after viewing the video model only once, suggesting that video modeling alone may be an effective strategy to teach perspective-taking skills to children aged 6 to 10 years with autism.

Behavior. Akmanoglu and Tekin-Iftar (2011) studied the effects of video peer modeling and graduated guidance on resisting the lures of strangers with three children with autism aged 6 to 11 years. The participants viewed the video with their "teacher." The teacher then asked the participant to stay in the room. The teacher would leave the room and a “stranger” would approach and try to lure the child by saying one of three statements: “Your teacher wants you to come with me,” “Would you like to go to McDonalds with me?” or “Do you want to take a drive with me?” (Akmanoglu & Tekin-Iftar, 2011, p. 211). The teacher would then reenter the room and prompt the participant in the target skill using graduated guidance, saying “no” and walking at least four to five steps away. In this study, all three participants learned the target response, although 138, 66, and 54 training sessions were required to meet the criteria. The participants each maintained 100% accuracy with resisting lures from strangers during maintenance checks at 1, 2, and 4 weeks after the study. All participants also generalized resisting lures from strangers when tested in different community sites.

Coyle and Cole (2004) studied the effects of video self-modeling and students’ self-monitoring of off-task behavior during independent work with three boys with autism aged 9 to 11 years. The duration of off-task behavior was recorded for 30-second intervals. During the intervention phase, students were taken to a training room down the hall from their classroom to watch a video of them engaging in on-task behavior during independent work. While watching the video, the experimenter would hold a picture card of *working* as the on-task behavior, describe the desirable behavior, and give praise for the desired behavior on the video. After viewing the video, the student pressed a start button on a timer (set for 30 seconds), then self-recorded when the timer sounded by placing a mark under the picture *working* or *not working*. This was practiced three times prior to returning the students to their classroom.

In the classroom, the picture *working* remained on the independent work desk. Coyle and Cole (2004) found that on-task behavior increased significantly after introducing video modeling, and off-task behavior decreased. Coyle and Cole found during the initial baseline, all three students were off task an average of 25 out of 30 seconds. With the intervention, two students reduced off-task behavior to a mean of 1.5 and 1.6 seconds, respectively. The other student reduced to a mean of 5.5 seconds. After returning to baseline, the mean off-task behavior increased significantly for all students, although it remained below baseline.

A third phase was introduced by Coyle and Cole (2004) for the student with the highest off-task data, which included an extended duration of self-monitoring. During this phase, the student decreased off-task behavior to less than 1 second and had less variability in data than during the shorter intervention phase. All three students increased off-task behavior near baseline during a 2-week follow up. Interobserver data were collected for one session each week, although the duration of each intervention phase was not specified. Interobserver agreement was strong, ranging from 98% to 100%. Generalized reduction of off-task behavior was achieved in this study.

Nikopoulos, Canavan, and Nikopoulou-Smyrni (2009) assessed the use of video modeling to teach three students aged 7 to 9 years with moderate and severe autism, as identified on the Childhood Autism Rating scale, to decrease the latency of responding when the teacher said, “Play is finished.” Nikopoulos et al. based this study on the findings of Schreibman et al. (2000), who effectively reduced disruptive behavior during transitions using video modeling. In the study by Nikopoulos et al., the video showed a peer playing with a puzzle, then being told “Play is finished,” and finally cleaning up the toy. Data were recorded on the latency of initiating a response to put the toy away. During baseline and treatment sessions, the participant was given up to 100 seconds to respond. After responding, or at the lapse of 100 seconds, whichever occurred sooner, the participant was moved to a play area. No prompts or reinforcement were used in any condition in the study.

Nikopoulos et al. (2009) found after two video modeling sessions that responding latency reduced to 5 seconds or less and was sustained throughout the intervention and maintenance for two of the three participants. Generalization included the use of three other toys that were not used in the video and across settings. Generalization assessments did not include the use of the video model prior to or during the session. Two participants generalized across toys and settings. One participant had variable generalization, although after reintroducing the video modeling intervention, latency again decreased. All sessions were videotaped, and latency was calculated from the video. Interobserver data were recorded an adequate number of sessions and was strong at 90% to 100% across conditions.

Ohtake, Kawai, Takeuchi, and Utsumi (2013) assessed the efficacy of video self-modeling with fidelity measures and replication across four participants on task avoidance. Two students, an 8- and 12-year-old with ASD, were taught to initiate a morning greeting to their teacher, and two students, 10 and 12 years old, were taught to complete specific steps in a hand-washing routine. All four students had instruction using prompting prior to implementing video self-modeling. For one participant, hand washing had been completed with verbal and gestural prompts prior to the study, although the skill did not increase the student’s independent completion of the task. During the intervention phase, students watching video self-modeling of initiations did so 1 hour prior to demonstrating the skill. Students watching the hand-washing video watched 23 and 18 hours, respectively. One student requested to watch the video repeatedly and would do so up to 6 times per day. Others watched at least 1 time every other day.

Ohtake et al. (2013) found varied results with the efficacy of video-self modeling to teach responding, initiating, and hand washing, with one participant in each group learning each skill and one participant in each group showing no progress. One participant responded to the teacher's greeting immediately and initiated greetings by the fourth training session. One participant improved hand washing immediately and met 100% by the second session. Video self-modeling was ineffective for the second participant who never responded or initiated with video self-modeling. However, when teacher praise was added to the video recording, the student began responding immediately and began initiating during the fifth session. The second participant in the hand washing group never improved, even with teacher praise and a character video. Ohtake et al. noted that the student who watched the video the most did the best, regardless of the participant having the lowest IQ and limited communication skills. No maintenance or generalization data were collected. Interobserver data were collected an inadequate number of sessions, ranging between 6% and 29% with an average of 18%, thereby limiting the internal validity of the study. However, agreement was high at 100% across all four participants.

Video modeling alone, without additional strategies or reinforcement, effectively taught students to clean up toys when told (Nikopoulos et al., 2009). Like Nikopoulos et al. (2009), Ohtake et al. (2013) found the participants significantly reduced avoidance behaviors using video modeling, although the video recording included embedded verbal praise. In both studies, video modeling was effective in changing behavior within two training sessions. Video modeling, in conjunction with other strategies, was found to be effective in changing behavior. Video modeling along with prompts and reinforcement were found to be an effective strategy to reduce lures of strangers in children with ASD aged 6 to 12 years (Akmanoglu & Tekin-Iftar, 2011), although over 50 training sessions were required to learn the skill. Coyle and Cole (2004) added a visual cue and self-monitoring to video modeling and found a significant and rapid decrease in off-task behavior.

As with other skills taught using video modeling, the implementation of the procedure is varied. Three studies implemented video modeling with the imitation immediately after (Akmanoglu & Tekin-Iftar, 2011; Coyle & Cole, 2004; Nikopoulos et al. 2009), and one study implemented video modeling with a delay of 18 to 23 hours (Ohtake et al., 2013). The delay of the video imitation did not appear to be a significant factor in the efficacy of video modeling for reducing behaviors, although Ohtake et al. (2013) reported the participant who viewed the video the most, up to six times per day, improved more rapidly than other participants in the study, and Isong et al. (2014) reported participants viewing the video model and the video goggles had reduced anxiety and reduced challenging behavior as compared to those who viewed the video only once. The number of times a video is viewed prior to imitation, therefore, warrants further investigation.

Transitions. Schreibman et al. (2000) was the first to assess the use of video modeling to reduce problem behaviors during transitions in three children with ASD. Using a multiple baseline design, Schreibman et al. taught two 3-year-olds and one 6-year-old to transition in the location specific where problem behavior occurred for each of the participants. Videos ranged in length from 1 to 4 minutes and used a person point of view to assess for the efficacy of the video modeling strategy. Schreibman et al. did not want to show the individual, peer, or adult in the video to avoid a confound in assessing the efficacy of the video modeling intervention. Participants viewed the video immediately before transitioning. Transitions included from home to a store for two participants and preparing to leave the house for one participant. Schreibman et al. found video modeling decreased disruptive behaviors immediately for one participant, after 4 weeks for the second participant, and after 41 sessions for the third participant. All three children maintained low rates of disruptive behavior 9 weeks after. Additionally, parents reported increased requesting and waiting quietly while in a store.

Cihak, Fahrenkrog, Ayres, and Smith (2010) studied video modeling via an iPod to teach four children with autism and moderate-to-severe intellectual disability aged 6 to 8 years to transition between activities. This study used an ABAB design and was conducted at each of the four participants' elementary schools. Ten different daily transitions were selected for each participant. As in the study by Schreibman et al. (2000), each participant's video reflected each of his or her specific transitions (e.g., bus to classroom, bus to cafeteria). Videos ranged in length from 2 to 5 minutes and used person point of view and video self-modeling. However, all students were pretrained on video modeling and on the use of the iPod with a two-step unrelated task (i.e., hang up coat or go to desk and pick up a pencil).

During the intervention phase, the students were presented with the iPod prior to a transition and told to turn it on. Students then pressed the play button and viewed the video. If a student did not initiate the transition or engage in a target behavior, the teacher would instruct the student to watch the video again. If the student again did not transition, the teacher would prompt using least-to-most prompting. All participants improved rapidly. When withdrawing the video modeling, all participants significantly decreased in independent transitioning, although they regained independent transitioning skills at the same rate or faster during the following intervention phase. Three students continued to transition at 100% accuracy, and one student transitioned with 90% accuracy at a 9-week maintenance check.

Cihak (2011) studied differences in students' independent transitioning between activities when using picture schedules versus video modeling. This study included four adolescents with autism aged 11 to 13 years. Using an alternating treatment design, picture activity schedules and video activity schedules were counterbalanced to reduce carryover effects. Each student participated in five transitions using a visual schedule and five additional transitions using video modeling. Visual schedules included pictures of each transition placed horizontally in a central location of the classroom. Videos contained both video self-modeling and person point of view and, although specifically stated, appeared to have used the video prompting procedure. The video showed each student transitioning to the next activity. Each video clip ranged from 10 to 15 seconds. In both conditions, students were told to check their schedules. If the students completed the transition, they were reinforced. If the student engaged in a target inappropriate behavior, or did not initiate the transition within 5 seconds, the teacher redirected the student to the picture or video. If the student did not initiate, the teacher used least-to-most prompting to assist the transition.

