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Fetal Alcohol Syndrome: Physical Therapy Implications and Treatment Strategies

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FETAL ALCOHOL SYNDROME:
Physical Therapy Implications and Treatment Strategies

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This Independent Study, submitted by Mary Lauren Emerson, in partial fulfillment of the requirements for the Degree of Master of Physical Therapy from the University of North Dakota, has been read by the Faculty Preceptor, Advisor, and Chairperson of Physical Therapy under whom the work has been done and is hereby approved.

Faculty Preceptor

Graduate School Advisor

Chairperson, Physical Therapy

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Title FETAL ALCOHOL SYNDROME: Physical Therapy Implications and Treatment Strategies

Department Physical Therapy

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Signature Mary L. Emerson

Date Jan. 30, 1996

TABLE OF CONTENTS

LIST OF FIGURES

Figure

LIST OF TABLES

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ABSTRACT

Fetal Alcohol Syndrome (FAS) describes physical and neurological (motor, cognitive, and behavioral) deficits that result from maternal alcohol intake during pregnancy. FAS is the leading cause of mental retardation and birth defects in the U.S., ahead of spina bifida, fragile X syndrome, and down's syndrome. The incidence of FAS increased more than three-fold from 1979 to 1992; this increasing incidence rate, enhances the importance of the Physical Therapists' role in early recognition and intervention of FAS. A review of current FAS research studies, reveals a need for additional resource information on FAS, regarding implications for Physical Therapy and possible treatment strategies. The purpose of this independent study is to create an organized resource, specific to Physical Therapists, that includes the diagnostic characteristics, clinical manifestations, and treatment strategies associated with FAS. The text of this independent study paper contains: a current literature review of FAS research history, diagnosis, clinical presentation, and implications; identification and screening mechanisms; and treatment strategies specific to Physical Therapists. In addition, the information contained in this independent study will be used to develop an informational booklet to be utilized by Physical Therapists and other allied health care professionals. The goal of the booklet will be to assist these professionals in the identification and treatment of children or adults with FAS.

CHAPTER 1

INTRODUCTION

History

Even as far back as Plato, 427-347 BC, people have been aware of the possibly detrimental effects that alcohol ingestion can have on an unborn child.[1] Fetal Alcohol Syndrome (FAS) is defined as a set of physical and neurological deficits that occur in the newborn/children as a result of prenatal alcohol exposure.[2] The term "Fetal Alcohol Syndrome"was first coined by Jones and Smith,[3] in 1973, whose primary research focused on abnormal fetal development as a result of maternal alcohol intake. These researchers recognized that this correlation was documented in early historical writings and focused attention on this historical evidence as the purpose of their initial report.

Some of the earliest known writings on the possible effects of alcohol on the developing fetus are found in the Bible, Genesis 9:20 and Judges 13:14, which cautioned the use of alcohol during pregnancy.[4] Early Greek and Roman mythology alluded to the effects of maternal alcohol ingestion on the developing fetus; and in Carthage, the newlyweds were "forbidden" to drink alcohol, in order to avoid conception of a defective child. The Great Britain House of Commons, in 1834, studied infants of alcoholic mothers and found that these infants had a "starved, shriveled, and imperfect look."

In 1900, Sullivan[5] noted increased rates of abortion and stillbirths, as well as increased frequency of epilepsy in the children of chronic alcoholic mothers. In 1968, before the term "FAS" was established Dr. Lamoine, a French physician, reported abnormal faces, retarded growth, psychomotor disruptions, and congenital defects in a group of children with alcoholic mothers.[6] Jones and Smith[3] also pointed out that the negative outcomes of maternal alcohol intake had never been formally researched. This is a key article in that it created a term specific to alcohol related birth defects. Since 1968, the initial recognition of FAS in the medical community, much research has been conducted and many clinical reports have been published on the topic of alcohol related birth defects. In addition, the effects of alcohol on the developing fetus have been reported in laboratory animal studies, but this data is not appropriate for the scope of this paper and therefore, will not be included.

Rate of Incidence

The Centers for Disease Control has focused more attention on FAS and is supporting more research, intervention, and identification.[7] One reason for this shift, and the overall shift of research focus to alcohol related birth defects, may be due to the increasing incidence rate of Fetal Alcohol Syndrome. It has been reported that the rate of verified cases of infants born with FAS has increased more than three-fold from 1979 to 1992.[8] In fact, in 1992, alone the rate was 3.7 per 10,000 live births. This data was derived from the Birth Defects Monitoring Program (BDMP) and diagnoses were made by physicians; however, Abel and Sokol[9] speculated that this data underestimated the true incidence of FAS. One possible reason for this underestimation is due to the unknown sensitivity and

specificity of the physicians' assessment tool/method.[9] Another reason for low estimates is the fact that FAS is often missed in the diagnosing process.[10] Abel & Sokol[11] reported a rather low estimate of approximately 0.3-0.5 per 1,000 births. However, Spohr et al[12] estimated that FAS occurs in 1-3 out of every 1,000 live births. In 1993, it was reported that FAS occurs in approximately 1 per 1000 births.[13] This distinguishes FAS as the leading cause of mental retardation and birth defects in the U.S. and Western Europe, ahead of spina bifida, fragile X syndrome, and down syndrome.[2,8,12,13,14]

In 1992, it was estimated that at least 1,200 cases of FAS occur each year in the United States, with Native Americans and African Americans having the highest rates.[15] FAS individuals can be found in many countries[16,17,18] other than the U.S., however, variations in incidence rate are not ethnically based. For example, in Sweden, the higher rates of incidence were noted in the larger cities, such as Gothenburg.[17] One population-based study on mental retardation, completed in smaller communities in Sweden, did not include any FAS individuals.[17] In the state of North Dakota specifically, 10-18 children with FAS are born each year and there are approximately 1124 known cases of FAS.[19]

The rate of incidence of FAS is influenced by the amount of alcohol that is consumed. It is unclear how much alcohol consumption will produce a child with FAS.[20] Lewis and Woods[10] reported that 1.5 to 8 drinks per week is associated with a 10% incidence of FAS and greater than 8 drinks per week is associated with 30 to 40% incidence of FAS.[10] A standardized drink is defined as 12oz. of beer, 5 oz. of wine, or 1.5oz. of 80 proof distilled liquor. Abel and Sokol[9] noted that 6% of alcoholic women have infants with FAS.

Schenker et al[21] found that approximately one-third of the infants born to chronic alcoholic mothers demonstrate the full syndrome of FAS. Coles[13] estimated that 35-40% of children born to alcoholic mothers will have FAS and many more will have milder affects.

