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Early Intervention in Pediatric Occupational Therapy

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Abstract

Early intervention is services for infants and toddlers who have developmental deficiency or considered high risk due to the environmental or biologic factors. The aim of the early intervention is increasing the physical, cognitive and emotional capacities of infants/toddlers with protecting them from the environmental or biological risk factors. Early intervention should start as soon as possible for obtaining the best results for the child and family. First 3 years of life are critical period of the child development because neurologic development still continues. Infants and toddlers are providing physical, cognitive, sensory and social development with different experiences and various sensory stimuli from the environment in this period. Occupational therapists evaluate and implement interventions to activity, environment, infant/toddlers and their families for minimizing the developmental risks. For these reasons, occupational therapists are considered important members of early intervention team.

Keywords: early intervention, occupational therapy, sensory motor performance, play therapy, cognitive, feeding disorders, social development

1. Introduction

1.1. High risk infant

This term is using for the infant who has increasing risk for disability, but the exact disability is not actualized yet. The risk factors of infants can be divided into two main subheadings. The first subheading is biological risk factors. These are: intracranial hemorrhage, diabetic retinopathy, sepsis, necrotizing enterocolitis, apnea, asphyxia, intraventricular hemorrhage and the brachial plexus injury. The second subheading is environmental risk factors. These are: adolescence pregnancy, low socioeconomic status, mental health problems of parents, substance abuse of parents and the lack of family caregiving skills [1].

1.2. Occupational therapy intervention in neonatal intensive care unit

Many high risk infants begin to the first days of their lives in Neonatal Intensive Care Unit (NICU) for provision of medical treatment. The occupational therapist should consider biological risk of infants, NICU's environmental risk factors and early separation problems of infant caregivers when planning their assessments and interventions. Due to this reason, occupational therapy interventions in the NICU should involve infants, families, NICU staffs and environmental factors.

The early mother and infant separation are risking the mother-infant bonding, which is critical role in infant development. Thus, occupational therapy intervention for high risk infants should start as soon as possible after the infant born. Occupational therapy intervention in NICU should include infant, family and environmental factors. Occupational therapist should motivate the parents to take care of their infants in NICU. This intervention provides positive social interaction between mother and infant at an early period. Occupational therapy program in NICU should include increasing the confidence of caregiving skills of mothers and establish strong relationship between infant and mother with increasing mother's observation skills to infant behaviors. These interventions' aim is providing the mother's positive feeling to infants. Then occupational therapists should give opportunity to observe the infant. Family should sensitive to infant's reaction to environmental stimuli and tries to provide a positive response from them. Thus, mother's self-confidence increase with ability to understand the response of the infant and mother can provide appropriate sensory stimuli to her infant [2].

Kangaroo care is another important intervention of occupational therapists working in the NICU. Kangaroo care is a technique that nude infant is positioned between the breast and under the clothes of his/her mother or primary caregiver in a vertical position to provide skin-to-skin contact. Mother sits on a rocking chair and swing rhythmically to provide vestibular stimulus to infant. Kangaroo care's aims are providing mother-infant bonding and preventing sensory processing disorders of infants. Due to that reason, kangaroo care should be initiated as early as possible even in the delivery room and infant-mother separation should be finished [3].

NICU environmental risk factors and immaturity of infants' biologic and neurologic systems are lead to sensory processing disorders in infants or even if loss of sense. All sensory interventions for infants who are taking medical treatment in the NICU, priority should be given to reduce sensory stimuli rather than provide sensory stimuli. Due to the reason, environmental adjustments in the NICU gain an important role for occupational therapists. Occupational therapist should adjust the environmental factors of NICU's light and sound. NICU lighting design should include: (1) infants should be kept out of the direct light, (2) incubator must have covered with a thick blanket for reduction of light, (3) the provision of day-night cycle by changing the light levels at specific times of day; this will be supporting the infant rapid eye movement (REM) sleep, and (4) levels of lighting instruments should measure and reduction of light exposure should be provided. Sound level design in NICU should include: (1) noise reduction should be provided in NICU, (2) NICU's sound level should not exceed 50 decibels, (3) temporary sound level in NICU should not exceed 70 decibels, (4) equipment noise

level in NICU should not exceed 40 decibels, and (5) NICU staff training should be done for decreasing noise level [4].

Another important intervention of occupational therapist in the NICU is providing minimal touch to infant. Occupational therapists should coordinate taking blood samples, imaging techniques, aspiration, and chest physiotherapy for providing minimal touch and give a formal warning to other health care providers regarding the provision of enough and quiet rest time to infant.

Occupational therapy interventions in the NICU provide infant's medical status get better, and infants can early discharge from the NICU. After discharge from NICU, parents should be educated for taking care at home for high risk infant and developmental follow-up must be done. At this period, occupational therapists should evaluate and implement interventions for infant's sensory processing disorders, social-emotional development, feeding problems, motor development, cognitive development and playing skills.

1.3. Sensory processing disorder

Dr. J. Ayres developed sensory integration theory in the 1970s. She defined sensory integration as a neurological organization process enabling the effective use of one's body through stimulus from his body and the environment [5].

Ayres' the most important contribution to the understanding for the child's development is highlighting the importance of senses, but especially proximal senses (vestibular, tactile and proprioceptive). From the point of sensory integration view, it was emphasized that proximal senses are very important. Child uses these senses for interacting with environment at early stages of life, because these senses are primitive and basic senses. The distal senses such as vision and hearing gain more importance as the child grows and gets more critical. Ayres hypothesis was that proximal senses are providing basic to child complex activities [5].