Cihak (2011) found both interventions increased students' transitions. Video modeling was most effective for two participants, visual activity schedule was most effective for one student, and one student performed equally using both interventions. Cihak noted visual activity schedules may be more beneficial for learners with moderate intellectual disabilities and those with attention problems due to the information (visual) remaining in sight after the instruction. Interobserver data were collected over 25% of the session, which was low but acceptable (Kennedy, 2005); however, agreement was high at 97% to 100%. Cihak recommended that future research evaluate the use of visual schedules and video modeling across a wider range of environments where students encounter greater distractions.

Video modeling alone, without any additional prompting or reinforcement, has been highly effective in improving transition skills rapidly for children with autism aged 3 to 6 years. Other studies by Cihak (2011) and Cihak et al. (2010) used the system of least prompts to cue students if the student did not initiate a transition and also found a combined treatment package effective in improving transitions for children aged 6 to 13 years. Less variation was seen in the implementation of video modeling when teaching transitions. For example, all researchers had participants immediately imitate after the video was shown (Cihak, 2011; Cihak et al., 2010; Schreibman et al., 2000). Two studies used additional prompting (Cihak, 2011; Cihak et al., 2010), although all found improved transitions (Cihak, 2011; Cihak et al., 2010; Schreibman et al., 2000).

Academic. Marcus and Wilder (2009) used a multiple baseline and multi-element design to compare video modeling to video self-modeling with two 9-year-old children and a 4-year-old child to learn Greek and Arabic letters on flash cards. Greek and Arabic letters were used instead of English letters to control for prior exposure. Two videos were made for each child. One video depicted a peer and one video was the child himself responding to the question, "What letter is this?" and naming the letter. Participants were shown one video three times per day (morning, afternoon, and evening) by their parents for 2 consecutive days prior to a session. Following the session, the second video was shown for 2 consecutive days, and then a session was held again. After the initial 4 days of viewing the videos, videos were shown only once per day immediately prior to the session by the researcher.

Three to four sessions were held weekly. During sessions, the researcher would praise correct responses and provide the correct answer following incorrect responses. All three participants reached 100% correct in the self-modeling condition taking 13, 16, and 30 sessions, respectively. All three participants reached 80% correct in the peer modeling condition, although only the second participant met the 80% or better for three consecutive sessions criteria. Neither maintenance nor generalization were assessed in this study. This research demonstrated video self-modeling as more effective in teaching letter recognition than video peer modeling.

Decker and Buggey (2012) also compared video peer modeling to video self-modeling in elementary-aged children. Decker and Buggey taught reading fluency to six students aged 8 to 11 years old. The videos for video modeling were created by videotaping a same-aged peer reading a passage. Videos for video self-modeling were created by editing several readings by the student himself, to create the appearance of fluent reading. Each video included embedded verbal praise like the videos used in Ohtake et al. (2013). Each group of students reviewed their assigned video daily. Decker and Buggey found immediate gains in reading fluency for both video modeling and video self-modeling, although two participants in the self-modeling group had greater and more immediate gains than other students in the comparison group. Generalization of improved academics was reported for one student in the video modeling group, although it was not directly measured in this study.

Burton, Anderson, Prater, and Dyches (2013) used a multiple baseline design to assess video self-modeling using an iPad to teach functional math to four male students aged 13 to 15 years. Twice daily, 4 days per week, students were given a worksheet with step-by-step directions. Students then viewed the self-modeling video of the specific math problem using the pause and rewind feature as often as they liked. The student then estimated the amount of money needed to purchase an item, paid for the item, and then made change using a simulated cash register. No additional reinforcement or prompts were used during intervention, although praise was given for being on-task. Burton et al. found video self-modeling to immediately and dramatically increase the completion of five different math problems. Because each of the five math problems had similar monetary values, practice effects may limit the findings of the study. Additionally, no data were reported on the number of times or duration of time each participant viewed the video. This does not allow for analysis suggested by Ohtake et al. (2013) that more frequent viewing results in faster acquisition of skills.

Studies found video self-modeling led to faster acquisition than peer modeling to teach academics (Decker & Buggey, 2012; Marcus & Wilder, 2009), although both strategies were effective in improving academic skills. Burton et al. (2013) also found video self-modeling to immediately improve math skills. However, Burton et al. implemented a variation in video modeling by allowing participants to pause, rewind, and review the video as often as the participant liked. Similarly, Marcus and Wilder (2009) varied implementation of video modeling by having participants view videos three times per day for 2 consecutive days prior to the start of the study and then once daily after the study started. These variations did not appear to impact the efficacy of the intervention.

Daily living skills. Shipley-Benamou et al. (2002) replicated the procedures used in Schreibman et al. (2000) to assess video modeling to teach daily living skills to three 5-year-old children with autism. The first participant's target skills were to make orange juice, prepare a letter to be mailed, and set the table. The second participant's target skills were to clean a fish bowl and set the table. The third participant's target skills were to feed her cat, put a letter in a mailbox, and set the table. Each video used a person point of view and contained a narrator's voiceover giving the initial instruction to attend to the video and imitate what was seen. To facilitate initial attending to the training video, a 5-second animated video segment of the child's favorite cartoon was dubbed with the same instruction at the beginning of the video. Following the procedure in Schreibman et al., the video of the target task was shown one time only, and reinforcement was not delivered. Sixty seconds were given to initiate the task, and an additional 60 seconds were given for completion of each sequential step. All three participants met 100% task completion for all skills by the third training sessions. Maintenance and generalization probes were not conducted in this study.

A study by Graves, Collins, Schuster, and Kleinert (2005) utilized video prompting with students aged 16 to 20 years with moderate to severe disabilities to learn how to cook by means of the following skills: (a) a stovetop skill, Ramen Noodles; (b) a microwave skill, macaroni and cheese; and (c) a countertop skill, making a peanut butter and jelly sandwich. Students did not have previous experience with cooking or video modeling. Each video was recorded using a subjective point of view. The voiceover directions alternated between female and male voices, although this was not an independent variable. Data were collected following a task analysis. A correct response was marked when completed within 20 seconds from the initial instruction or 20 seconds following completion of the previous step. Interobserver data were collected for 26% of sessions, which is considered low but acceptable (Kennedy, 2005). Graves et al. found video prompting was effective in teaching the target skills near 100% mastery criteria between five and nine sessions for all participants. Each skill assessed showed 100% maintenance, and parents reported cooking skills generalized to the home setting.

A study by Mechling et al. (2008) evaluated video prompting on the independence of young adults using a portable DVD player to learn cooking skills. Three students aged 19 to 22 years, who had previous experience with cooking and with video modeling were taught like the participants in the study by Graves et al. (2005) to cook using a stove top, a microwave, and a countertop. Each participant was trained prior to the study to use the portable DVD player with an unrelated video. Each video segment was recorded using a subjective view with voiceover instructions. The video model was an unknown adult. A task analysis was used to record data, and the system of least prompts was used only to cue the student to use the repeat video button on the DVD player; no other prompt was used. A correct response was marked when a step was initiated within 3 seconds and completed within 1 minute from the initial direction or completion of the previous step. Sessions to criteria ranged across participants from 1 to 5, with most utilizing prompts for the initial session. Video self-prompting was shown to be successful by immediately and significantly improving cooking skills for all three participants. Maintenance and generalization probes were not conducted in this study.

Goodson, Sigafoos, O’Reilly, Cannella, and Lancioni (2007) sought to replicate the study by Sigafoos et al. (2005), which evaluated video prompting to teach adults to microwave a meal. However, video prompting was found to be an effective teaching strategy to teach only one of the four men with an intellectual disability and autism to set the table. Therefore, Goodson et al. added video prompting plus an error correction (i.e., viewing the video a second time if an error was emitted) to teach the three other men in a vocational training center to set a table. Each video clip ranged from 9 to 13 seconds and was recorded using person point of view for each of the 10 steps in the task analysis. Goodson et al. used a multiple baseline with withdrawal design. Varied results were found. Two of the participants made progress in video modeling, although plateaued prior to meeting criteria. The fourth participant showed no improvement in the video modeling condition. All three participants showed immediate and significant improvement with the error correction procedure. These findings were similar to those of Ohtake et al. (2013) who found additional viewings of the video resulted in faster acquisition of the targeted skill.

A study by Van Laarhoven and Van Laarhoven-Myers (2006) extended the finding of Alberto et al. (2005) and Cihak et al. (2006), which also compared video prompting to visual schedules. Van Laarhoven and Van Laarhoven-Myers added an error correction procedure as seen in Goodson et al. (2007) by reviewing the video clip again after emitting an error. High school students, aged 17 to 19 years with moderate intellectual disability were taught to microwave pizza, fold laundry, and wash a table. The videos were recorded using both a perspective and a subjective view. Although all three systems were effective in increasing the targeted skills, video rehearsal plus video prompting resulted in higher independent responding.

A study by Norman et al. (2001) assessed video prompting using person point of view with three students, aged 8 to 12 years, with a variety of disabilities to teach daily living skills of cleaning sunglasses, putting on a wrist watch, and zipping a jacket in a small group setting. The author described the teaching procedure as both video modeling and video prompting. The videotape started with the task direction presented both verbally and textually. The total task was then shown and the verbal voiceover and textual directions presented again. Verbal directions alternated between male and female voices. After a 5-second delay, the first step in the chained task was presented again in a video clip accompanied with a verbal prompt.

There was a 15-second delay, the maximum time allotted for task completion, and then the presentation of the next step in the chained task. Social reinforcement was given on every third response. Limited interobserver data were collected over a range of 17% to 19% of sessions with agreement ranging from 88% to 100% across participants. Reduced interobserver agreement limits the study's validity leading to questions of integrity of implementation. Poor implementation may be the reason 24 to 30 instructional sessions were required to reach mastery criteria, whereas results from other video modeling studies on daily living skills showed mastery within only a few sessions. Some maintenance and generalization of skills were seen with the participants.

Taber-Doughty, Patton, and Brennan (2008) examined the effects of video prompting compared to video modeling with an extended delay to teach three middle-school boys to use the Dewey Decimal System to locate books and DVDs in the library. This delay was 1 hour 5 minutes to 1 hour 35 minutes during travel to the library. The video recordings used a person point of view. A system of least prompts was used when students did not respond within 10 seconds to the verbal and video prompt. Data were collected using a task analysis checklist. Results showed that targeted skills were acquired using both systems, although the student's preferred system resulted in faster acquisition. Additionally, all three students generalized using the Dewey Decimal System at an unknown library. The findings of this study suggest that both video prompting and video modeling are effective strategies; however, student choice in the method of instruction is an important factor to include when selecting an intervention.