Economic Burden

Along with the increasing incidence rate, there is a concern over the economic burden of caring for FAS individuals. In 1991, Abel and Sokol[11] estimated the median cost of care for an FAS patient to be $6,223 per year. Based on the prevalence of .33 in 100 births, $74.6 million was the total annual estimated cost for FAS.[11] Three-fourths of that total annual cost was used to treat and care for mental retardation and 16% addressed problems associated with low birth weight. Mental retardation related to FAS accounts for 11% of the annual cost for institutionalized mentally retarded individuals in the U.S. and 5% of all congenital anomalies are FAS related.[9] A further break down of the estimated total annual cost is provided in Table 1. In 1983, 200 FAS individuals were treated in the state of Minnesota and $42 million was the estimated cost for treatment in that year. Low birth weight and mental retardation were the source of most of these estimated costs.[2] Costs for FAS in the state of North Dakota are approximately $1.2 million per year and the cost for each case (to age 18) is close to $124,000.[19] Abel and Sokol,[9] reported that at least $321 million per year was spent on problems associated with FAS, calculated with patients up to 21 years of life. The estimated cost throughout a lifetime for a child with FAS is $1.4 million.[14]

One reason for the discrepancy among the estimated costs is the variation in incidence rates that are used for cost calculations.[22] Some of the estimates may be low due to the

TABLE 1 Estimated Annual Cost for Different Physical Problems Associated with FAS[11]

Problems	Cost
Heart Defects	$1.9 million
Serous Otitis Media	$1.25 million
Cleft Palate	$566,960
Hypospadia	$298,400
Sensorineural Auditory Defects	$104,440
Inguinal Hernia	$171,580

prospective study nature, in which higher risk groups are not accounted for. Another reason for the difference in estimated costs is the variation in cost components used in calculation. Abel and Sokol[11] used treatment and care as criteria, while Harwood and Napolitano[23] also included residential care and lost productivity as cost components. There are limitations to these cost estimates as well. First, pain and suffering of the FAS individuals and their families are not included as legitimate cost components. Even though pain and suffering are not quantifiable, they should be considered as pertinent costs.[24] Second, these figures do not provide appropriate guidelines for developing prevention and treatment programs.[22] Therefore, expanding efforts in prevention would have economic justification.

Medical Criteria for Diagnosis

FAS is difficult to diagnose because of the myriad of symptoms that may be displayed. Little et al,[25] in a 1990 study, noted a 100% failure to diagnose FAS at birth at a large teaching hospital. Therefore, for the sake of simplification, four diagnostic criteria have been suggested by Clarren and Smith:[26] 1) prenatal and/or postnatal growth retardation below the 5th percentile, 2) central nervous system impairment, 3) characteristic facial malformations, 4) history of maternal alcohol use during pregnancy.[2,13,26,27,28] More recently, Clarren et al,[29] suggested that the growth retardation criteria be below the 10th percentile while all other criteria remain the same. These criteria define FAS and give guidelines for diagnosis. Even with these guidelines, FAS remains difficult to recognize in newborns for three reasons: a) the dysmorphic facial features are often subtle, b) some types of CNS deficits in infants are difficult to detect, and c) the birth weights of some

affected infants are normal.[8] If children are exposed to alcohol prenatally, but show less obvious effects than the three criteria of FAS, they may be classified as having Fetal Alcohol Effects (FAE).[27] The topic of FAE in comparison to FAS will be discussed later in this paper.

Of the three diagnostic criteria of FAS, the characteristic facial features are among the most distinctive.[30] Facial features related with FAS include: absent philtrum, thin upper vermilion (lip), hypoplastic (flat) mid-face, low nasal bridge, short up-turned nose, epicanthal folds, shortened palpebral fissure, low set ears, and micorencephaly.[8,13] See Figures 1-4. The facial features provide consistency and accuracy in early diagnosis of FAS, however, they gradually become less distinctive as the child grows older.[10,14] In adolescents and adults, eye anomalies, abnormalities of the philtrum and lips, and short palpebral fissures remain functional diagnostic features.[14]

The criteria for determining the extent of growth retardation commonly exhibited by the child with FAS include height, weight, and head circumference.[16] Decreased amount of adipose tissue is included, usually denoted by retarded weight.[20] Streissguth et al[14] and The Committee on Substance Abuse (1992)[34], found that 75% of patients with FAS are small for their gestational age. These children may show some catch up growth during the first years of life, but head circumference and height deficits generally persist.[2,12,13] Spohr et al[12] reported that all aspects of growth deficiency were more severe in boys than in girls.

Perhaps one of the most unfortunate and long-term effects of prenatal alcohol exposure is its influence on the developing nervous system.[35] Spohr, Wilms, and