When infant behavior is examined from the sensory integration theory, both environmental and biological factors are effective on the of infants' behavior. Infant's related factors, "Four As" (arousal, attention, affect and action), the sensory threshold and self-regulation skills. Each of these factors is interrelated and affects each other. "Four As" was defined by the Anzalone. These factors are:

1. *Arousal*: Arousal is the ability to maintain infant's vigilance and manage to pass between situations.
2. *Attention*: Attention is the ability to give selective attention to stimulus or task by infant.
3. *Affect*: Affect is the emotional components of behavior.
4. *Action*: Infants' ability to perform purposeful behaviors [6].

Sensory threshold, ideally, this threshold is high enough that we can tolerate the complexity and stimulation inherent in the environment, yet low enough that we can perceive subtle

changes and novelty in the environment. This threshold varies both between and within individuals. Infant's threshold range will determine infant's behavior organization level.

Self-regulation is a process that involves the infant's capacity to modulate mood, self-calm, delay gratification and tolerate transitions in activity.

Environmental factors are sensory stimuli from infant's physical and social environment [7].

1.3.1. Evaluation tools of infant/toddler sensory processing disorders

There are three specific tests for determining sensory processing problems in the range of 0–3 years. These tests are: Test of Sensory Functions in Infants (TSFI), Sensory Rating Scale (SRS) and the Infant/Toddler Sensory Profile (ITSP) tests. The SRS and ITSP are both parent-reported questionnaires, whereas the TSFI is a performance-based assessment [8].

1.3.2. Sensory integration interventions for infant/toddler

Sensory integration interventions can be applied in three different ways for infants/toddlers. The first type of these interventions is individualized sensory integration therapy. The second type of sensory intervention is the sensory diet. The third type of this intervention is family education [9].

1.3.2.1. Individualized sensory integration interventions

Sensory integration interventions should include these parameters; desensitization of hyper-reactive response, increasing the hyporeactive response, ensures attention continuity, providing purposeful activity and ensures appropriate behavior to sensory stimuli. The most important principle of sensory integration therapy is gaining ability to organize and process senses to provide purposeful activity. The occupational therapist uses individualized sensory integration interventions for treating atypical responses to sensory stimuli. For example, brushing techniques can be used for desensitization of hypersensitivity to touch or for gaining appropriate response to vestibular stimulus; hammock can be use in therapy. Such sensory integration techniques will help to normalize the child's response to sensory stimuli [9].

1.3.2.2. Sensory diet

A sensory diet is individualized home program that is carefully planned and has a positive effect on functional skills to regulate sensory stimulus. It is important to specify the intensity, duration and timing of sensory-based activity to obtain optimal performance from the sensory diet.

One of the most important principles in the treatment of sensory processing disorder for infant/toddler is including sensory integration intervention into the activities of daily living and play activities. It can provide with modifying child's daily routine, functional activities and play materials to meet the child's sensory needs. House environment also should be configured in sensory diet [10].

Sensory integration theory provides the basic principles for the treatment of sensory modulation disorder. Sensory diet of children will provide optimum sensory modulation and optimum sensory modulation facilitates the appropriate adaptive response. This is an indirect treatment method for sensory modulation disorder. Sensory diet for infants should be included in activities of daily living such as bathing and feeding. Normal sensory response will gain with changing daily routines and the sensory parameters of home environment that ensuring optimum sensory stimulation [11].

1.3.2.3. Family education

Family education is often used for regulation disorders caused by sensory processing disorder, and constitutes an important part of the treatment process. There are two important benefits of family education. First, family will understand that sensory processing disorders are underlying factor of infant/toddlers' behavioral problems. By this way, it helps the mother and infant bonding. Second, family education teaches coping strategies to families for infant/toddler's behavioral problems [12].

1.4. Social-emotional development

Social-emotional development process begins with infant-primary caregiver bonding in infancy period. Infants' first interaction is with their primary caregiver. Infants express needs with crying or gaze at something. Primary caregiver meet the infant's needs and infant calm down; thus infant carry out first social communication. Children increase the social development interacting with other family members, peers and teachers. Social skills may be negatively influenced from the factors related to primary caregiver such as mother's mental health problems or factors related to infants such as insufficient cognitive skills. Negative experiences in infancy may cause insufficient social skills in childhood [13].

1.4.1. Evaluation tools of social-emotional development for infants/toddlers

Social-emotional development in infancy can be evaluated with The Social-Emotional Assessment/Evaluation Measure, Ages & Stages Questionnaire: Social-Emotional (ASQ: SE), Brief Infant-Toddler Social-Emotional Assessment (BITS), the Temperament and Atypical Behavior Scale (TABS), Infant-Toddler Social-Emotional Assessment (ITSEA), the Functional Emotional Assessment Scale (FEAS), Bayley Scales of Infant Development, Infant Behavior Record, Parent-Child Early Relational Assessment (PCER), the Devereux Early Childhood Assessment Clinical Form (DEC-C), Social Skills Rating System (SSRS), Preschool Learning Behaviors Scale (PLBS) and Infant/Toddler Symptom Checklist [14, 15].