Haring, Breen, Weiner, Kennedy, and Bednersh (1995) assessed video peer modeling to facilitate generalized purchasing skills with three students with autism and three students with severe intellectual disabilities aged 10 to 16 years. Following a 12-step task analysis, participants were told to "Buy an (item)." If the participant did not respond within 5 seconds, the instructor used least-to-most prompting to assist the participant to engage in the skill. Students were then assigned to one of three treatment conditions. One treatment group received in vivo instruction followed by video peer modeling. The second treatment group received video peer modeling followed by in vivo instruction. The third treatment group received concurrent video peer modeling and in vivo modeling.

During each treatment condition, least-to-most prompting was used and verbal praise was issued after an independent response. After reaching 80% independence, verbal praise was faded. Videos ranged in length from 3 to 5 minutes and included nine separate videos: three videos purchasing a single item in three different stores. During the video peer modeling intervention, each participant watched the video twice and then answered a set of questions pertaining to the video. Participants were then taken to a store to purchase the item, although the study did not identify the lapsed time between viewing the video and going to the store. In the in vivo condition, students were trained to purchase a single item. After the student completed the steps with 100% accuracy, one additional item was added to the list to be purchased.

The number of sessions for both video modeling and in vivo ranged from two to four sessions per week. Video modeling increased purchasing skills more quickly, although purchasing skills increased across all three groups, regardless of the order it was presented. This study assessed generalization of purchasing an item in three ways: using video modeling of a novel store, purchasing a trained item in a novel store, and purchasing an untrained item in a novel store. Haring et al. (1995) found generalization did not occur using video modeling only, although in combination with other procedures, all participants generalized. Interobserver agreement data were collected every fifth session, suggesting data were collected in 20% of sessions. This meets only the minimal suggested interobserver data collection (Kennedy, 2005), although agreement was strong at 100% on all videotaped sessions, with a range of 82% to 100% agreement on training at community sites.

Cannella-Malone et al. (2006) compared video prompting to video modeling to teach six adults with developmental disabilities aged 27 to 41 years to put groceries away and to arrange one place setting. Recordings for video prompting used a person point of view, and recordings for video modeling used a spectator view. Both contained one-sentence voiceover instructions for each step in the task analysis having to be completed within 30 seconds. This study found video prompting resulted in faster acquisition of the targeted skills than video modeling.

Cannella-Malone et al. (2011) replicated a previous study by Cannella-Malone et al. (2006) comparing video modeling to video prompting. Cannella-Malone et al. (2011) used a multiple baseline design with seven participants aged 11 to 13 years with severe intellectual disabilities, and one participant also had a hearing impairment, to teach washing dishes and doing laundry. Like in the previous study by Cannella-Malone et al. (2006), both videos contained single-sentence voiceover instruction for each step in the task. In video modeling, each participant was shown the video and then asked to do the task. In video prompting, each participant was shown one clip and then asked to do the task. If the task was not completed or was completed inaccurately, the researcher would complete the task to prepare the materials for the next clip of the video. The participants were not prompted to complete tasks in either condition of the study. One exception was with one participant who showed low and variable task completion. After the 36th session, in vivo modeling was added and task completion increased rapidly for that participant. This research showed an increase in task completion for all participants in the video prompting condition. Interobserver agreement was calculated across a range of 20% to 46% across all conditions, with agreement being 99%. Neither maintenance nor generalization was assessed.

Rayner (2011) assessed video prompting with three children aged 9 and 10 years on tying shoes using peers, siblings, and adults as the model. Rayner used the Imitation Disorders Evaluation Scale, which assesses imitation skills across six categories to determine if each participant has imitative prerequisite skills. No prompting or verbal instructions were provided during any condition except backwards chaining, in which verbal prompts were used. Rayner used a multiple baseline design across subjects and an alternating treatment design. Treatment conditions included video prompting with a peer, video prompting with an adult, video prompting using person point of view showing two different colored laces, and backward chaining. Each video was 2 minutes 23 seconds in length.

Following an 11-step task analysis, participants completed a range of zero to eight steps during the video prompting with peer modeling, video prompting with adult modeling, and two-color laces video prompting condition. In the backwards chaining with prompting condition, two participants completed all 11 steps in the task analysis. Two participants were assessed using a withdrawal condition. One participant maintained 11 steps in the task analysis, and the second participant ranged from 9 to 11 steps. All interventions were conducted using lacing cards, although generalization was assessed with the first and second participant using a real shoe. Both participants showed strong generalization tying the laces on a real shoe. Findings suggest tying shoes may be learned more quickly using real shoes instead of lacing cards, and the addition of a backwards chaining procedure may be an effective strategy in conjunction with video modeling to teach it.

Therefore, research on video modeling to teach daily living skills primarily uses the video prompting method (Cannella-Malone et al., 2006, 2011; Goodson et al., 2007; Mechling et al., 2008; Rayner, 2011; Taber-Doughty et al., 2008; Van Laarhoven & Van Laarhoven-Myers, 2006). This method may be well suited to teach these skills, as daily living skills typically include multiple sequential steps. Studies by Cannella-Malone et al. (2006, 2011) found video prompting led to faster acquisition of targeted skills than video modeling. However, other studies (Haring et al., 1995; Norman et al., 2001; Shipley-Benamou et al., 2002) used video modeling to teach daily living skills and found participants acquired targeted skills as quickly as studies using video prompting.

An additional feature of video modeling not seen in other areas is the use of voiceover narration within the video recording. Taber-Doughty et al. (2008) used the term *video simulation* to refer to video prompting that includes a voice over. Graves et al. (2005) and Norman et al. (2001) alternated male and female voiceovers, although they did not measure it as an independent variable. Other studies also used voiceover narration but did not specify the gender of the voiceover (Cannella-Malone et al., 2006, 2011; Goodson et al., 2007; Mechling et al., 2008; Norman et al., 2001; Rayner, 2011; Shipley-Benamou et al., 2002; Taber-Doughty et al., 2008; Van Laarhoven & Van Laarhoven-Myers, 2006). Efficacy of voiceover instruction warrants further investigation.

Vocational. Allen, Wallace, Greene, Bowen, and Burke (2010) studied the effects of video modeling on the acquisition of vocational skills (e.g., working as a costume character) for three males with PDD-NOS aged 17 to 22 years. Allen et al. used the existing staff training video for a costume company by reducing the length of the video to

3 minutes 30 seconds. The video showed person point of view and the spectator view from store customers. The video depicted eight specific movements in the costume (e.g., wave, hand shake, tail wag) and the character interacting with customers. Each participant viewed the video twice in the employee training room and was asked to put on the costume and stand in a retail store aisle where they would be evaluated on interactions with customers.

The three participants performed on average 37%, 80%, and 50%, respectively. Two participants showed variable level trends in data. The other participant showed a variable ascending trend in data. During the 1-month maintenance check, two participants showed an increase in average responding from the treatment condition, although both participants' data were highly variable. The other participant consistently responded, although just below the criteria. Participants were assessed for generalization by working as a character in an untrained costume. All three participants demonstrated generalization by engaging in two or more character movements reaching the targeted criteria.

Bennett, Gutierrez, and Honsberger (2013) assessed the effects of voiceover instructions embedded in video prompting on five teenage boys with autism to teach photocopying, making labels, and sending a fax. Video clips were created using first-person point of view. Participants viewed each video clip and then were asked to complete the task by a job coach. Continuous social praise was provided for each completed step. Bennett et al. found all five participants improved task completion with the session of video prompting, regardless of voiceover or no voiceover conditions, and, like Taber-Doughty et al. (2008), the participants had a preferred method of instruction and found the preferred method led to faster acquisition.

Alexander, Ayres, Smith, Shepley, and Mataras (2013) assessed video modeling with voiceover to teach seven students with ASD preparing for postsecondary transition to sort mail. Using three different sets of mail, Alexander et al. recorded the video using first-person perspective with voiceover. Participants watched the video and then immediately imitated using a replication of the school's mail box system. Alexander et al. found varied results in the study with four participants improving rapidly, reaching 80% to 100% between one and five sessions, and rapidly generalizing and maintaining skills up to 6 weeks. Conversely, three participants did not show improvement with video modeling and limited or no improvement when adding a live model as an error correction procedure. Alexander et al. reported that some of the participants who did not make progress also did not attend to the video. These anecdotal reports also have been made by Alberto et al. (2005) and Cihak et al. (2006).

Video modeling using first-person point of view was effective in teaching a variety of vocational skills. Allen et al. (2010) used a combination of first-person and spectator point of view in a company's standard employee training video to train three men to work as a costumed character. Allen et al found video modeling to be effective, although skill demonstration was highly variable. Alexander et al. (2013) found varied results with half the participants making immediate gains and half making no progress. However, Bennett et al. (2013) found video prompting led to faster acquisition than video modeling, although both procedures were effective. Bennett et al. also noted that student preference led to faster acquisition than the less preferred instructional method. These findings suggest that video prompting may be more effective in teaching multi-step skills, such as vocational tasks, than video modeling.

Medical. Some research indicates video modeling, when paired with reinforcement and a desensitization protocol, decreases anxiety and fear in children with

ASD and increases compliance with medical and dental procedures (Cuvo et al., 2010; Huckfeldt, 2006). A treatment package using video modeling, desensitization, reinforcement, and prompting was used by Cuvo et al. (2010) to treat fear and increase compliance with a 10-step physical examination in six children with ASD, aged 2 to 6 years. In this study, the children were taught to comply with a 10-component physical exam: enter the room, play, sit on exam table, lung exam, heart exam, lie on table, abdominal exam, nose exam, throat or neck exam, and ear exam). A 9-minute video was shown once per day by the parents at home. A similar treatment package by Huckfeldt effectively used video modeling along with desensitization and reinforcement as a treatment package to effectively decrease fear and increase compliance with dental procedures in children with ASD.

Dental. Video modeling was used as early as 1974 to assess its effect on dental compliance with preschool children (Machen & Johnson, 1974). Fifty-eight children, aged 3 to 5 years without any previous dental experience, were assigned randomly to one of three groups: control, desensitization, or video modeling. Each treatment group received the intervention prior to the dental appointment, and dental work was completed by a dentist blind to the participants' assigned treatment group. During each dental appointment, each participant had dental caries repaired. Data were recorded using a behavior rating scale of 1 to 4 to measure each patient's behavior during each dental treatment session. Participants in both the desensitization and video modeling group showed improved behavior after the first training session, although no statistical significance was found between either of the treatment groups. No improvement was seen in the control group. Findings by Machen and Johnson (1974) suggest both desensitization and video modeling are effective treatment strategies to increase young children's compliance with dental procedures.