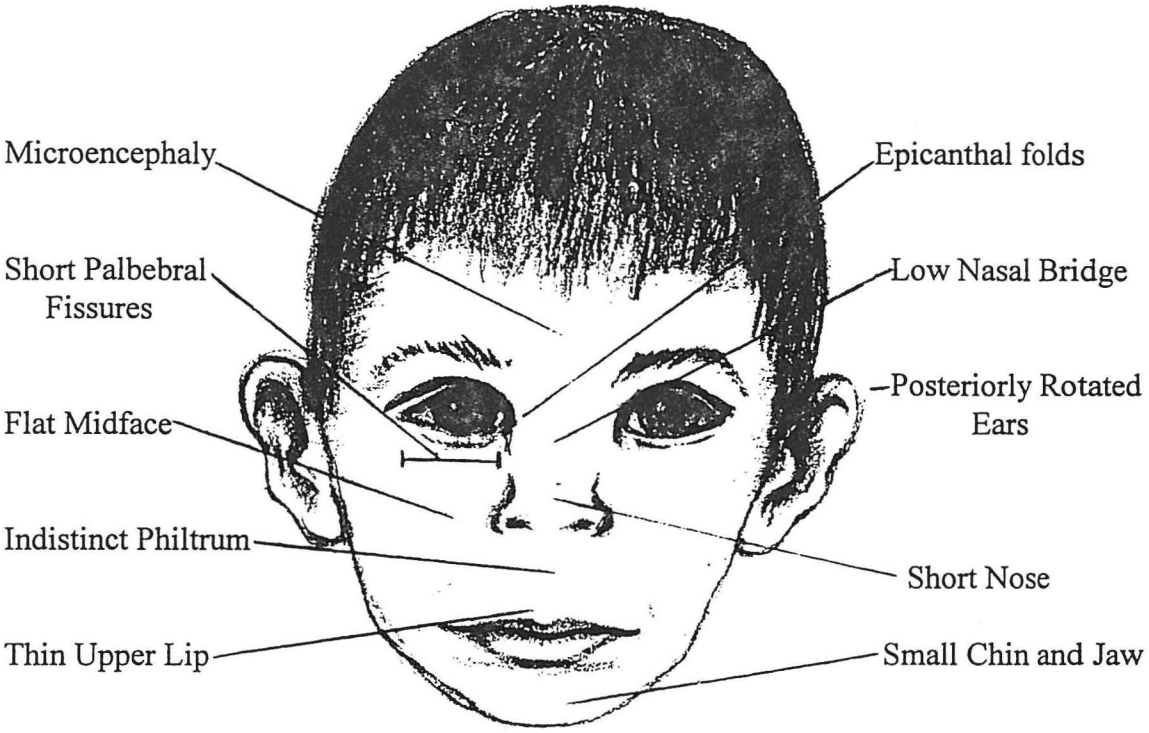

Figure 1 Facies of Fetal Alcohol Syndrome
(Drawing compliments of Virginia Achen
adapted from Little and Streissguth 1982)[31]

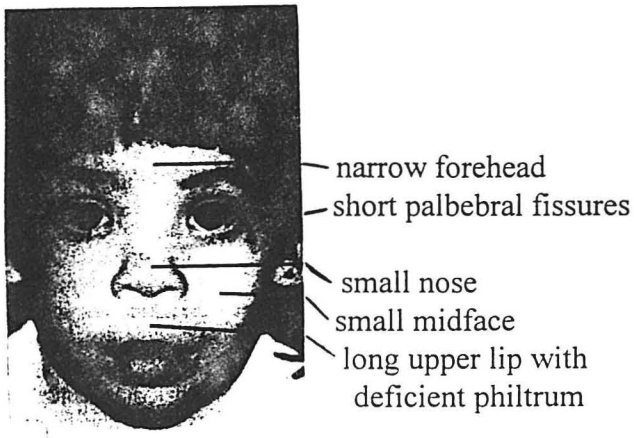

Figure 2 Facial Features of an Individual Child with FAS[32]

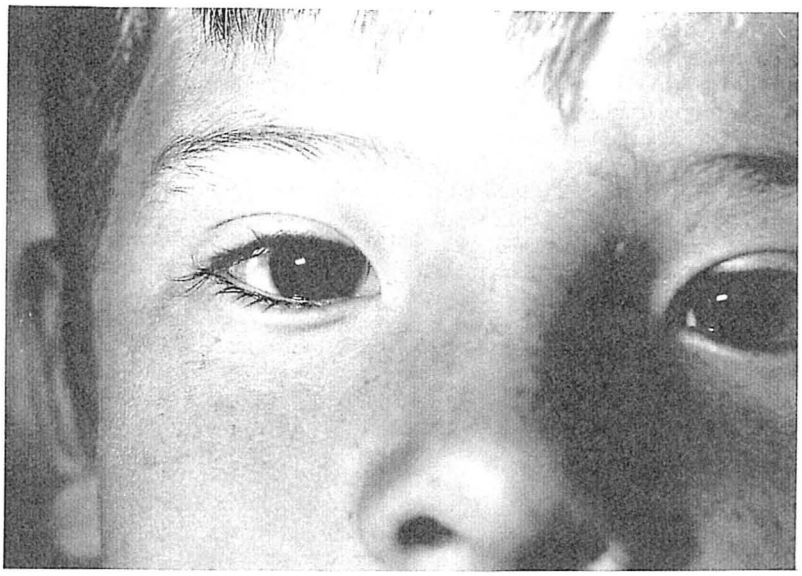

Figure 3 Eyes and midface of a child with FAS, showing short eye openings and drooping eyelids[33]

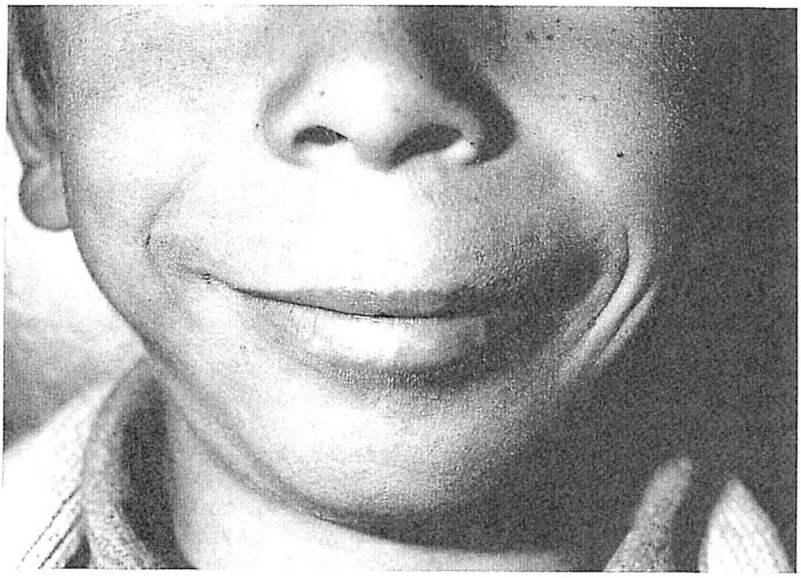

Figure 4 Lower face of a child with FAS, showing slightly a short nose, underdeveloped philtrum, and thin upper lip.[33]

Steinhausen[12] defined central nervous system dysfunction as "any neurological abnormality, developmental delay, or intellectual impairment." Evidence for damage to the central nervous system is most obvious with microencephaly. It is also evidenced by cognitive impairment, motor problems, behavioral problems (even in the neonatal period), and neuropsychological assessment outcomes.[13] Deficits commonly associated with central nervous system impairments included mental retardation and/or learning disabilities, hearing loss, seizure disorders, irritability in infancy, muscle hypotonia, hyperactivity, and attention deficit disorders.[2,13,35]

FAS versus FAE

When alcohol affected children show few physical deformities and do not meet the criteria for FAS, a diagnosis of FAE is used.[7,36] Sokol and Clarren[27] recently coined the term alcohol-related birth defects (ARBD) to describe the outcome of prenatal alcohol exposure. It has been recommended that this new term replace the term FAE, due to the ambiguity of the term FAE.[27] However, for the purpose of this paper, the term FAE will be used.