1.4.2. Occupational therapy intervention for social-emotional development of infants/toddlers

Occupational therapy interventions in this area can be classified in three subheadings. First is touch-based interventions for providing self-regulation of infant and infant-caregiver bonding. Second is relation-based interventions for providing positive mother-children interaction. Third is increasing attention skills.

Touch-based interventions include kangaroo care, deep pressure and massage interventions. These interventions' aims are ensuring calming the infant and promotion of mother-infant bonding.

The occupational therapists frequently use DIR-Floortime method for relationship-based intervention. DIR is the developmental, individual-differences and relationship-based model that was developed by Dr. Stanley Greenspan and Dr. Serena Wieder. Dr. Greenspan stated the goal of DIR model, as increasing social, emotional and intellectual capacities of children. *Developmental* in this model represents that the intervention should be appropriate to developmental milestones. There are six milestones defined in this model. These are (1) *Self-Regulation and Interest in the World* (0–3 months): Being calm and feeling well enough to attend to a caregiver and surroundings. (2) *Forming Relationship, Attachment and Engagement* (2–7 months): Interest in another person and in the world, developing a special bond with primary caregivers. (3) *Two-Way Purposeful Communication* (3–10 months): Simple back and forth interactions between child and caregiver. (4) *Complex Sense of Self* (9–18 months): Engaging complex organized problem solving interactions. (5) *Representational Capacities* (18–30 months): Meaningful and creative use of ideas and words. (6). *Representational Differentiation* (30–48 months): to establish relationships between ideas. *Individual differences* in this model represent all individuals' perception of environment are different from each other. In particular, attention is drawn on differences between sensory processing capacities of each child. *Relationship-based* part of the model emphasizes the developments of the human being bring results with interaction with other people. With young children, these playful interactions may occur on the "floor," and these interactions should be purposeful. In this model, the parents who play with child should know six major milestones of the early development stages. In this therapy method, parents should play 20 or more minutes with their children on the floor. However, there are two important points that therapists should pay attention. First, the parents should follow the leadership of the child and the second, all the interactions between the child and parent should support developmental process. DIR model is holistic approach that addresses the both family and child strength and needs. This model is not focus only on the child's development; it also aims to improve the overall functioning of the family. DIR-floortime effectiveness can be provided with cooperation between therapists and families, and parents must be committed to the program [16, 17].

Joint attention is the process in which an infant learns to recognize the direction of an adult's gaze, orient their own gaze to follow it, and then look in the same direction. Attention skills are critical for social development, and it seems related to language development [18].

Socio-emotional behavior is a key factor of understanding the child because it will affect the other performance areas. Occupational therapist should help to determine the parents which behavior of the child most problematic in home environment for improving the fit between the child and the environment. The determined behaviors constitute the objective of intervention, and later therapist can make suggestions for compensation to cope with this behavior [19].

1.5. Feeding disorders in infants/toddlers

Swallowing is one of the two vital functions of humans along with respiration. Feeding disorders are occurring approximately 50% of high risk infants and toddlers. Feeding disorders

may continue to older ages for most of the infants who experienced these disorders during infancy period [20].

Sucking: Swallowing function begins with sucking at 36 weeks' gestation. Tongue, upper lip, mandible and the hyoid first move to up and down and later forward and backward as a unique unit to provide the positive and negative pressure, thus milk bolus ingestion provided. This nutritive sucking occurs in term infants per second [21, 22].

Sucking swallowing breathing: Sucking-swallowing-breathing reflex is essential for successful sucking because infant has to coordinate especially swallowing and breathing. Prematurity, neurologic disorders in infancy or respiratory disorders have higher risk for the developmental process of this reflex [23].

Chewing: At almost 6 months of age, infants begin a munching type of oral-motor activity, using back-forth tongue movement and up-down movements of the jaw. An infant can eat pureed or soft foods after achieving munching. The next developmental stage of chewing is lateral motion of the jaw and seen at 9 months of age. At this stage, lateral movement of tongue start and infant can transfer the food to masticatory surface. The final developmental stage is rotatory movement of the jaw. This stage can be seen between 18 and 30 months of age. At this stage, infant can eat most of the hard foods [24, 25].

1.5.1. Evaluation methods of infant/toddlers feeding disorders

Evaluation methods are: Neonatal Oral-Motor Assessment Scale (NOMAS), Pediatrics Feeding Behavioral Assessment Scale (BPFAS), Pediatric Eating Assessment Tool (Pedi-EAT), Fiberoptic Endoscopic Evaluation of Swallowing (FEES) and Videofluoroscopic Swallow Study (VFSS) for infants and toddlers [23, 26].

The VFSS test is the gold standard for the diagnosis of oropharyngeal dysphagia. VFSS is a radiographic procedure that provides a direct, dynamic view of the oral, pharyngeal and upper esophageal function. Barium bolus is given to the clients during VFSS, and the movement of bolus is observed. Each episode of deglutition starting from the oral phase to until the end of the swallowing function is recorded, all phases of swallowing can be assessed at this time. VFSS provides the most detailed evidence to swallowing problems and provides specific recommendations about the content of food, feeding position (for reducing the aspiration and to provide oral motor skills) [27].

1.5.2. Occupational therapy interventions for feeding disorders

Intervention should plan according to the strength and weakness of infants/toddlers that informations gained from the evaluation process. Therapists' first goal should be providing safety during the intervention session.