In 1975, Melamed et al. compared the effects of video modeling, called filmed modeling in dental literature, to an unrelated video on noncompliant behavior of 16 neurotypical inner city children during dental treatment. Children, aged 5 to 11 years, were randomly assigned to the dental video modeling group or to the unrelated video group, although children were matched by age, gender, socioeconomic status, and scores on the modified Children's Fear Survey Schedule. Over three sessions, Melamed et al. showed children in the treatment group a video of an initially anxious child having a dental procedure by a sensitive and friendly dentist. The control group viewed a video of a child engaging in an activity unrelated to dentistry. A blind rater and the author recorded behavior and fear each on a 10-point scale for each child during each session. Interobserver agreement was strong with over 94% for both measures. Melamed et al. found children in the video modeling group to have similar scores on the first and second treatment to the control group. During the third treatment session, the video modeling group had significantly lower rates of anxiety (.01 level) and less disruptive behaviors. This research showed improved behavior and reduced anxiety through video modeling, showing that the content of the video is a valid and important component to video modeling. However, this study has limited generalization, as the study only included three data points in which behavior changed during the third session only.

Berggren and Carlsson (1986) assessed the use of video modeling with an older population than the earliest studies by Machen and Johnson (1974) and Melamed et al. (1975). In this study, 99 adults were referred for treatment at a dental anxiety clinic in Sweden. These adults were divided into two treatment groups: general anesthesia and psychophysiological treatment, which included desensitization and video modeling.

Participants were reported to have higher than average rates of fear, with a median length of 16 years since the last dental appointment. Other psychological factors, such as high rates of unemployment, sickness, and alcohol and drug use, were seen in the patients in this study. Treatment for the general anesthesia group included one general sedation up to 4 hours and subsequent dental visits to complete small cavities and other minor restorative treatment using traditional dental treatment. The group receiving psychophysiological treatment included the use of meditation audiotapes that were listened to at home each night, video modeling that occurred in the office, and verbal descriptions of procedures and expectations.

Patients were provided with a remote control to pause the video if, at any time, they began to feel anxious. Relaxation instruction then played if the participant paused the video. The video would then restart from the same scene during the subsequent session. All participants were monitored for anxiety using an EMG machine for biofeedback, and a pretest and posttest using Corah's Dental Anxiety scale and the Mood Adjective Checklist were administered. Berggren and Carlsson (1986) found a significantly greater number of visits were completed at the .05 level by participants in the group receiving psychophysiological treatment. Both groups had decreased anxiety, although the group receiving psychophysiological treatment had a statistically significant reduction at the .01 level compared to the general anesthesia group. Also, both groups had significant decreases in dimensions of mood, although no statistical significance was seen between groups. Follow-up data were collected 2 years later, and all findings maintained. Findings by Berggren and Carlsson support the use of desensitization and video modeling as an effective treatment option having long-term effects for adults.

Video modeling also has been used in dental settings to increase the number of steps completed in a dental cleaning for children with ASD (Altabet, 2002; Conyers et al., 2004; Luscre & Center, 1996). Luscre and Center (1996) described a treatment package of video modeling, desensitization, and reinforcement to reduce fear and increase compliance with dental cleanings in three children with ASD. Desensitization in dental research and practice refers to a variety of procedures and end results. Some refer to gradual exposure with reinforcement of relaxation; others refer to compliance with dental procedures using systematic presentation (Lyons, 2009). Additionally, Luscre and Center used the term video modeling, although more recent research has coined the term video prompting for the procedure described in this article.

Luscre and Center (1996) used a multiple baseline design across two 9-year-old males and one 6-year-old male. Each step in the dental procedure was introduced using video prompting and show-tell-do following a task analysis and introducing each step in the dental cleaning only after compliance with the previous step in the identified sequence. Patients viewed the video during treatment each day. Researchers found all three participants gradually increased compliance ranging from 16 to 24 sessions during analog sessions. Only one participant demonstrated compliance while in a dental setting after six training sessions. The remaining two patients demonstrated 11 and 12 steps in vivo.

Similar results to Luscre and Center (1996) were found in the study by Conyers et al. (2004), which measured compliance with a dental procedure for six adults with severe intellectual disabilities. Participants were assigned to treatment via in-vivo desensitization (e.g., verbal prompting, physical prompting, and praise) or video modeling. Using a multiple baseline design across three participants, Conyers et al. conducted training sessions one to two times per week. In the video modeling treatment, one participant complied with all steps in the dental procedure during the first session. The other two participants complied with all 18 steps in the dental procedure gradually, taking five to nine training sessions to meet 100% compliance. Similar results were seen with participants receiving in vivo desensitization treatment. One participant completed all steps during the first session, and the other two participants improved rapidly, although compliance was variable across subsequent weeks. Interobserver agreement was strong at 80% of sessions assessed and robust with 100% agreement.

Neumann, Altabet, and Fleming (2000) used a treatment package of video modeling, systematic desensitization with paired relaxation, and positive reinforcement to treat three adult men with a variety of behavioral and mental disorders to comply with a 34-step modified dental cleaning. Participants had training sessions three times per week for 8 weeks and then faded services to one time per month. Neumann et al. did not provide data but did describe each participant’s progress. One participant was reported to make progress each session by allowing the dentist to perform more steps in the procedure. This participant was reported to complete a dental cleaning in a typical dental office without restraint or sedation. The second participant could complete all steps in the dental cleaning after four training sessions, although was unable to complete a dental cleaning at a dental clinic without redirection and prompted relaxation. The third participant was preoccupied with the buttons on the video player and thereafter was removed from the video modeling intervention. Instead, he received live modeling and audio desensitization. He also showed improvement by completing a dental cleaning during his fifth session and also generalized this by completing a cleaning at a dental clinic. Therefore, video modeling may be a beneficial strategy to add to dental behavior management treatment.

As a follow-up to the study by Neumann et al. (2000), Altabet (2002) addressed behavioral interventions in dental care in an attempt to reduce sedation and physical restraints for patients showing resistance to dental treatment. Adults with severe or profound intellectual disabilities living in the same care center as participants in the study by Neumann et al. received treatment in either the desensitization group or the nontreatment group. Thirty-five participants started in the treatment group, although only 23 completed all treatment sessions. Participants in the treatment group received systematic presentation of steps in the dental cleaning in a least-to-most anxiety provoking order. Relaxation techniques included modeling and reinforcement. Altabet reported participants in the treatment group completed more steps than the nontreatment group, although neither group significantly reduced the number of restraints or sedation. Neither modeling procedures nor materials were discussed, so it is unclear if live modeling or video modeling was used, although the study stated it was a follow-up study to Neumann et al., which employed video modeling.

Isong et al. (2014) conducted a group design in which participants with ASD were randomly assigned to one of four groups. Group A served as the control group, Group B received the peer video modeling intervention, Group C received video goggles to view a favorite video while receiving a dental cleaning, and Group D reviewed video modeling and video goggles. This study assessed the cooperation of patients using a 5-point behavior rating scale (i.e., Venham Anxiety and Behavioral scale), and the physiological arousal of the patients across pretest and posttest visits. Isong et al. found a decrease in uncooperative behaviors and anxiety between baseline and follow up visits for participants in the video modeling and video goggle group and the group receiving video goggles only. No statistically significant change was seen in the group receiving only peer video modeling. Isong et al. noted that participants viewed the video modeling film a range of one to five times, and the participants who viewed it more times had lower anxiety and uncooperative behavior.

A recent study by Marion, Nelson, Sheller, McKinney, and Scott (2016) provided parents of children aged 6 to 10 years with ASD a choice of a social narrative, video model, or both, prior to their child attending a dental visit. The social narrative contained a sequence of 12 large photos taken from the dental site with small narrative text along the bottom of the page. The video model was reported to mirror the text and images. Parents were given a 29-question survey prior to the visit and a nine-question survey following the dental visit. Though the study did not assess the efficacy of the intervention on dental compliance, the study did find interesting results in the parents' preference and the reported preference of their child's interest. Ninety percent of the 16 child-parent dyads chose video modeling, with 40% choosing video modeling alone, 50% choosing a combination of the two interventions, and 10% choosing the social story only. No statistical significance was found in 'usefulness' of either intervention, although many parents reported it eased their child's fear and helped prepare the child for the dental visit.

Video modeling has been shown to be effective in teaching children with autism to brush their teeth in a study by Sallam et al. (2013). Sallam et al. assigned 36 students with ASD aged 6 to 12 years to a video modeling group, visual task strip group, or demonstration group to assess the acquisition of brushing their teeth independently. Students in the video modeling group were shown a video of a peer brushing his teeth. After 10 exposures (i.e., 2 weeks), the students were asked to demonstrate brushing their teeth. At that time, four of 12 students demonstrated the skill independently. After 20 exposures (i.e., 1 month), all 12 students independently brushed their teeth. Additionally, parents reported through a survey that the skill had generalized to the home setting. Video modeling was superior to visual task strips to improve independent teeth brushing and no progress was made by participants in the demonstration group made no progress.

Charlop-Christy et al. (2000) compared in vivo modeling to video modeling across two groups of children with ASD aged 7 to 11 years. This study assessed a variety of skills including social skills, expressive emotions, conversational speech, cooperative play, teeth brushing, and face washing. Videos were shown twice for two sessions and then once prior to each subsequent session. Charlop-Christy et al. found the group of students who were taught using video modeling acquired skills more quickly than the group taught using in vivo modeling. One student was taught to brush his teeth using video modeling and to wash his face using in vivo modeling. This student learned to brush his teeth after three presentations of the video versus learning to wash his face after seven presentation of the live model. Additionally, the skills taught through video modeling generalized for all students, whereas the skills taught through in vivo modeling did not.

Although there is limited research on the use of video modeling in dental care and dental treatment, existing research suggests it is effective in increasing compliance with dental procedures (Berggren & Carlsson, 1986; Conyers et al., 2004; Luscre & Center, 1996; Machen & Johnson, 1974) and reducing anxiety (Berggren & Carlsson, 1986; Melamed et al., 1975; Neumann et al., 2000) when paired with relaxation strategies. Additionally, video modeling has been shown to have lasting effects up to 2 years (Berggren & Carlsson, 1986) and generalization (Charlop-Christy et al., 2000; Sallam et al., 2013), allowing individuals to access services at general dental clinics (Neumann et al., 2000).