The incidence of FAE is three times more common than FAS,[2,7] with 36,000 FAE infants born each year[2] and an incidence rate of 3-5 per 1000 live births.[9] Children with FAE generally show central nervous system and behavioral disorders, such as fine-motor impairment, clumsiness or subtle motor performance delay, significant attention deficit, hyperactivity, learning disabilities or delayed learning, speech disorders, memory problems, and poor judgment.[2,34,35] FAE children seem to repeat behaviors that have had a poor outcome in the past. These children are at risk for decreased intellectual functioning

and can have IQ and achievement deficits. FAE is distinguished from Attention Deficit Hyperactive Disorder (ADHD), by evidence of subnormal IQ.[2] The academic outcomes are poor for FAE and FAS, but the social problems for FAE victims are greater.[13] Harris et al[28] found that the FAS children in their study fared much better developmentally and behaviorally than the FAE subjects. The physical/morphological and intellectual problems of FAE individuals may be similar to those of FAS subjects, but of a lesser magnitude, which is probably due to the dose-severity relationship.[14] The scope of this paper does not allow for further discussion on FAE, but physical therapists need to be aware that prenatal alcohol exposure can present a variety of disabilities, including developmental delay and behavioral deficits in both the FAS and FAE child.[28]

Factors Influencing Severity

Alcohol use by women is fairly common.[13] The National Institute on Drug Abuse administered a household survey in 1990 and the results indicated that about 80% of the women surveyed used alcohol at one point during their lives, 61.5% drank weekly in the last year, and 44.1% drank weekly in the last month. This survey also reported that the women who drank the most were middle-class, well-educated white women in the Northeast and West.[13] However, FAS has been found in all ethnic groups and socioeconomic classes.[36]

The teratogenic affects of alcohol exposure prenatally depend on amount, timing, and conditions of exposure.[7,37] Mills et al[38] found that the consumption of at least one to two drinks a day is correlated with a markedly increased risk of giving birth to a growth-retarded infant. As stated previously, a standardized drink is defined as 12oz. of

beer, 5oz. of wine, or 1.5oz of 80 proof distilled liquor.[10] Two drinks a day is also associated with a seven-point decrease in IQ score tested at age seven.[39] The greatest exposure, either in dosage or duration, "results in poor cognitive and motor development, and low growth attainments."[13] It should be noted that abnormal outcomes in each area, (structure, function, morphology, and growth) have a unique dose-response and critical period.[40] In clinical and epidemiological studies, researchers suggest that the number of abnormal facial features are dose-related to maternal alcohol intake.[3,15,41] In general, distractibility, poorer test performance, and impulsivity were related to greater alcohol exposure.[13] Lower exposure level produced more neurobehavioral effects than growth or morphologic effects and neurobehavioral effects seem to be more overwhelming, except in extreme or severe cases.[37] There is a dose-response relationship with neurobehavioral effects, in which high levels of exposure are paralleled with effects of greater consequence and more subtle effects are related with moderate levels of alcohol exposure.[37] Coles[13] noted that heavy drinking before pregnancy resulted in lower verbal intelligence and receptive language skills. Heavy drinking was defined as five or more drinks a day, two to five drinks a day is considered moderate drinking, and binging indicated drinking more that 5 drinks per day on occasion.[2] Binge drinking can be more damaging to the fetus than the same amount of alcohol over a longer period of time, due to the inability of the fetus to eliminate the alcohol.[40] Binge drinking was associated with subsequent cognitive deficits and greater academic problems. Binge drinking and drinking before realization of the pregnancy, appear to be important aspects of maternal alcohol consumption and are strong predictors of later neurobehavioral deficits.[37] Again, drinking at different times, for

different durations, and in varying quantities will have different affects. Lewis and Woods[10] reported that hyperactivity, language problems, and fine and gross motor deficits were most often found in FAS infants whose mothers drank through the third trimester. Rosett et al[42] also found that third trimester exposures were also associated with growth, intellectual, and behavioral deficits. Streissguth found that the degree of growth retardation and mental handicap was directly related to the amount of craniofacial abnormalities.[16] In addition, severity of growth retardation and pattern of malformation, was correlated with intellectual impairment severity.[16]

It should be noted that all infants who are exposed to alcohol prenatally, will not be affected in the same way or to the same degree of severity.[40] There are other factors that can further compromise the developing fetus, such as poor prenatal care and the concurrent use of other drugs.[2,13] Nutritional deficits are also a contributing factor; for example, folate, magnesium, and zinc deficiencies are common among alcoholics and alone have teratogenic effects.[2] However, Jones and Smith[3] ruled out secondary nutritional deficiency of alcoholic mothers, as the major cause of this syndrome. A list of contributing/confounding factors is listed in Table 2. One contributing factor is subsequent births to an alcoholic mother. The risk of an FAS infant increases dramatically, from 6% with the first child, and up to 70% with subsequent births if the alcoholism continues.[15]

Another contributing factor is environmental stressors. When environmental stressors were present, prenatal alcohol effects were more evident. All environmental factors cannot be controlled, therefore, it is difficult to ascertain whether behavioral problems are

TABLE 2 Confounding Factors to the Teratogenic effects of prenatal alcohol exposure.[13,14]

1. Mother and/or baby's genetic predisposition, including metabolic or other physical vulnerability
2. History of pregnancies (e.g., number, prematurity or other complications)
3. Maternal health and willingness to seek or availability of health services
4. Types of other drug use or addictions (e.g., nicotine, caffeine, marijuana, cocaine, narcotics, etc.)
5. Type of exposure for all drugs (alcohol included): the dose, duration, and timing or "critical period"
6. Parity
7. Environmental factors
8. Education available or cognitive awareness of the detrimental affects of all drugs during pregnancy

a result of prenatal alcohol exposure.[13] Frequently, FAS children come from unstable environments and almost a third are adopted or in foster care. Streissguth and colleagues[14] found that only 9% remained with their biological parents, only 3% remained with their biological mothers, and 69% of the biological mothers had died.[14] Caruso and Bensel[2] found that 15.2% of their subjects were living with the biological mothers, 65.2% were in foster care, and 7 to 8% had been adopted. Streissguth et al,[16] noted that a stable environment was associated with better social and emotional development of individuals with FAS. However, the initial severity of FAS was not counterbalanced by the quality of the home environment later.

Streissguth et al[37] found that severe alcoholism could be predicted, based on the severity of FAS illustrated by four of their subjects. Caruso and Bensel[2] concluded that there is no "safe" level of maternal alcohol consumption, since some FAE or mildly affected children were the result of relatively little alcohol consumption during pregnancy, therefore, abstinence is recommended.