1.5.2.1. Enabling swallowing

Occupational therapist can activate swallowing muscles of infants with cold application on the tongue and palate with frozen pacifier. This application helps swallowing muscles

to get ready and swallowing duration time get shortened. Occupational therapist can use frozen popsicle or an ice for providing cold application to toddlers. Another method for enabling swallowing is cold or sour bolus (e.g., lemon juice). Therapist should carefully evaluate, and if needed, the cold applications should be carried out for providing swallowing [28, 29].

1.5.2.2. Oxygen support and positioning adaptations

Respiratory disorders may cause problems in coordination sucking-swallowing and breathing (SSwB) of infants, because increased respiratory rate leads to pausing sucking for breathing and cause problems in SSwB coordination. Oxygen support should be provided for infants with low oxygen level during feeding. Thus, respiratory rate gets normal range, and infant can swallow easier [30].

Infants with respiratory disorders usually struggling during the feeding. Because they cannot coordinate SSwB. As a result, breathing becomes an urgent requirement, infants cough or vomit. Glass and Wolf suggest “external pacing” technique for providing external support to SSwB coordination disorders. Occupational therapist should know the suck-swallow-breathe requirements for feeding by bottle and can determine the problems in SSwB coordination. After third to fifth suck without spontaneous suck, break the suction by inserting finger into corner of mouth while leaving the nipple in place, tilt the bottle downward to stop flow of liquid and remove the bottle. Therapist gives an opportunity for breathing and relaxation to infants with the interruption of the sucking [21].

Occupational therapists should consider age, motor developmental level, feeding skills of children to decide best feeding position. Because appropriate positioning provides necessary support during feeding. For newborns and infants, side-lying position in caregiver’s arm is appropriate during breast feeding or bottle feeding. Supine position on caregiver’s thigh is another appropriate feeding position for infants. This position provides neutral alignment and midline orientation to infants. The caregiver’s both hands are free during this position. An another advantage of this position is providing caregivers and infants’ eye contact that can promote social interaction during feeding. For toddlers with good sitting posture, high chair or booster seat can be appropriate. The toddler can sit the table, and thus, social and communication skills may increase [19].

1.5.2.3. Sensory integration interventions for feeding disorders

Infants/toddlers with feeding disorders are generally hyper responsive to touch near or within the mouth. Oral hypersensitivity is usually correlated with experiences during neonatal period. Newborns who experienced medical interventions in NICU such as intubation, orogastric or nasogastric tube feeding and the toddlers who cannot experience oral feeding for a prolonged period may exhibit oral hypersensitivity. Preterm infants usually have increasing risks for sensory modulation disorders and may experience hyper responsive to tactile stimuli. Cerebral palsy, autism, developmental disorders, genetic disorders and neurologic disorders may lead to exhibition of oral hypersensitivity too [31, 32].

Occupational therapist generally uses desensitization techniques for intervention to hypersensitivity to touch. Oral desensitization activities for infants should begin with discovering the mouth with his/her fingers. Therapist may help to infant to take his/her hand to infant's mouth and let the infant to suck the hand. NUK brushes, toothbrushes can use for providing tactile stimulation. Therapist can apply firm pressure to infant's palate for decreasing oral hypersensitivity. Towel's texture touch is easy to manage for infants/toddlers with oral hypersensitivity. Thus, therapist should use towel for brushing or applying pressure and let the infant/toddler suck or chew the towel [31].

Sensory integration activities should contain new flavors and textures for increasing acceptance of foods. Therapist may dip the rubber toy or toothbrush to pureed foods or juice for providing oral activities to infants/toddlers. These activities should provide challenge but not discourage feeding attempts [31].

Positioning adaptations should be done considering the sensory processing disorders in addition to these sensory-based activities. Therapist should provide head and neck support when positioning infants/toddlers to make feel stable and safe, but not constraint whole body movements. Infants/toddlers with general sensory processing disorders may be more undisturbed when sitting on a chair rather than being held by mother's hands, because human touch provides intense sensory stimuli [31].

1.5.2.4. Transition from non-oral feeding to oral feeding

Non-oral feeding methods are using when the infant/toddlers cannot meet his/her nutrition or hydration orally. These methods are nasogastric and orogastric feeding, pharyngostomy, esophagostomy and gastrostomy. They may be used because of dysphagia, infant/toddler's medical problems or infants/toddlers cannot feeding orally to provide adequate growth [33].

Infant/toddlers' medical status and readiness to transition of oral feeding should be evaluated carefully by multidisciplinary team. The team should discuss with the family all the stages of transition process and show respect to family's decisions about transition process (such as beginning time to transition). Occupational therapists should provide assistance to family during all the stages of transition [34].

Oral motor intervention is the first stage of the transition process. Infant/toddler should try to succeed the oral feeding. Occupational therapist should desensitize the near or within the mouth. Therapist tries to increase oral-motor skills during the sensory-based play activities. Desensitization activities may involve sucking and chewing the rubber toys, NUK brushes and textured fabrics [35]. Babbling activities and blows toys may be other activities to provide oral motor activity. Therapist must emphasize all of the success of infants/toddlers and provide working toward the goals of interventions together with infants/toddlers and their families [36].

The families sometimes have an anxiety about feeding separate from infant/toddlers' medical status or weight loss problems and show increased attention on feeding. This process sometimes cause to infants/toddlers' avoidance or behavioral problems during feeding. Behavioral techniques should be implemented when the feeding problem originated from the behavioral problems of infants/toddlers [37].