Summary of video modeling. Video modeling has been shown to be effective in teaching individuals with autism a variety of skills including social skills, communication, play skills, transitions, on-task behavior, academic skills, vocational tasks, daily living skills, and dental compliance. Individuals with ASD across age spans have improved skills and behaviors using video modeling. Research has effectively demonstrated improved clerical skills (Bennett et al., 2013), sorting mail (Alexander et al., 2013), math skills (Burton et al., 2013), reduced task avoidance (Ohtake et al., 2013), social-communication skills (Wilson, 2013), initiating communication through the use of the Picture Exchange Communication system (Cihak et al., 2012), a variety of play skills (Dupere et al., 2013), and dental compliance (Isong et al., 2014).

Variations of using an adult (D’Ateno et al., 2003; Maione & Mirenda, 2006; Mechling et al., 2008; Nikopoulos & Keenan, 2004; Wert & Neisworth, 2003), self (Buggey et al., 1999, 2011; Burton et al., 2013; Cihak, 2011; Coyle & Cole, 2004; Decker & Buggey, 2012; Marcus & Wilder, 2009; Ohtake et al., 2013; Sherer et al., 2001), or peer as the model (Akmanoglu & Tekin-Iftar, 2011; Apple et al., 2005; Haring et al., 1995; Isong et al., 2014; Marcus & Wilder, 2009; Marzullo-Kerth et al., 2011; Nikopoulos & Keenan, 2003; Nikopoulous et al., 2009; Reeve et al., 2007; Sherer et al., 2001), had little to no effect on the efficacy of the intervention, nor did using person point of view (Allen et al., 2010; Bennett et al., 2013; Cannella-Malone et al., 2006; Cihak, 2011; Goodson et al., 2007; Graves et al., 2005; Hine & Wolery, 2006; Norman et al., 2001; Shipley-Benamou et al., 2002; Taber-Doughty et al., 2008) versus third-person point of view (Cannella-Malone et al., 2006). However, participants’ attention to watching the video (Buggey et al., 1999; Plavnick & Ferreri, 2011) and number of times the video was viewed (Allen et al., 2010; Buggey et al., 1999; Burton et al., 2013;

Charlop-Christy et al., 2000; Charlop et al., 2010; Marcus & Wilder, 2009; Ohtake et al., 2013; Taylor et al., 1999) appeared to have the greatest impact on the efficacy of the intervention.

Most studies on video modeling include multiple baseline across three or fewer participants (Apple et al., 2005; Buggey et al., 1999; Charlop et al., 2010; Charlop-Christy & Daneshvar, 2003; Charlop-Christy et al., 2000; D'Ateno et al., 2003; Hine & Wolery, 2006; Kleeberger & Mirenda, 2010; Luscre & Center, 1996; 2009; Maione & Mirenda, 2006; Marcus & Wilder; Nikopoulos & Keenan, 2004; Schreibman et al., 2000; Taylor et al., 1999). Though studies using these research designs showed strong internal validity, that video modeling was responsible for the changes in participants' skills, these studies have limited external validity, being unable to generalize the results due to the low number of participants in each study. National Professional Development Center on Autism Spectrum Disorders (Wong et al., 2013) and the National Standards Report (National Autism Center, 2009, 2015) have conducted thorough reviews of the literature and have identified video modeling as an effective intervention with good external validity due to the number of studies showing efficacy.

Summary

Dentists who feel well prepared are more likely to treat patients with special needs, to set up their practice to meet their needs (Dao et al., 2005), and have more confidence in treating these patients. Dentists' confidence may improve parent satisfaction with services and increase the likelihood of bringing their child with ASD to the dentist if they perceive the dentist to have knowledge of ASD (Abbasnezhad-Ghadi, 2010). Infrequent visits to the dentist may result in a higher occurrence of caries, and it, is therefore, imperative for children with ASD to visit the dentist routinely (Abdullah-Jaber, 2011; DeMattei et al., 2012; Kopycka-Kedzierawski & Auinger, 2008; Marshall et al., 2010; Solanki et al., 2016). Some basic behavior-management techniques and ABA strategies have been used with patients with ASD in dental practice to increase patients' compliance with dental procedures (Berggren & Carlsson, 1986; Conyers et al., 2004; Luscre & Center, 1996; Machen & Johnson, 1974; Melamed et al., 1975; Neumann et al., 2000). Specifically, the use of visual supports and video modeling warrant further investigation on the efficacy of improving behavior during dental procedures (Cihak, Smith, Cornett, & Coleman, 2012).

Research Questions

In order to compare the effectiveness of visual supports and video modeling on compliance in patients with ASD and parent satisfaction with these strategies, the following questions were addressed:

1. How has patients' compliance with dental cleaning procedures changed following the use of visual supports?

2. How has patients' compliance with dental cleaning procedures changed following the use of video modeling procedures?

3. Does one of the two interventions lead to compliance with dental cleaning procedures more quickly than the other?

4. How do the parents rate their satisfaction with the components of the intervention and overall?

Chapter 3: Methodology

Participants

Because of ease of access, a convenience sample was selected from new patients from the pediatric autism dental clinic. Of the new patients to the dental clinic, 14 children participated in this study. Although inclusion criteria included a suspected diagnosis of ASD, all participants had a confirmed ASD diagnosis. Additionally, inclusion criteria allowed for participants as young as 18 months, although children who participated ranged in age from 3 to 5 years old. Seven participants were in each intervention group. The pool of participants represented a variety of ethnic and socioeconomic backgrounds. Also, participating in the study were the parents of the children in the study. The parent was included in this study when the parent consented to participate and communicated in English. One parent was also eligible to participate when her second child participated in the study. Thirteen parents were eligible to participate in the parent survey. Eligible parents represented all patients who participated in this study.

Instruments

Task analyses. During each dental visit, patients' compliance with the dental cleaning was recorded using a checklist based on a 40-step task analysis (see Appendix A). The task analysis was developed based on the sequence of dental procedures during a routine dental visit. These 40 steps have been identified as pivotal procedures in completing a dental cleaning. These steps also have been utilized in other research studies examining the effects of treatment on compliance with dental procedures (Altabet, 2002; Conyers et al., 2004; Luscre & Center, 1996).

Altabet (2002) and Conyers et al. (2004) began data collection when the patient was in the waiting room. In the pediatric dental clinic, data collection using the 40-step task analysis also began in the waiting room and proceeded through dental procedures using a sequence of steps that have been used in previous studies (Altabet, 2002; Conyers et al., 2004). Altabet, for example, measured compliance with dental procedures among individuals with severe and profound intellectual disabilities using a task analysis that included a sequence of 34 steps.

Parent-satisfaction survey. The instrument used to collect parent-satisfaction data was the parent-satisfaction survey (see Appendix B). To collect pilot parent-satisfaction feedback, a consent form was given to a pilot group including a pediatric dentist or dental resident, a behavior analyst, and three parents of children who had attended the pediatric autism dental clinic. The members of the pilot group were contacted via email to request their participation in this study. Those who were willing to participate in the pilot group were emailed the parent-satisfaction survey and a feedback form (see Appendix C). The participants were asked to return the feedback form within 3 days. The parent-satisfaction survey was then revised based on the pilot group feedback.

Feedback from the pilot group was tested for construct validity through the evaluation of the internal consistency of each test question using a spreadsheet. Construct validity examines individual questions to assess the internal validity of the survey (Nitko & Brookhart, 2011). This examination is done by analyzing each survey question using a spreadsheet program. For this study, survey questions receiving an internal-consistency score above 0.70 or below -0.70 were considered to have high internal consistency and remained unchanged. Survey questions having internal-consistency scores between 0.70 and -0.70 were considered to have low internal consistency and were modified. Less than half of the survey questions were found to have low internal consistency; therefore, the modified survey was not presented to the pilot group.

The final version of the parent-satisfaction survey was made available to parents electronically. An electronic version of the survey was created using Opinio software. This electronic survey was sent to all parents consenting to participate in the study. An additional paper version was available to parents following the research study if parents indicated limited or no internet access or a preference for a paper version, although no parent indicated limited or no internet access. The parent satisfaction survey used a Likert scale. The Likert scale was developed by Renis Likert in 1932 and is widely used in human-subject research (Boslaugh, 2012). The Likert scale is commonly used with interval data and ordinal data. Interval data refers to data that has equal intervals between measurements. Ordinal refers to data ranked in a logical order so that data having a higher value represents more of some characteristic, than lower values (Boslaugh, 2012). The Likert scale used in this survey was a 5-point ordinal scale. Parents were asked to respond to statements on the scale ranging from 5 (*strongly agree*) to 1 (*strongly disagree*). Although these responses are ordered, there is no assumption that the value of the responses are equidistant. Therefore, the survey data were considered ordinal.

Procedures

Design. This study used a group design. Seven participants were assigned to each condition. Patients were assigned to the video modeling group or the visual support group and were matched by age and gender. Participants attended two training sessions per week, up to nine visits. This was expected to be a sufficient length of time, as results from Conyers et al. (2004) saw changes as quickly as one training session before meeting 100% compliance with dental procedures. Additionally, participants returned to the dental clinic 1 month after the last training session to assess maintenance of compliance.

After consent to participate was obtained, individuals were assigned to the video modeling group or visual task strip group based on the order of receiving consent to participate. The first respondent was assigned to the video modeling group; the second was assigned to the visual task strip group. Respondents were assigned to groups alternating between the video modeling and visual task strip group. To control for gender and age, when a respondent with the same gender or the same age enrolled, this respondent was placed in the opposite group of the same gender or same-aged peer. Parents were scheduled for an initial meeting. During this meeting, parents along with their child met with the pediatric dentist to review dental history and parental dental concerns and questions. Because some patients resisted entering the dental operatory, this initial meeting was held in a room outside of the dental operatory. After collecting the dental history and addressing parental concerns, the training session began.

In the video modeling condition, each participant viewed a video depicting each step identified in the corresponding task analysis only once prior to the dental cleaning while in the waiting room. The video showed a peer model transitioning from the waiting room into the clinic, sitting in the dental chair, touching dental instruments, and complying with dental cleaning procedures. The video used both person point of view and spectator point-of-view modeling (Van Laarhoven & Van Laarhoven-Myers, 2006). After viewing the video, dental staff transitioned the participant into the clinic to complete the dental cleaning procedure. During each subsequent training session, the participant viewed the video in the waiting room, then transitioned to the dental operatory where the dentist followed the same dental cleaning procedure, presenting each step in the task analysis.