Pharmacokinetics

"Alcohol readily crosses the placental barrier" and an equal amount of alcohol consumed by the mother is given to the baby.[43] The distribution of alcohol is proportional to water content in the fetal tissues, therefore, it is highest in the placenta, amniotic fluid, kidney, lung, thymus, liver, pancreas, heart, and brain.[44] Fetal metabolism of alcohol is limited and alcohol has to be eliminated by the maternal system. Elimination is accomplished by passive diffusion of the alcohol across the placenta.

It also takes twice as long to eliminate the alcohol in the amniotic fluid as it does from the maternal blood.[45]

"Critical Period"

The phrase "critical period" is used to refer to a prenatal timeframe, in which the embryo/fetus is most vulnerable to alcohol exposure, in terms of the developmental processes in that period.[46] The most critical time in embryonic development with respect to alcohol effects is from day 9 to 41, during the first trimester.[2,46] Organogenesis, when the major organs are formed, occurs during the first trimester, as does initial musculoskeletal formation.[42] Alcohol exposure during the first trimester can result in a variety of structural abnormalities.[46,10] During the second and third trimesters, neurological disturbances, such as behavioral problems and intellectual deficits, and growth retardation appear to be the result of alcohol exposure.[46,42] Structural changes have also been observed in the third trimester after alcohol exposure, therefore cessation of drinking as late as the third trimester is worthwhile.[10] See Figure 5 for further explanation of exposure time related to possible defects produced.

Information Available

There is information about FAS available in different professional arenas, such as nursing and education, that specifically address intervention with FAS individuals.[1,47] For example, the Minnesota Nursing Convention in 1991 dealt with the topic of FAS and encouraged nursing programs and educators to include FAS as an integral part of their curriculum.[47] In the educational arena, several sources are available that outline this problem and provide strategies for educational intervention.[1]

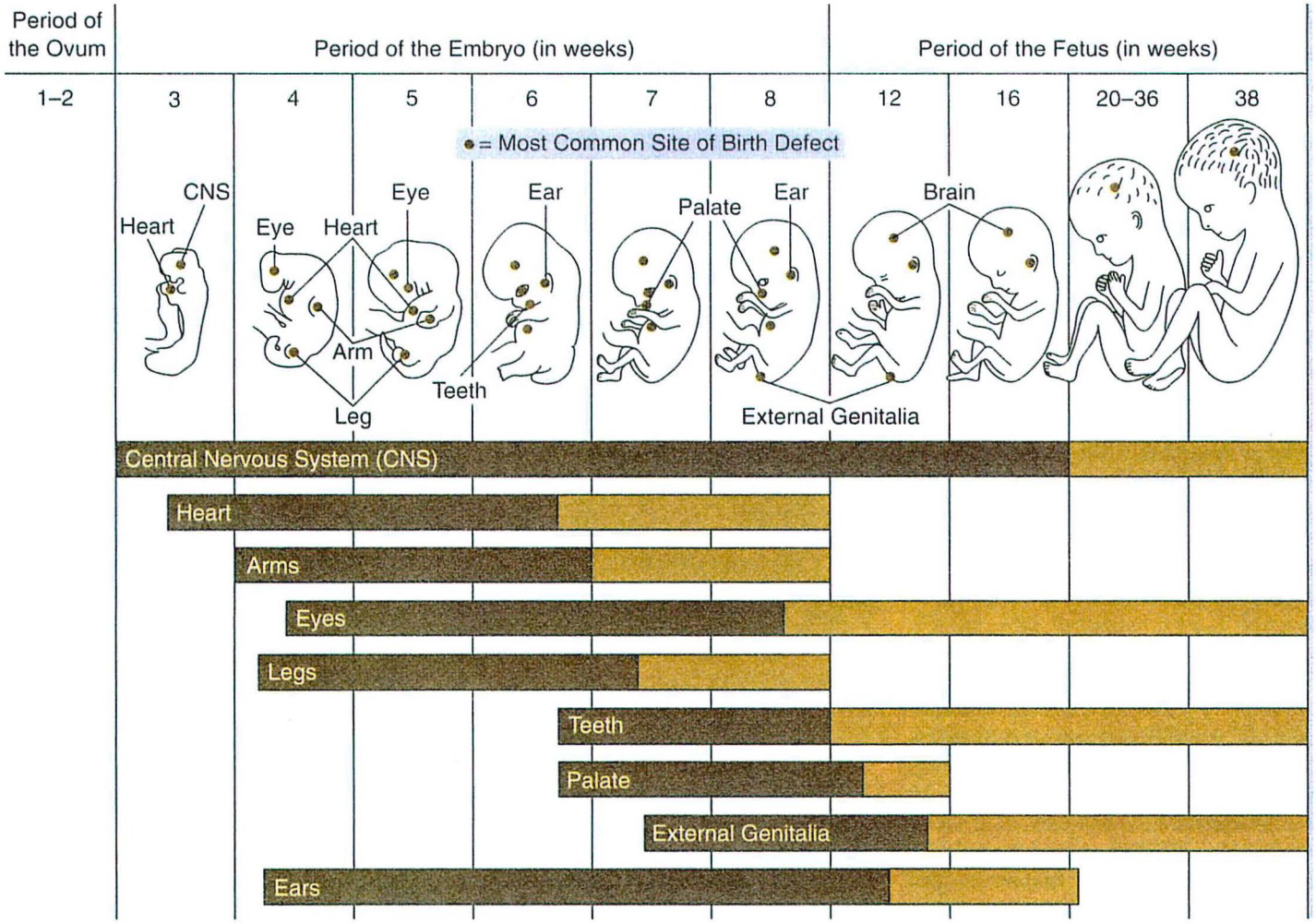

Figure 5 Vulnerability of the fetus to the defects during different periods of development. The red portion of the bars represents the most sensitive periods of development, during which the teratogenic effects on the sites listed would result in major structural abnormalities in the child. The tan portion of the bars represents periods of development during which physiological defects and minor structural abnormalities would occur.

While there has been substantial research published on the teratogenic affects of prenatal alcohol exposure, only minimal research regarding the implications for physical therapy and possible treatment strategies has been published. Only two reports could be found pertaining to physical therapy assessment and treatment of individuals with FAS.[28,36] The purpose of this paper is to provide information specific to physical therapists on FAS implications and treatment strategies. Particular attention will be given to the diagnosing and screening of FAS, in an effort to enhance early intervention and recognition. FAS is a grave and disabling problem that has lifelong consequences to the patient, as well as to their community, therefore increased awareness and information on this disorder in the physical therapy profession are crucial. It is imperative that healthcare professionals, are knowledgeable in the prevention, diagnosis, and intervention of this 100% preventable problem.