The achievement of transition process is dependent on the providing support both infant/toddlers and their families. The prolonged non-oral feeding duration causes difficulties in transition to oral feeding. The family support groups may be efficient for providing shortened transition to oral feeding [37].

1.6. Motor development

High risk infants usually have problems in motor, cognitive and behavioral responses areas when compared with term infants. These problems may cause negative effects on both child's school success and adolescent period even in adulthood [38, 39].

Motor system includes posture, muscle tonus, reflexes, movements and activities [40, 41]. Characteristically, hypotonia is observed in premature infants. Hypotonia's severity is related to gestational age of infants [42, 43]. For example, an infant who was born at 28 weeks of gestation has wider range of motion than a full-term infant and has more flexibility in shoulders, elbows, hips and knees. Typical positions of premature infant's extremities are extension and abduction. There is an impairment in the midline orientation and flexor patterns. Random movements are generally decreased. Primitive reflexes are decreasing and disappearing or emerging in a contrary manner [44]. Functional motor skills and both gross and fine motor skills delay in premature infants when compared with term infants [45, 46].

Newborn motor skills are influenced by many factors such as autonomic instability, stress, environmental heat, infection, electrolyte irregularity, jaundice, respiratory distress and drugs [40]. One of the most important roles of neonatal occupational therapists is to determine the developmental level of the infant and plan the occupational therapy intervention. In particular, in the first 2 years of life, it is very important to determine the developmental impairment and problems in early motor development for providing early intervention [47].

Motor control or effective use of the body for infants means mobility, discovering the environment and increasing communication skills before talking. Motor control is often on the basis of most intervention programs because of the influence on the social, cognitive and emotional system [48].

1.6.1. Evaluation tools of motor development for infants/toddlers

Motor development in infants and toddlers can be evaluated with Pretechl's Qualitative Assessment of General Movements, Naturalistic Observations of Newborn Behavior, Brazelton Neonatal Behavioral Assessment Scale [40], The Bayley Scales of Infant Development, Psychomotor Developmental Index I-II, Griffiths Locomotor Subscale, Test of Infant Motor Performance, Alberta Infant Motor Scale, The Peabody Developmental Motor Scales, The Vineland Adaptive Behavior Scale, Denver II Gross Motor Sector, Wee Functional Independence Measure, Infant Motor Aktivite Log [49]. Canadian occupational performance measure is used to determine the motor developmental level of infants from the primary caregiver's point of view [50, 51].

1.6.2. Occupational therapy intervention for motor development for infants/toddlers

1.6.2.1. Neurodevelopmental treatment

This intervention was developed by Bobath to provide motor control for children with cerebral palsy. It is a treatment approach widely used by the members of interdisciplinary team [52]. This intervention method is convenience during infancy period [53]. The aim of intervention is to improve function of infant and provide quality of movement with special handling techniques. The therapist and family members provide the physical movement of infant with handling techniques. In addition to therapeutic handling, the therapist can modify the infant's environmental factors to improve function. Environmental adaptations can be simple (using a roll blanket in the cradle to facilitate side-lying positioning) or complex (such as using an infant seat). Adaptations should design according to targets of both family and infant and also matched with treatment principles. For example, if the infant cannot achieve sitting position properly, the sitting adaptations should be done. Adaptations are particularly effective when only meet the goals of the family. The role of the occupational therapist in this intervention is shaping the philosophy in accordance with the function of the other team members [48].

1.6.2.2. Neonatal positioning

Preterm infants often have positional problems that lead to different posture and movement problems. For example, the shoulder protraction and the posterior pelvic tilt occur because the preterm infant cannot perform the neonatal flexion position precisely. If these positions are not corrected, it may not be possible to bring the infant's hands to the midline. These problems lead to delays in the area of fine motor skills and insufficiency in midline hand play. Positioning is not merely to provide of infant comfort, but also focuses on flexion and midline orientation. Positioning can reduce stress and provide psychological stability. This will provide the arrangement of sleep, which is vital for development and weight gain. Each infant's specific positioning needs should be decided on the basis of individuality. The main criterion for selecting the position is infant's presenting problems such as low muscle tone, prolonged extension position, and impaired movements caused by the infant [40].

Positioning techniques: Positioning is carried out in consideration of the individual needs of the infant along with the medical and developmental advantages and disadvantages of each positioning techniques [40].

Prone position: This position facilitates flexion, head control and hand-to-mouth activity. In this position, the bed should be inclined by 15° in order to raise the infant's head. The hip and knees are in the flexion, the arms are near the head in the flexion, the head is on one side, and the hand is on the face near the mouth [40].

Supine position: In this position, this is easy to meet the infant's medical needs and facilitates visual discovery of infant. The infant's knees and hips should be in the right flexion to the abdomen and the feet in this border, the elbows should be on the flexed side of the body, the head should be on midline or on the side where the infant feels comfortable [40].

Side-lying position: It facilitates the midline position of the head and extremities. It also facilitates hand and hand-to-mouth activities, the flexion and adduction of the legs, and prevents the external rotation of the legs. The infant's hips and knees should be in flexion. The arms should be forward and comfortably flexed. The head should be on the midline and a slight flexion if possible. The back should be supported well to maintain the position [40].

Seated position: It is an alternative position for older babies when they are awake. The hip and knees should be positioned symmetrically on the flexion, shoulders on the front and head in the same line as the body or slightly flexed [40].