Each participant in the visual task strip group waited in the waiting room. Dental staff transitioned the participant into the clinic to complete the dental cleaning procedure following the task analysis. Upon entering the dental clinic, a dental staff member presented the visual task strip depicting the steps in the dental cleaning procedure. Participants turned over each picture after completing the step in the dental cleaning. Like in the video modeling group, no additional prompts, coaching, social praise, or reinforcement were issued by the pediatric dentist or dental staff. However, the adult accompanying the participant provided comfort and praise as he or she saw fit. During each subsequent training session, the participant transitioned to the dental operatory upon arrival where the visual task strip was presented and the dentist followed the same dental cleaning procedure presenting each step in the task analysis.

Additionally, in both conditions, if the participant did not initiate compliance with the step within 5 seconds of the pediatric dentist presenting the procedural step, the pediatric dentist moved on to the next step in the task analysis. However, if the participant resisted entering the dental operatory, the parent encouraged, escorted, or carried the participant in. If the participant resisted sitting, the parent sat with the participant in the dental chair but did not restrain him. The participant was also permitted to stand for the duration of the dental procedure, although either deviation from the prescribed step was marked as noncompliant (-). Finally, if the participant resisted opening his or her mouth for the dental mirror, all subsequent steps measuring the duration of the open mouth were marked as noncompliant (-). The parent of each participant was sent the final version of the parent satisfaction survey through Opinio. After submitting responses to the survey, the survey data is deidentified via Opinio. Deidentified data were retrieved by this researcher and recorded on a password-protected spreadsheet on the researcher’s password-protected laptop.

Data collection. Dental students served as research assistants for this study. The dental students do a clinical rotation in the pediatric autism dental clinic as part of their dental training, in which this study took place. Each research assistant was blind to the study's hypothesis. Each participant's data collection sheets were assigned a numerical code. A code key linking each numerical code to patients' files was created on a password-protected file and stored in a locked cabinet in the researcher's office. Only the researcher had access to the laptop and passwords. Compliance data were collected using task analysis data sheets marked with the identifying numerical code. The research assistant collected data beginning with the participant's transition into the dental clinic and remained in the clinic observing as unobtrusively as possible. The research assistant recorded patient compliance (+) or noncompliance (-) with each step during the dental exam using a checklist corresponding to the task analysis. The pediatric dentist who completed the dental procedure also followed the same task analysis.

Treatment fidelity. The research assistants were trained to collect data through discussion, modeling, and live coaching using the video created for this research study. Interobserver data were calculated using trial-by-trial correspondence and used the following formula to calculate interobserver agreement: [number of steps agreed / (number of steps agreed + number of steps disagreed)] x 100 = IOA% (Cooper et al., 2007, p. 116). Data collection training continued to occur with coaching and feedback until the research assistant reached 90% agreement with the researcher (Cooper et al., 2007). Throughout the research study, compliance with dental procedures was collected by a research assistant, with interobserver data collected across at least 30% of sessions (Kennedy, 2005).

The pediatric dentist was also trained by this researcher through discussion, modeling, and live coaching using the video created for this research study. Using role-play activities, fidelity of implementation was collected on the pediatric dentists' implementation of the task analysis using the fidelity checklist until the pediatric dentist reached a minimum of 90% accuracy with implementation of the task analysis. Throughout the research study, interoberserver agreement was recorded a minimum of 30% of sessions for fidelity of implementation using the fidelity checklist, as recommended by Kennedy (2005).

Data analysis. This research study contained two components. The first component was an analysis of each independent variable on dental compliance and then a comparison of dental-compliance data based on the task-analysis checklists. The second component was the social-validity data collected from the parent-satisfaction survey.

Compliance data analysis. A spreadsheet was created to compile compliance data from the task analyses and included each patient's assigned number and columns for each treatment session. The patient's corresponding data were entered into a spreadsheet. This data were displayed using a line graph for each group (Alberto et al., 2005; Cihak et al., 2006), an ordinal bar graph, and a bar graph comparing the mean number of visits for each intervention group. Visual analysis was also used to report descriptive statistics.

Compliance data were also analyzed using a chi-square test. The chi-square test "is one of the most common ways to examine relationships between two or more categorical variables" (Boslaugh, 2012, p. 191). The chi-square test examined the null hypothesis (H_0), or that the independent variables (i.e., visual supports and video modeling) are independent of one another and change dental compliance equally, and the alternate hypothesis (H_a), or that the variables are not independent and do not equally change dental compliance equally.

The level of significance was calculated at $p > .05$. The level of significance used in previous research was at the .05 level when assessing compliance with a dental cleaning (Altabet, 2002). The degrees of freedom were calculated using the formula $df = (r - 1) * (c - 1)$, in which r is the number of rows for each categorical variable (i.e., visual support group and video modeling), and c is the number of columns for the other categorical variable (i.e., the number of dental visits). Statistical significance was calculated using the formula $X^2 = \Sigma [(O - E)^2 / E]$, in which O is the observed number of steps complied with for visual supports and with video modeling, and E is the expected numbers of steps complied with for visual supports and video modeling (Boslaugh, 2012) The findings of this statistical analysis were calculated and reported.

Parent-satisfaction data analysis. The second part of data analysis assessed the social validity of the program. Survey data collected from the parents of participants was reported to show the perception of parental experiences at the pediatric dental clinic. Parent surveys were completed by rating each question using a 5-point Likert scale. The parent-survey data were analyzed using a descriptive analysis by calculating the rating for each question. Boslaugh (2012) stated, "Percent agreement is the simplest measure of agreement; it is calculated by dividing the number of responses in which the parent agreed, by the total of responses" (p. 123). For each question, the number of participants responding to each category (i.e., 5 = *strongly agree*, 4 = *agree*) was recorded as the *n*. This calculation resulted in a percentage of responses rating each of the five possible responses. These percentages described the percentage of parental agreement in descending order.

Limitations

One limitation of this study was the number of participants. Because a convenience sample was selected, generalization of findings is limited (Lodico, Spaulding, & Voegtle, 2010). Additionally, participants in this study were fewer in number as compared to the total number of patients in the pediatric dental clinic due to the inclusionary criteria. Future studies can be conducted with a larger sample size and across dental clinics to improve generalization of findings. Testing effects refer to exposure to a specific condition. In this analysis, there was no control group to compare with the experimental groups. Changes in compliance could be due simply to exposure to the dental clinic and not the specific treatment methods used. Future research can be conducted to include a treatment group and a control group.

Maturation refers to changes in a patient over the course of treatment (Cooper et al., 2007). For example, the patient gets older during the course of dental treatment. This is a threat in this analysis because research shows that children become more compliant with dental procedures as they get older (Loo et al., 2009). Younger children whose data are included in this study may show lower compliance than older patients whose data are included in the study. To minimize this effect, participants were matched by age.

Chapter 4: Results

The purpose of this study was to assess and compare changes in participants' compliance with dental procedures when using visual task strips or video modeling. An additional survey was disseminated to collect parent-satisfaction data. This research sought to answer the following four questions:

1. How has participants' compliance with dental cleaning procedures changed following the use of visual supports?

2. How has participants' compliance with dental cleaning procedures changed following the use of video modeling procedures?

3. Does one of the two interventions lead to compliance with dental cleaning procedures more quickly than the other?

4. How do the parents rate their satisfaction with the components of the intervention and overall?

Data were reviewed and graphed using a line graph and histogram. Data were analyzed using visual analysis and a chi-square test. Additional parent-survey data were analyzed to determine parent satisfaction with the intervention methods and satisfaction with the overall experience.

Changes in the Visual Support Group

The first research question examined the changes in participants' compliance with dental procedures following the use of visual supports as an intervention. The number of steps completed independently within 5 seconds of presentation were recorded as compliant. Changes in compliance were collected by recording data on each step in a 40-step task analysis across each dental visit. The total number of steps complied with were divided by the total number of steps in the task analysis, resulting in a percentage. This percentage was graphed on a line graph for each participant in the visual support group (see Figure 1). Two participants achieved 100% compliance on the first visit. Other participants met the criteria at Visits 2, 3, 7, 8, and 9. Two participants had 100% compliance during the first dental visit, and therefore, no change in compliance was achieved. Five of the seven participants' compliance improved with the use of visual supports.

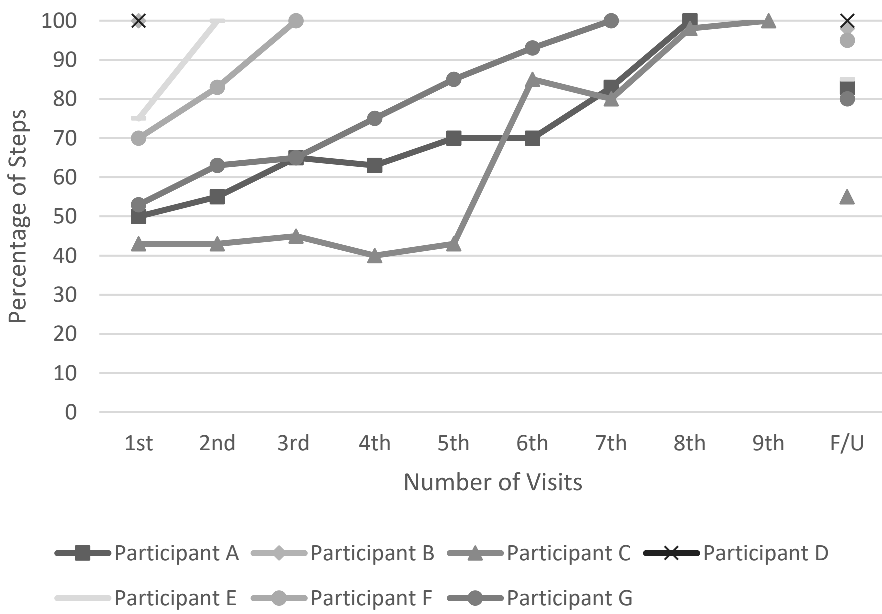

Figure 1. Percentage of compliance of all participants in the visual support group across each dental visit.

Changes in the Video Modeling Group

The second research question examined how participants' compliance with dental cleaning procedures changed following the use of video modeling procedures. The same compliance data as the visual support group were collected following the same 40-step task analysis. The compliance data for the seven participants in the video modeling group were graphed using a line graph (see Figure 2). Three participants met the 100% compliance on the first visit. The other four participants met the criteria at the second dental visit. Three participants had 100% compliance during the first dental visit, and therefore, no change in compliance was achieved. Four of the participants' compliance with the dental cleaning procedure improved with the use of the video modeling intervention.