Prevention

The ultimate goal in the treatment of FAS is prevention.[2] This would mean abstinence from alcohol consumption for women who wanted to conceive or who thought they were pregnant. Various researchers have shown day 9 to day 41 to be the most critical time in embryonic development with respect to alcohol effects.[2,46] This is usually before the woman is aware that she may be pregnant. Hanson et al[48] suggested that maternal alcohol consumption during the month preceding pregnancy may affect fetal outcome. The goal in secondary prevention is cessation of drinking, which involves educating all women, including pregnant women, about the risks and effects of alcohol consumption during pregnancy.

Tertiary prevention is the least desirable form of prevention, according to Caruso and Bensel[2], and involves the early identification of FAS/FAE children.

CHAPTER 2

CLINICAL PRESENTATION OF FAS, DEVELOPMENTAL STAGES AND DIAGNOSIS

Clinical Presentation of FAS

"Alcohol has been shown to have teratogenic effects on almost every system of the body."[42] The clinical features can involve a variety of symptoms, variable combinations, and different severity levels, creating a unique pattern of presentation.[36] The areas from which patterns of presentation may arise include: physical effects or characteristics, such as craniofacial malformations, internal organ anomalies and skeletal anomalies; and neurological dysfunction, such as intellectual impairment, behavioral differences, and motor/neurodevelopmental abnormalities.[12,36] A summary of the problems associated with prenatal alcohol exposure are provided in Table 3.

Facial dysmorphology and related problems

Craniofacial malformations are among the most notable defects in FAS.[10] Dysmorphic characteristics include: microencephaly, short palpebral fissures, thin upper lip, long and flat vermilion, short up-turned nose, hypoplastic maxilla and mandible, cleft lip and palate, epicanthic folds, ptosis, low set and posteriorly rotated ears, low anterior hairline, strabismus, and micropthalmia.[10,20,36] Jones[49] reported that these distinctive facial features are probably secondary to decreased forebrain development.

Table 3. Summary of Problems Associated with Prenatal Alcohol Exposure[12,16,13,25,34,52]

Area of Involvement	Problems Noted
Intra oral deformities	Cleft palate, malocclusions (class III), poor dental alignment
Hearing	Chronic otitis media, permanent hearing loss
Vision	Eye ground malformations, optic nerve hypoplasia, strabismus, ptosis, nystagmus, severe myopia
Cardiac	Heart murmurs, ventricular septal defects, atrial septal defects, Tetralogy of Fallot, patent ductus arteriosus
Genitourinary	bladder diverticula/cystic diverticula, renal hypoplasia, hydonephrosis, labia hypoplasia, urethral duplications,
Immune system	T-cell loss, allergies
Behavioral	Past/present hyperactivity, impulsivity, stubbornness, oppositional behavior, attention deficits
Skeletal	Congenital hip dislocation, limited joint movement, camptodactyly, clinodactyly, altered palmar crease patterns, coccygeal fovea, bilateral halluces valgus, pectus excavatum, flexion contractures (knees), scoliosis, foot position defects, radioulnar synostosis, Klippel-Feil anomaly, severe hypoplasia of great toes, hypoplasia of the nails, limb reduction defects, C2/C3 cervical spine fusion
Environmental	neglect, physical abuse, suspected sexual abuse
Motor	muscular hypotonia, psychomotor developmental delay, ataxia, tremor, poor coordination, fine and/or gross motor delay
Other	cerebral convulsions, CP, mental retardation, speech difficulties, hemangiomas, hirsutism in infancy; diaphramatic, umbilical, or inguinal hernias; diastasis recti, accessory nipples, breech presentation at birth, long hospital stay after delivery, "failure to thrive"

Abnormalities of the philtrum, lips, and teeth are exhibited by 80% of individuals with FAS.[14] Sensory deficits often accompany these facial anomalies, in the areas of vision, hearing and speech.[10] Visual problems include: strabismus, nystagmus, optic nerve hypoplasia, malalignment of the eyes, bilateral myopia, astigmatism, and poor visual acuity less than 20/70 in 94%.[50] Hyperacusis or abnormal sensitivity to sound is a common hearing problem, as well as conductive hearing loss and sensorineural hearing loss, both of which occur independently or simultaneously in one-third of FAS infants.[51] Ninety-three percent of FAS infants have recurrent serous otitis media[50] which is thought to be associated with the malformation of the middle ear.[13] Speech deficits may result in speech that is slurred, guttural, dysarthric, and monotonous.[10] Expressive and receptive language delays are seen in more than 90% of children with FAS.[50] These delays are most likely a result of hearing deficits, structural anomalies of the mouth (such as dental malalignments and malocclusions), and/or mental retardation.[10] Dental malalignments, malocclusions, and eustacian tube dysfunction are thought to be associated with midface hypoplasia.[16]

Congenital anomalies

There are many other physical problems that occur as a result of prenatal alcohol exposure (see Table 3). For example, cardiac malformations occur in 29% to 41% of infants with FAS, with both atrial and ventricular septal defects occuring more frequently than tetrology of Fallot.[50] Genital and renal malformations are present in close to 50% of infants with FAS.[50] Limb abnormalities are also a consequence of prenatal alcohol exposure, such as hypoplastic terminal phalanges, radio-ulnar stenosis, limited movements of some joint (especially the elbow), cervical spine fusion and Klippel-Feil anomalies.[52]

Froster and Baird[52] collected data from their population-based study and found that radio-ulnar stenosis and Klippel-Feil anomalies are specific skeletal abnormalities observed in the Native North American Indian population. Some of the joint anomalies, including reduced movement, are thought to be related to neurological impairment of the fetus.[3] Camptodactyly or clinodactyly occur in 68% of FAS individuals who had joint anomalies; palmar crease abnormalities occurred in 56% and limited elbow movement in 24%.[14] Refer to Table 3 for additional physical problems associated with FAS.