Positioning is to prevent head flattening: In preterm infants, head tilt is occurring due to the head not being able to hold on the midline, which causes pressure on the sitting side of the head weight, causing a typical head flatness in the soft cartilaginous skull. To prevent this condition in preterm infants, lateral supports can be used in the supine position. It is also suggested to replace water beds, gel pillows and change of head position [40]. All these positioning are very important both in improving neurodevelopmental outcomes and in decreasing infant stress and facilitating sleep. The role of occupational therapist is to give suggestions and train the early intervention team about positioning [40].

1.6.2.3. Modified restricted movement therapy

This intervention suggests the restriction of the unaffected arm's movements and providing the intense use of the affected arm. There are four main steps in the treatment of infants: (a) 24/7 casting of the less affected upper extremity for 23 days, followed by 4 days without casting; (b) intensive occupational therapy sessions for 4 weeks, 5 days a week; (c) family education to improve the use of the affected upper limb and (d) providing treatment services for infant's home. The therapy sessions include functional, play-based, sensory, and force-enhancing activities to enhance the movement of the affected upper limb. The therapist ensures consistent and positive reinforcement for consistency of motor ability. Specific sensory-motor targets can be created for each infant. Play activities are selected by considering the level of infant ability, motivation, environment and goals of the family. Therapists can often use the play in a supine, crawling and supported sitting position with the aim of weighting the affected limb. The tasks selected here are carried out according to the motor learning and are selected for the purpose of releasing the repetitive motions and motor patterns targeted in the therapy. The family is trained to perform targeted activities. These are the activities of the therapist and can be adapted to put in the routine of the family (such as facilitating eating or bathing with the affected hand) [54].

1.6.2.4. Newborn individualized developmental care and assessment program

The basic movements revealed by infant should not be regarded as neurological function only. It should be kept in mind that these movements may be signs of pain and stress. These stress responses may appear as signs of incompatibility between the developmental capacity of the preterm infant and the environment. Occupational therapists can handle this situation with the Newborn Individualized Developmental Care and Assessment Program (NIDCAP) [55].

The NIDCAP can be integrated easily with the Person-Environment-Occupation Model, because NIDCAP assesses infant's psychological and behavioral responses to different handling types together with the environment [56]. Movements observed in NIDCAP are categorized as stress signals or stability signals. These are general extremity movements, specific extremity movements and specific hand movements. In this approach, occupational therapists help preterm infants to self-organizing and to provide engagement in their own environment [56, 57].

In children receiving developmental intervention, it has been shown that there is an increase in the organization of autonomic, motor and state systems and self-regulation. In addition, infants receiving developmental intervention are in a decreased state of alert, and this leads to an increase in the quality of social and environmental interactions. Flexion posture is gained instead of extension posture with the intervention program [40, 58]. In this approach, which is a special developmental intervention, the environment is defined as an important area. The nature of the environment, especially the quality of the home environment, also affects gross motor function [46].

1.6.2.5. Goal activity motor enrichment intervention

The intervention is based on active motor learning, family-based care, family coaching and environmental enrichment. Family goals and environmental enrichment for motor learning are customized according to the child's motor skills. This approach involves the activities according to the targets defined to increase of motor practices and the family with home programs [50]. Together with the family, the basic goals related to motor development are defined. The therapist helps the family to set realistic goals in terms of both developmental and temporal aspects. In this intervention, the family should learn how to help the child, the deviations from the target and the needs of the child. The family also should learn how much help they should offer to the child according to needs. The environment for the child is enriched with the right toy selection to find out the motor movement desired in the treatment. If the therapist sees appropriate, siblings take part in treatment. Therefore, the environment is enriched with mother, siblings, therapist and toys [51].

1.7. Cognitive development

According to Jean Piaget's cognitive development theory, there are four stages of logical thinking: (1) sensory-motor stage (0–2 years), (2) preoperational stage (2–7 years), (3) concrete operational stage (7–11/12 years), and (4) formal operational stage (11/12 years and over) [59].

Sensory motor phase (0–2 years): The infant tries to understand the environment with his/her senses and motor skills. They start to use simple symbols. The information about the world in that the infant is in is very limited, but he learns about the surroundings with motor movements. When they are about 7 months old, they lose the object permanence. This acquisition is especially important because it shows memory development. When children reach their second birthday, they start to use symbols to think and communicate. Language skills develop during this period. They can evaluate the events from a self-centered point of view. They can classify objects. Symbolic plays take an important place in the daily life of the child [60].

This defined cognitive development may be delayed in premature infants. Immaturity in neurologic systems and mother infant separation causes impairments in executive functions in premature infants [61]. However, it has been reported that there is a deficiency in verbal and nonverbal abilities in cognitive development in these infants [62].

1.7.1. Evaluation tools of cognitive development for infants/toddlers

Occupational therapists try to determine the factors that disrupt successful activity performance in the framework of activity performance. Occupational therapist can obtain information about cognition by observing performance, asking questions to family members and using standardized cognitive tests. The standardized cognitive measures used by occupational therapists are usually related to functional tasks and/or daily objects. These are Wee Functional Independence Measure, Peabody Picture Vocabulary Test-Revised, Bayley Scale of Infant Development-2nd edition [63].