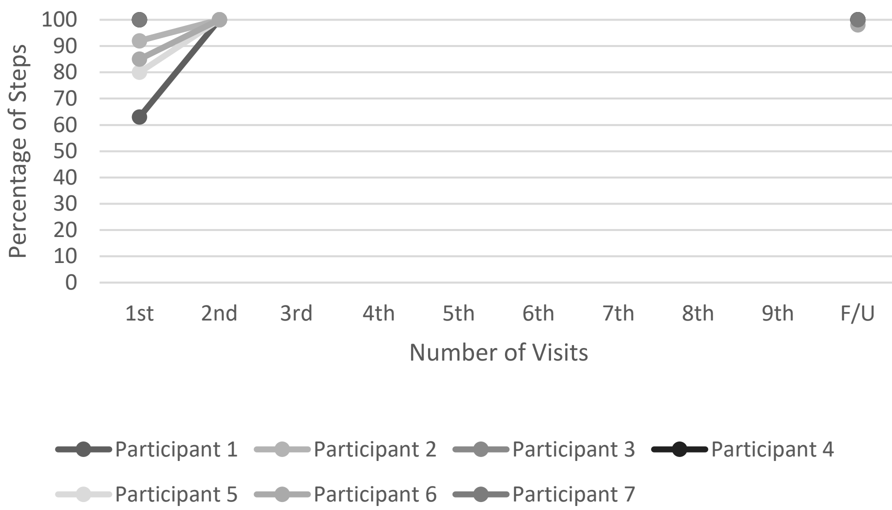

Figure 2. Percentage of compliance of all participants in the video modeling group across each dental visit.

Comparison of Interventions

The third research question for this study asked if one of the two interventions led to compliance with dental cleaning procedures more quickly than the other. The number of visits required to meet the criterion was graphed across participants using a histogram (see Figure 3). The histogram shows that both groups had participants in this study who met the criterion in a single visit and during the second visit. Participants in the visual support group required subsequent visits to meet the criterion. When comparing the mean number of visits for each intervention group, the video modeling group averaged 1.6 visits to meet criterion, and the visual support group averaged 4.4 visits to meet the criterion (see Figure 4).

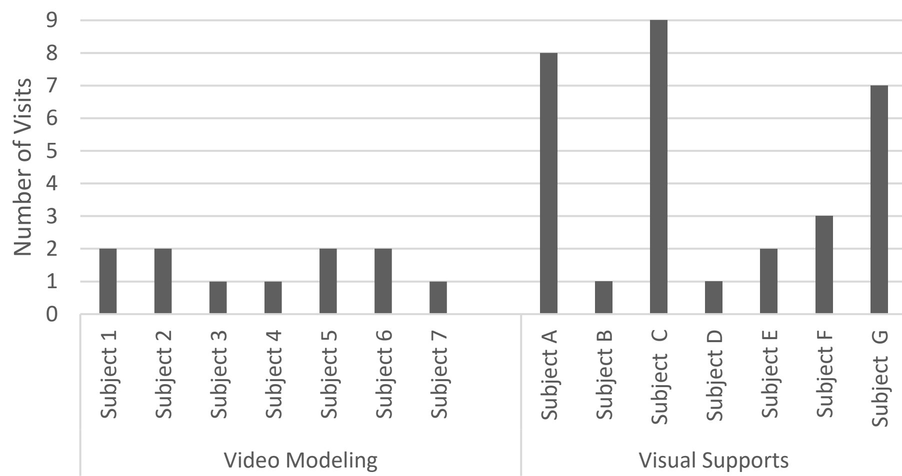

Figure 3. Number of dental visits each participant attended.

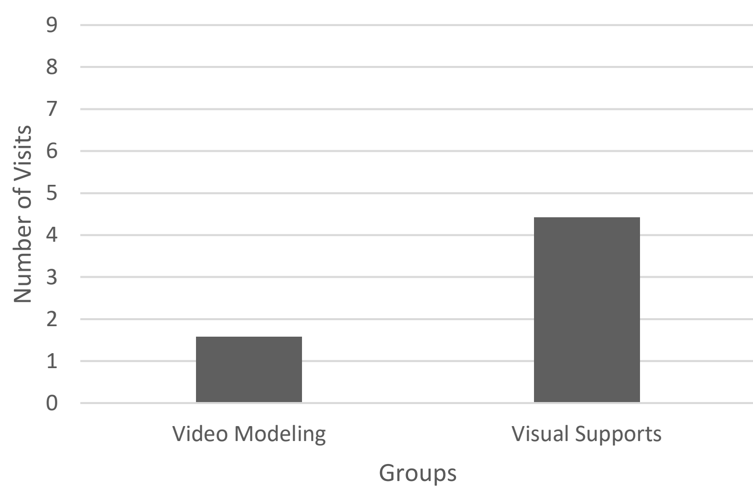

Figure 4. Comparison of the mean number of dental visits each intervention group attended.

A chi-square test of independence was performed to examine the relation between compliance with dental procedures in the video modeling group and the visual support group. The relation between these variables was found to be significant, X^2 (3, N = 240) = 7.81, $p < .05$., meaning the difference in the number of steps for compliance for participants in the video modeling group compared to the compliance of participants in the visual support group was statistically significant. Those in the video modeling group were more likely to comply with dental procedures in fewer visits than those in the visual support group.

Parent Satisfaction

To assess the social validity of the program, parents of the participants were asked to rate their satisfaction with the components of the intervention and their overall satisfaction. Data were collected from the parents by having parents rate each survey question using a 5-point Likert scale. Ten parents completed the survey, but six completed only the demographic section and did not respond to the questions about satisfaction. Four of 13 parents completed the entire survey. As such, this researcher chose to analyze the data descriptively rather than present percentages, as the percentages may be misleading.

The four parents who completed the entire survey included two parents from each intervention group. Both parents of participants in the video modeling group rated the video modeling intervention as highly effective in showing their child what to expect during the dental visit. One parent in the visual support group rated the visual task strip intervention as highly effective. One parent rated the visual task strip intervention as moderately effective. Both parents of participants in the video modeling group completely agreed that the video modeling intervention helped their child learn to participate in the dental cleaning.

One parent in the visual support group completely agreed that the visual task strip intervention helped his or her child learn to participate in the dental cleaning. One parent somewhat agreed that the visual task strip intervention helped his or her child learn to participate in the dental cleaning. Parents of participants in both intervention groups completely agreed that they would like the dentist to continue using the intervention with their child.

Summary

The purpose of this study was to examine the effectiveness of visual task strips and video modeling on participants' compliance with dental procedures using parent-satisfaction measures. This study found that all participants in the visual task strip group complied with dental procedures and met the 100% compliance criterion. The number of dental visits required to meet this criterion ranged between one and nine visits across participants. All participants in the video modeling group complied with dental procedures and met the 100% compliance criterion. The number of dental visits required to meet this criterion ranged between one and two visits. More participants in the video modeling group met criterion in fewer visits than participants in the visual task strip group.

When comparing the mean number of visits between groups, the video modeling group required 1.6 visits to meet criterion; the visual task strip group required 4.4 visits to meet criterion. Although both intervention groups met the criteria, fewer visits were required in the video modeling group. All parents of participants who responded to the parent-satisfaction survey reported being satisfied with the assigned intervention in helping their child to participate in the dental cleaning and reported the intervention as effective in showing their child what to expect during the dental visit. All parents completing the survey completely agreed that they would like the dentist to continue using the intervention with their child. These results showed that parents were satisfied with both interventions.

Chapter 5: Discussion

Summary of Findings

Results of this study showed compliance with dental procedures in both the visual support and video modeling group. When comparing changes in compliance between the two intervention groups, results showed both groups had participants who met the criterion in a single visit (visual supports, n = 2; video modeling, n = 3) and during the second visit (visual supports, n = 1; video modeling, n = 4). Participants in the visual support group required additional visits beyond the second training session to meet criterion, whereas all participants in the video modeling group met criterion during the first or second visit. When comparing the mean number of visits for each intervention group, the video modeling group averaged 1.6 visits to meet criterion, whereas the visual support group averaged 4.4 visits to meet criterion. In other words, the video modeling group achieved the criterion in fewer dental visits than the visual support group. Therefore, the video modeling procedures resulted in faster dental compliance than visuals alone. Results suggest that, although both interventions were effective in teaching dental compliance to preschoolers with autism, video modeling was a superior intervention in teaching participants dental compliance utilizing fewer dental visits.

Parent-satisfaction measures showed that both groups of parents were satisfied with the use of the procedures and the effectiveness of assisting in their child's participation in the dental cleaning. No parent in either intervention group reported being dissatisfied. All parents of participants reported that they wanted the dentist to continue using the intervention with their child. These findings provide evidence of the social validity of this study, in which, the "intervention procedures are acceptable" (Cooper et al., 2007, p. 704) to the caregivers of the participants. The results of this study have implications for the field of ABA and dentistry. Findings of improved dental compliance with a population of pediatric children with autism, with the use of visual supports, and with the use of video modeling, add to the existing body of research.

Implications of Findings

The findings of this research study add to the existing literature in both the field of ABA and dentistry. The efficacy of simple antecedent interventions in an applied dental setting improve the field of pediatric and special care dentistry. Because behavior management and patient compliance are necessary to improve patients' oral health during dental cleanings, these antecedent interventions were found to be effective in reaching 100% compliance with procedures in a dental cleaning, and eliminate the need for advanced behavior management such as physical and chemical restraints, which are routinely used with noncompliant patients (Loo et al., 2009).

Adding to the dearth of literature on behavior management in dental settings for children with autism, these findings could lead to further research in the field of pediatric and special care dentistry and influence the way dentists prepare patients for dental visits. Adding to the literature in the field of ABA, this is the first study to assess visual supports as an intervention in an applied dental setting (Harnois, 2016; Wibisono et al., 2016). Visual supports were found to be effective in helping all patients achieve 100% compliance with the dental cleaning procedure.

These findings extend previous findings on the efficacy of visual supports with children with ASD to a new setting (Pilebro & Backman, 2005; Sallam et al., 2013; Wibisono et al., 2016). This study supports existing research on the efficacy of video modeling with dental procedures (Conyers et al., 2004; Isong et al., 2014; Machen & Johnson, 1974; Melamed et al., 1975), and extends existing research with its application in an applied setting (Luscre & Center, 1996) and with a younger population of children with ASD (Isong et al., 2014). Video modeling was shown to be effective in helping participants achieve 100% compliance as quickly as one intervention session.