Growth

Growth retardation is another physical effect of prenatal alcohol exposure and includes length/height, weight and head circumference.[3,13] However, Streissguth et al[14] found that 16% of patients with FAS are within the average range for height. Growth retardation can occur in pregnancies where alcohol has not been consumed, however, growth retardation is the primary finding in children with FAS.[53] Boys were more affected than girls in all aspects of growth deficiency, height, weight and head circumference.[12] Clarren and Smith[26] found that microencephaly occurs in more than 80% of infants with FAS. Microencephaly was only loosely associated with mental retardation.[12]

Cognitive

Cognitive impairment is another manifestation of FAS. "Mental retardation is the most serious birth defect associated with" FAS.[10,54] One-third of individuals with FAS have an IQ of less than 70, and 67 is the average IQ for those afflicted.[2] Streissguth et al[14] found that 50% of the patients in their study had an IQ score of 50 or below. Streissguth and colleagues[4] had no FAS patients in their study with an IQ above 90. Therefore, those

classified as mildly retarded (50 to 70) included most FAS individuals. These individuals can be educated and usually have "greater deficits in verbal IQ than in performance IQ."[14] As the number of physical anomalies increases, the IQ score decreases, demonstrating an inverse relationship.[37] "The likelihood of impaired intelligence tended to increase with severity of morphological damage at first assessment."[12] Some individuals with FAS have IQ scores in the normal range, but still have learning disabilities.[36] Due to the wide range of IQ scores, it is very difficult to predict the limitations facing an individual with FAS based on the diagnosis alone.[4]

Academic placement and ability of these children with FAS is variable. Streissguth et al[14] reported that "6% were in the regular classroom, 28% were in self-contained special education classrooms, 15% were not in school or work, and 9% were in sheltered workshops." The average academic functioning level in adolescents and adults was early grade school, with respect to reading, spelling, and math. Most of these individuals require some remedial help in the classroom.[14]

Behavior

There are many specific behaviors exhibited by infants and children with FAS, most of which will be discussed in reference to developmental ages in the next section of this chapter. Some of the most common and persistent behaviors of individuals with FAS include: attention deficit, poor social adaptation, and problems with comprehension and abstraction.[2] Streissguth et al[14] found that socialization and communication skills were not age appropriate for individuals with FAS. There was a wide range of deficits seen in

individuals with FAS, especially in how they process both object-related and social function.[7]

The most common types of maladaptive behavior seen in individuals with FAS include: poor concentration and attention (77%), forgetfulness, dependency (53%), stubbornness or sullenness (50%), social withdrawal (62%), teasing and bullying (53%), crying or laughing too easily (42%), impulsivity, and periods of high anxiety (51%).[7,14,37] The specific percentages for each behavior came from the Vineland Adaptive Behavior Scales, which were used in a study by Streissguth et al.[37] Other common problems seen in adolescents and adults with FAS are socialization, emotional lability, easy distractibility, poor judgment skills, excessive unhappiness, and hyperactivity.[2,10,14] Maladaptive social function is evident in victims of this syndrome, such as showing lack of consideration and poor eye contact.[37] Conduct problems such as, lying, cheating, stealing, and defiance, are characteristics that have been found to be demonstrated by individuals diagnosed with FAS.[10,14] Suicide attempts, schizophrenia, depression and chemical dependency may be exhibited by individuals with FAS as well.[2]

Motor/Neurodevelopmental Abnormalities

Neurological damage may also be displayed in abnormalities of gait, persistence of primitive reflexes, and other motor deficits.[13] Research findings support the fact that motor deficits and gait incoordination are often a consequence of prenatal alcohol exposure.[36] Gait differences include shorter stride length, increased angle of placement of hind foot, and decreased symmetry in gait. Marcus[55] reported that children with FAS have "clumsy gait", wide-based gait, and had difficulty performing tandem walking. These

children also demonstrated delayed motor development and poor motor test performance.[3] Autti-Ramo and Granstrom[56] completed a study assessing 53 infants diagnosed with FAS and found motor delay to be more common than cognitive delay. Motor delay has been reported in children with FAS at various ages including birth, 8 months, 12 months, 4 years, 6 and 7 years, and 6 to 18 years.[36] Specific motor abnormalities included increased body tremors, head to the left orientation, and hand-to-mouth activity, decreased total body movements, poor hand-eye coordination.[57] Conry[58] evaluated 19 children with FAS and found lower scores in sensorimotor tasks: reaction time, non dominant finger tapping, grip strength, and motor speed. Fine motor skills seem to persist more than gross motor skills.[36]

Balance appears to be affected in children with FAS.[35] Marcus[55] found that children with FAS have significantly lower scores in specific skills associated with balance such as head, trunk, lower extremity and locomotion control. Clarren[40] hypothesized that these balance difficulties are related to cerebellar dysfunction and may also include kinetic tremors, disdiadochokinesia, dysarthria, and axial ataxia. Prenatal alcohol ingestion has been found to interrupt cerebellar development thus altering motor control.[40] It should be noted that the cerebellum undergoes considerable growth in the early neonatal period.[35] In addition, the major growth spurt of the brain occurs during the third trimester, but continues for the first two years of life postnatally.[36,46]

Developmental Stages

There are characteristics that can serve as warning signs indicating a child with FAS. These will be illustrated by addressing the characteristics observed in infants and children

with FAS at various developmental stages. These stages include infancy, preschool, midddle childhood, adolescence and adulthood.

Infancy

Infants with FAS may show jitteriness, tremulousness, weak suck, hyperexcitability and/or increased activity level, seizure activity, increased respiratory efforts, and fitful sleeping.[7] During infancy hypotonia and irritability may be evident.[7,10,13] Seizure activity may occur immediately postpartum.[10] These babies have difficulty "habituating" and show alterations in orientation behavior.[13] Poor habituation, hyperactivity and inability to stay on task have been explained by a FAS child's inability to inhibit.[35] Spohr and associates[12] found that within their sample of infants with FAS, 84% had low birth weights, 71% exhibited severe feeding problems during the first few months, and 50% were readmitted to the hospital for greater than 4 weeks during the first year. At eight months of life, small deficits in mental and motor development are evident by assessment with the Bayley Scales of Infant Development.[37] Behaviors seen in FAS infants, that are similar to withdrawal symptoms seen in adults include, tremors, spontaneous seizures, hypertonia, abdominal distention, opisthotonos, hyperacusis, abnormal fears, and increased respiratory rate.[59] Behavior alterations during the neonatal period are not necessarily predictive, but may indicate a child at risk and a need for future follow-up.[13]

Preschool

During the preschool years, FAS children are often talkative, alert, friendly, cooperative and passive, and are typically short and skinny.[7,10,13] These children with FAS are emotionally labile, may exhibit temper tantrums, and have difficulty making transitions.