1.7.2. Occupational therapy intervention for cognitive development for infants/toddlers

Early intervention methods to increase cognitive skills of infants, which are applied by occupational therapists are family-based approaches, developmental interventions and kangaroo care [64–68].

1.7.2.1. Developmental interventions

These interventions can be applied at neonatal intensive care unit, at home, child care services and kindergarten. Developmental interventions result in gains in early cognitive development (e.g., infant and preschool age) with inconclusive evidence for gains through school age [64].

1.7.2.2. Kangaroo care

Kangaroo care contributes to the neural maturation of prematurity in the neonatal period. There is a increase in autonomic function, maternal attachment and decrease maternal anxiety after care. This leads to the development of cognitive development and executive functions of the child [65].

1.7.2.3. Creating opportunities for parent empowerment

The education of families of preterm infants is very sensitive to the needs of infants and is very responsive to increased cognitive and attention interaction. The theoretical framework of the intervention is based on the theory of self-regulation and control. Being able to cope means cognition and behavioral change in order to meet specific internal and external demands. This concept of coping involves arranging emotional responses and problem solving. It is also very important to assess the ability of the mother to cope and its consequences. In such a program, mothers will be informed about their infants' behavior and will be able to better understand their infants and what they can do. This will increase the infant and mother interaction in

an appropriate manner. In the early period, high-quality family-infant interaction influences cognitive and social-emotional development positively. Negative mode of mother, family stress and low level family confidence are problems in child development and behavior in the later period [66].

At the beginning of the practice, infant's characteristics, stage of development, behaviors, and the intensive care unit where the infant is located are evaluated and recorded by mother. Then therapists should do recommendations to provide caregivers participation in the care and development of the infant, the identification of the infant's signs of stress and communication readiness, the identification of strategies for calming, and the implementation of the strategies learned in the hospital in the post-discharge period at home [66–68].

In home-based therapy, occupational therapist learns how to interact with the infant's environment and infant's development of adaptations. More realistic and helpful approaches are offered. Targets are defined according to the needs of the infant, in accordance with the socio-economic situation of the family. These goals are facilitating the play development, normal sensory-motor development, and socio-economic development of infant with the family-infant interaction. At the same time, it is discussed with the family in relation to premature infants, general development, risk factors of premature infants and play development in children in this treatment [62].

1.8. Play development

In the context of occupational behavior, play is considered as the primary activity of the child and precondition for the fight/competition of occupational roles in the next life. Observation of the play is easy, but it is difficult to define it theoretically. The play is multidirectional behavior. Internal motivation and enjoyment are often considered in the construction of the play. Play has competing and exploration component. Work and play are developmental continuity; play continuity provides adaptive function in adulthood. During the play, children have the opportunity to explore the surrounding objects and people, how they affect it, develop and test their social and occupational roles. When children move around, they discover the world, receive information from the senses, learn about the properties and nature of the objects, understand their space and time localization. These abilities evolve during the play as children respond to the demands of the environment and interact with them. This provides perceptual, conceptual, intellectual and linguistic development, resulting in the final combination of the cognitive abilities [69]. Child establishes an interactive relationship with peers and learn different roles such as imagining scenarios and preparing food, being a cop or being a firefighter. The success of the role of the player gives meaningful occupational connection and increases the quality of life for child [70].

Children learn by playing games. One of the first steps in the learning process is that the child is self-aware. After that, he is ready to practice and learn other things related to him. Then, the child moves one step and learns the names of the parts he touches. Then he may explain, "My mouth is under my nose, my ears on the sides of my head." Then the child uses what they learn and relate to his toys. The baby moves and crawls to recognize both the space and the body. As a result, the child uses this information when feeding, washing and starting to self-dress.

At the same time, the child must learn and understand the world around him. Children learn differences between shapes and structures by playing plays. He does this when he starts taking objects into his mouth. While child learn what to do with the objects in the environment; also he learns to make sound from their toys, shoot and build them. Although the child learns all these and more while playing, as he grows asking questions, practices, learns the wrongs, and improves his skills [71].

1.8.1. Evaluation tools of play development for infants/toddlers

Evaluation should be made in the natural environment of infant. The evaluation should be done in consideration of the infant's position and the time spent in that position, play development, repertoire, play phase, play interests [41, 72]. However, play frequency, current toy variety, physical environment, social interaction with peers and caregivers should be considered in these processes. The cultural structure also affects the value of the play. The occupational therapist should use structured measures as well as the child observes in the unstructured environment. However, the occupational therapist should evaluate the play over as many as five factors: (1) What the infant/toddlers do. (2) Why the infant/toddlers enjoy chosen play activities. (3) How the infant/toddlers approach to the play? (4) Infant's capacity to play. (5) The relative supportiveness of environment. Standard scales that can be used for play assessments are: Play history, test of playfulness version 4, Revised Knox Preschool Play Scale, Child-Initiated Play Assessment, Transdisciplinary Play-Based Assessment, Test of Environmental Supportiveness, Home Observation for Measurement of the environment [63].

1.8.2. Occupational therapy intervention for play development for infants/toddlers

Occupational therapist working in sensory integration, neurodevelopmental, occupational behavior and developmental contexts describe the social, constructive and sensorimotor benefits of play and widely use as a treatment modality [69]. Occupational therapists may encounter difficulties in combining plays with different treatments. For example, a spastic diplegic infant's muscle tone may be exacerbated by effort spent. The therapist can benefit from the play of regulating the tone without disturbing the motivation, curiosity and discovery necessary for the play. Alternatively, it may facilitate cognitive and social development without producing abnormal motion patterns. The clinical decision requires that actual treatment targets be met within infinite total needs [48] or an infant who is hypersensitive to touch may not want to play textured toys. In this example, the occupational therapist can provide the toy that can be adapted to the sensory preference of the child, and giving information to the family about the toy preference of child during the play participation [73].