Population. Five of the 14 participants complied with the dental cleaning procedure during the first dental visit, with an additional five participants complying during the second dental visit. The findings of this study are inconsistent with previous findings from dental research on behavior management of patients with ASD, which reported frequent use of reactive strategies (Loo et al., 2009), behavior challenges in the office (Rada, 2013), and even that “children [with ASD] are incapable of cooperating” (Rekha, 2012, p. 126). With the use of visual supports or video modeling, participants from both intervention groups cooperated with the dental cleaning procedures. The use of either of these interventions, therefore, should be considered by dental practitioners as a valuable tool to help increase cooperation of patients with ASD.

Visual supports. This study is the first study to assess the use of visual supports in an applied dental setting. Although previous research (Harnois, 2016; Wibisono et al., 2016) has recommended the use of visual supports during dental cleanings for children with ASD, no research to date has been conducted. The findings of this study suggest visual supports improve dental compliance in preschoolers with ASD. All participants in the visual supports group reached 100% compliance with the dental cleaning procedure without the use of additional behavior management, prompting, or reinforcement. These findings show that the intervention was effective with this population and in an applied setting.

Video modeling. Like previous studies on video modeling and dental compliance (Conyers et al., 2004; Isong et al., 2014; Machen & Johnson, 1974; Melamed et al., 1975), video modeling was effective in teaching dental compliance with preschool children (Machen & Johnson, 1974) and continues to show its effectiveness across populations (Melamed et al., 1975; Sallam et al., 2013) and ages (Berggren & Carlsson, 1986; Isong et al., 2014). Video modeling was found to improve dental compliance as quickly as one to three visits in previous studies (Conyers et al., 2004; Isong et al., 2014; Machen & Johnson, 1974; Melamed et al., 1975), and the current study shows participants complied with all steps in the dental cleaning during the first or second dental visit.

Other studies found dental compliance improved after a longer number of visits (Berggren & Carlsson, 1986; Luscre & Center, 1996) and did not generalize to a real dental operatory without additional training. In light of the difficulty with lack of generalization in previous studies (Berggren & Carlsson, 1986; Luscre & Center, 1996), this study used interventions within the real-life setting. Because video modeling successfully taught dental compliance in the real-life setting, the need to train for generalized skills was no longer needed. This indicates that video modeling may be an effective intervention that could be used across other real dental settings, instead of treatment centers or contrived settings, to increase dental compliance.

Research Design

The use of a group design in this study to assess two ABA interventions is unique. Group designs are common in dental research, and dental research relies primarily on this research design (McDonald et al., 2004). Research by Machen and Johnson (1974), Melamed et al. (1975), Sallam et al. (2013), and Isong et al. (2014) all used a group design to compare video modeling to other interventions. However, the assessment of ABA strategies, such as visual supports and video modeling, are typically conducted using single-subject designs, such as multiple baseline (Apple et al., 2005; Buggey et al., 1999; Charlop et al., 2010; Charlop-Christy & Daneshvar, 2003; Charlop-Christy et al., 2000; Cooper et al., 2007; D'Ateno et al., 2003; Hine & Wolery, 2006; Kleeberger & Mirenda, 2010; Luscre & Center, 1996; 2009; Maione & Mirenda, 2006; Marcus & Wilder, 2009; Nikopoulos & Keenan, 2004; Schreibman et al., 2000; Taylor et al., 1999). The use of this group design with ABA interventions proved both useful and challenging. The data analysis associated with group designs is statistical. Calculating statistics was useful in identifying the number of completed dental visits across interventions to find statistical significance. Using a group design requires more participants than a single-subject design. Enrolling enough participants to meet the minimum number required in a group design was challenging.

The benefit of finding statistical significance may not outweigh the time spent on recruiting and enrolling a sufficient of number of participants; the same intervention could have been applied to three participants in a single-subject research design and completed within a fraction of the time. Completing the research faster would enable the finding to get to the field faster and inform practice. However, using a group design and finding statistical significance allows these findings to be shared with a broader audience than the field of ABA; it allows the findings to be shared with the field of dentistry. The findings of this study may support the movement of servicing children and older patients with ASD in general and specialty dental practices within community settings.

Limitations

This study had a small number of participants, which limits it generalization. Recruiting a sufficient number of participants took 2 years. Multiple staff changes took place within the clinic during that time, often delaying the recruitment of participants.

Future studies should be conducted with a larger sample size and across dental clinics to improve generalization of findings. Unlike some dental studies on video modeling (Isong et al., 2016; Machen & Johnson, 1974; Melamed et al., 1975), in this analysis, there was no control group to compare with the experimental groups. Changes in compliance could be due simply to exposure to the dental clinic and not due to the specific treatment methods used. Findings, therefore, should be interpreted with caution, as it is unknown if changes in compliance would have occurred in a control group. Future research can be conducted to include a control group.

Recommendations for Future Research

This research found both visual supports and video modeling to be effective in teaching preschool-aged children dental compliance. Future research could extend to other populations such as older children and adults with ASD, typically developing preschool-aged children, and individuals with reported dental anxiety or fear. Future studies could be conducted with a larger sample size to improve the generalization of findings. Although video modeling was highly effective in this study, other studies have shown video prompting to be more effective than video modeling in chained tasks (Bennett et al., 2013; Canella-Malone et al., 2006, 2011; Norman et al., 2001; Taber-Doughty et al., 2008), like in the sequence of steps in a dental cleaning. Future research could assess the efficacy of video prompting with dental compliance. This study used person point of view and video peer modeling in the video modeling intervention. Other variations of video modeling, such as voiceover narration and video self-modeling could also be assessed.

Future research could focus on generalizing these findings across dental settings. The materials used in the visual representation of the steps of the dental cleaning would need to be recreated to accurately depict the tools used in other settings. It would be interesting to see the findings of the same intervention across new materials and new dental settings. Across studies, a variety of methods have been used to display the visual supports, including: a central location (Banda et al., 2009), portable book (Whatley et al., 2009), and computer format (Dauphin et al., 2004). No pattern of a superior delivery method has been identified, and all were found to be effective. This current study used a portable visual task strip to effectively teach dental compliance. In applying this knowledge to the dental setting, visual supports could be assessed in a variety of formats, including a visual display in the waiting room, on a computer monitor in the dental operatory, and in a portable book from the waiting room to the dental operatory.

An additional dependent variable could assess dental anxiety using objective measures such as the use of a heart rate monitor in conjunction with visual supports or video modeling. Research by Elmhurst and Thyer (2017) demonstrated that avoidant behavior, reported as fear, does not proportionately reflect the heart rate, indicating internal states of anxiety or fear may still be present without the occurrence of overt avoidant behavior. Using an objective measure, such as a heart rate monitor, in conjunction with visual supports or video modeling, may lead to further refinement of the intervention methods and application of the interventions in applied settings.

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Appendix A

Task Analysis for Dental Cleaning and Fidelity Checklist

Task Analysis for Dental Cleaning and Fidelity Checklist

	Date		Date
1. ***Enter clinic***		21. Clean one tooth	
2. ***Sit in chair***		22. Front top	
3. ***Gloves*** -Present gloves		23. Front bottom	
4. Touch gloves		24. Right side top	
5. Allow dentist to wear gloves		25. Right side bottom	
6. ***Mask*** -Present mask		26. Left side top	
7. Touch mask		27. Left side bottom	
8. Allow Dentist to wear mask		28. ***Mr. Thirsty***- present	
9. ***Dental Mirror***- Present mirror		29. Touch	
10. Touch mirror		30. Allow in mouth	
11. Hold mirror		31. Close mouth	
12. Allow mirror in mouth (1 sec)		32. ***Toothpaste***- Present toothpaste	
13. Open mouth w/mirror (2-4) sec)		33. Smells toothpaste	
14. Open mouth w/mirror (5-10 sec)		34. Brush one tooth	
15. Open mouth w/mirror (10+ sec)		35. Front top	
16. Look at gums		36. Front bottom	
17. Says ‘cheese’ to examine teeth		37. Right side top	
18. ***Prophy Cup*** -Present prophy cup		38. Right side bottom	
19. Touch prophy cup		39. Left side top	
20. Hold prophy cup		40. Left side bottom	

Appendix B

Survey

Survey

My child's age: _______________

My child's primary diagnosis:
- ☐ Autism
- ☐ Pervasive Developmental Disorder (PDD)
- ☐ Asperger Disorder
- ☐ Other ___________________________

My child had been to the dentist before coming to the pediatric autism dental clinic:
- ☐ No, this was my child's first dental experience
- ☐ Yes, my child had been to a dentist before

The following are behavior-management strategies that may have been used with your child. Please rate the level of effectiveness with each of the following items:
Video Modeling-reviewing a video prior to having the dental cleaning completed
Visual task strip- reviewing a sequence of picture cards that show the steps in the dental cleaning

	Highly effective	Moderately Effective	Somewhat effective	Ineffective	Not effective at all	N/A
1. Viewing **a video** of the dental procedures in the waiting room prior to your visit to show my child what to expect (sit in chair, open mouth, touch dental instruments, etc.)						
2. Viewing **a visual task strip** during the dental appointment to show my child what to expect (sit in chair, open mouth, brush teeth, treasure chest)						

Please rate your agreement with each of the following statements.

	Completely agree	Somewhat Agree	Neutral	Somewhat disagree	Completely disagree	N/A
3. **Video Modeling** helped my child learn to participate in the dental cleaning						
4. **Visual task strip** helped my child learn to participate in the dental cleaning						
5. I would like the dentist to continue using this strategy with my child.						

Appendix C

Feedback Form

Feedback Form

Thank you for taking the time to review the parent satisfaction survey and provide feedback in order to improve the clarity of the survey questions.

Please mark each question as "Clear" or "Unclear" meaning the content was easy to understand and clear in what it is asking. Please provide comments and recommendations on the bottom of the feedback form.

Parent Satisfaction Survey Questions	Clear	Unclear
Rate the level of effectiveness for each of the following procedures		
1. Viewing **a video** of the dental procedures in the waiting room prior to your visit to show my child what to expect (sit in chair, open mouth, touch dental instruments, etc.)		
2. Viewing **a visual task strip** during the dental appointment to show my child what to expect (sit in chair, open mouth, brush teeth, treasure chest)		
Please rate your agreement with each of the following statements		
3. **Video Modeling** helped my child learn to participate in the dental cleaning		
4. **Visual task strip** helped my child learn to participate in the dental cleaning		
5. I would like the dentist to continue using this strategy with my child.		

Comments/Recommendations:

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