Occupational therapists define play as a therapeutic intervention, a way of strengthening intervention, a way of developing role. They also use the play as an evaluation tool [74]. Infants and toddlers spend most of their time with playing during the time they are awake. Therefore, play is a very important issue for occupational therapists. Research reveals clearly the relationship between play and learning as well as play and development [75].

According to infant space theory, infant's play development happens in four stages up to 18 months. The first stage of development is visual play. During the first 2 months, infants are

scanned with mothers, then, object tracking outside the visual field, choosing objects, playing with hiding, using eyes and hands together. The second stage of development is mapping and changing the infant's house view. The third stage of development is play with a fixed object, and the fourth stage of development is play with a mobile object [76].

In play development, the first stage of playing with an object is called an exploratory play. Exploratory play (2–10th months) is the way to evaluate the environment to gain information from objects or toys for infants. The second phase is the relational use of objects (10–18th months). At this stage, objects are combined and defined by hand. Then, the use of functional objects (12–18th month) is learned. Finally, symbolic play is learned (18–30th month) [77]. As a result, therapists should consider treatment plans in view of all these developments.

Occupational therapists use play-related approaches with interdisciplinary approaches. Piaget's cognitive and play development theories and Gesell's motor development theory are among them. It is stated that children show the best performance for play in their natural habitats. In the structured circles, it is stated that the play has less effect on the development than the play in the home environment. It is not easy to create natural environmental opportunities to develop infant skills, but it is very important for development. Occupational therapists use natural play opportunities to create enriched playing environment for infant. Occupational therapists find out what is limiting and makes the necessary adaptations for infant. However, how the spatial structure of the clinical and educational environment affects, development is also assessed. All approaches should be done with the family involvement [76].

The occupational therapist should fully understand the individual and environmental factors, the role of the player, and the time required for the play, in order to facilitate the infant's play experience and specialize in the player role. The role of the occupational therapist is to improve the child's potential and abilities for play, to ensure participation in play, to organize the cultural, social, temporal and physical environment that supports the play. The child's abilities and interests are influenced by the barrier and support of the playing neighborhood, the difficulties and convenience of the play [69].

Playing without constraints allows the infant to discover his own capacity, experiment with objects, make decisions, understand cause-effect relationships, learn, insist and understand the results. This kind of play strengthens the child's creativity and improves social development, especially when played with a peer. It also provides the child to learn how to cope with anxiety, frustration and fatigue. Unfortunately, a disabled infant is deprived of the benefits of playing regularly. As a result of this situation, being dependent on another individuals, low motivation, loss of confidence, reduced social skills in unstructured situations can occur for infants. These results will adversely affect the development of the child both early and later in life. Preventing secondary problems is a very important role for the occupational therapist [72, 75].

Many obstacles are defined in front of non-constraint play. The obstacle created by the caregiver (not knowing exactly what the child will do, risk of injury, etc.), physical and individual limitations of the child (such as inadequate mobility and communication, difficulty in reaching and understanding, impaired sensory responses, reduced internal motivation and concentration), environmental (limitations on home and playground) and social barriers (peer and family interaction problems), cause to the children be deprived from the play.

The occupational therapist has the opportunity to work with these children at home, in the field of treatment, or in a wide range of social settings. Occupational therapist can facilitate this consulting process by being aware of the obstacles frequently encountered by the child and by defining the child's abilities at the same time [69, 75].

In this context, opportunities for free play should be created. Play should be actualized at home, in the community, or during therapy. Opportunities must be created for the child to choose, explore, create, and respond to change in order to be free. At all possible times, the family should be encouraged to explore the child and to establish an independent relationship. The family must understand the value of the play as well as the importance of the play in terms of health and development [69].

The relationship between the family and child should be mutual. Family's anticipations and beliefs will affect the quality of the play. Sometimes parents see negatively motivation, self-concept development, and very active participation. In that case, it may be useful to increase the participation of siblings or peers at home or on the playground. The occupational therapist clearly displays the practices that the family will do at home and matches the objects and spaces in the house appropriately. The goals of typical play development take place in daily life experiences. With the treatment being understandable, the therapist and the family will put it in the target they want to see in the child. Thus, therapist uses the natural objects in the house more effectively, and the family contributes to this improvement by using many small play opportunities in everyday life. In this approach, the occupational therapist can place the objects near the child to develop the child's visual play, follows child to create home memory, and plays along the edges of the room to create spatial development patterns. For playing with stationary objects occupational therapist can use single or combined object plays that can be found in house-rich playgrounds. Any area of the house (curtains, bookshelf, corridors) and objects can be used for therapeutic toys, far from commercial toys. The therapist can actively take part in the typical development of mobile object play interventions such as dancing, climbing, driving and transporting. At the same time, the therapist can train the family on daily activities and routines for the child to explore the home environment and to promote movement [69, 77].

As a result, the play is child-centered, organized in the form of flexible and needs-based interventions with a holistic perspective with participation in the family in occupational therapy approaches.

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