More than 50% show hyperactivity and many are oversensitive to touch or other stimulation. Attention deficits, fine motor delay and developmental delay become evident.[7] Apparent skill level is usually higher than tested level of ability, and these affected children show higher rates of learning disabilities. Children with FAS are often clumsy, compliant, and impulsive.[10] At four years of age, there are four variables that can be measured that reflect prenatal alcohol exposure: IQ scores, attention variability and motor performance.[37]

Middle Childhood

In middle childhood, behavior profiles show hyperactivity, distractibility, impulsivity, and memory difficulties.[7] The child with FAS will often lack social skills to make friends or stay away from strangers.[7,13] Children with FAS still have trouble with transitions and predicting the consequences of their behavior. Academic problems for children with FAS increase during this period and their tendency toward concrete thinking interferes with learning abstract concepts, especially math.[7] Behavioral problems noted by parents or teachers include intentional stealing, lying, or defiance.[7,10] Children with FAS continue to have temper tantrums, don't like to share, and need simple, concrete rules with clear consequences.[13]

Adolescence and Adulthood

During adolescent and adult development, they usually remain short in stature and often have small head size. Most FAS victims have average IQ in the mildly mentally retarded range; the range is anywhere from severely retarded to intelligence within normal limits.[7] The individual with FAS will plateau academically and in daily functioning.[7]

Characteristics such as attention deficit, poor judgment, and impulsivity create obstacles to employment and stable living.[4,7,13] These individuals are at risk for serious life adjustment problems including depression, alcohol abuse and early pregnancy.[7]

Diagnosis

As was noted earlier, the minimal diagnostic criteria for FAS are the presence of prenatal and or postnatal growth deficiencies (height and weight below the 10th percentile), CNS dysfunction (any neurological abnormality, developmental delay, or intellectual impairment), and a characteristic facial dysmorphology (at least two of the following: microencephaly with head circumference below the third percentile, short palpebral fissures, poorly developed philtrum, thin upper lip, flattening of the maxillary area).[12,36] Correct diagnosis is important because "an incorrect diagnosis could lead to inappropriate advice about the risk of FAS in future children. The risk of FAS in future children is potentially high, unless maternal alcoholism is controlled."[3] Correct diagnosis is also crucial to approprate intervention and treatment strategies.

Communication among members of interdisciplinary teams, who are responsible for care of the mother and child prenatally or the child with FAS postpartum, is crucial in the identification of FAS.[36] Early diagnosis and early intervention are key factors in managing the problem of FAS.[36] It has been speculated that early diagnosis and appropriate early intervention could reduce secondary psychopathology.[14]

Early diagnosis appears to be a challenge. For example, in a study by Streissguth et al[14], few patients were diagnosed with FAS in infancy. In contrast, Abel and associates[60] felt that FAS could be recognized in the newborn period, due to the results of their study

in which there was a high degree of accuracy and consistency between medical providers and biomedical scientists in FAS diagnosis. Caruso and Bensel[2] studied a population made up of 70% boys, caucasian or American Indian, and the average age of the children was 3.4 years at initial assessment. The range of ages for initial diagnosis was from birth to 17 years of age. One explanation for age variations in initial diagnosis is that the head growth is slow after delivery, therefore, infants with FAS may not be diagnosed until 9-12 months, instead of at birth.[16] Cognitive and behavioral impairments are also very difficult to identify during infancy.[61]

According to Burd[61], the "peak period to identify symptoms of FAS begins at about three to four years of age and continues to twelve or thirteen years of age." In a survey of 550 cases of FAS[62], 62% of the FAS diagnoses were partially based on the distinctive facial features. However, accurate diagnosis may be more difficult when the facial features of FAS occur in "conjunction" with exposure to other drugs prenatally.[60] In addition, new patients are rarely recognized in adolescence and adulthood, possibly because the emaciated appearance of a young child with FAS does not remain a diagnostic features in adolescents, especially for females.[16] However, Abel et al[60] suggested that facial features associated with FAS are identifiable and problems with recognition should not be a major contributor in achieving accurate diagnosis of FAS.

There are a few tools available to aid in diagnosis of FAS. Clarren and colleagues[29] put together a screening guide for FAS in 1993. This guide provides three arenas used in diagnosis, which are similar to the diagnostic criteria already discussed: the brain, the face and somatic growth.[29] Clarren et al[29] looked at the brain structurally, neurologically and

behaviorally. These researchers felt that the facial dysmorphology is critical in FAS recognition and facial features contribute to a major portion of their screening tool, including photographs and graphs. Occasionally patients will be given the diagnosis of FAS, when the patttern they present is highly suggestive of FAS. This "non-verbal pattern recognition skill" is an important factor in diagnosis of many syndromes, including FAS, but these diagnoses have not been sucessfully reduced to anomaly checklists.[29] However, Breen and associates[63] created the Breen Screen in 1991, and it was revised in 1992; which provides a checklist (yes or no), including the areas of growth, facial features, neck, upper limb, chest, skin, CNS and mental status, and maternal drinking history.[64] Each area has a specific point value and the total score determines if further evaluation is warranted.[64] Martzolf and Burd[65] have revised the Breen Screen and produced the FAS Screening form. This form is similar to the Breen Screen in the areas of assessment, with some slight organizational changes. The terms in each assessment area are in more user friendly terms. The weighted scoring scale is similar to that of the Breen Screen and a score greater than 20 indicates a need for further assessment.[65] See appendix A and B for examples of the Breen Screen and FAS Screening Form.

Clarren and associates[29] stressed that before final diagnosis can be made, other diagnoses, which may be confused with FAS, must be excluded. Some of the alternative diagnoses include but are not limited to: Aarskog's syndrome, Noonan's syndrome, Sphrintzen's syndrome, and fragile X syndrome.[29]

CHAPTER 3

PHYSICAL THERAPY INTERVENTION/TREATMENT STRATEGIES

There are several elements that promote success in the management of FAS. First, a correct diagnosis must be made. Second, an appropriate treatment program that addresses specific symptoms must be designed. Third, the treatment program and outcomes with respect to the child with FAS must be monitored carefully.[61] Treatment programs for children with FAS should address impairments with intellectual, behavior, and social functioning[61], as well as motor deficits.[28] "Treatment of the child with FAS should be directed toward obtaining appropriate services to meet individual needs."[10]

Although there has been much research conducted concerning the teratogenic effects of prenatal alcohol exposure since FAS was first recognized in 1973, there are very few reports involving the specific motor deficits displayed and the subsequent role of physical therapists in assessment and treatment of individuals with FAS.[28] Osborn and associates[36], in one of the earliest studies regarding physical therapy and FAS, reported FAS implications for physical therapists. Harris and co-workers[28] also reported on the implications for physical therapy intervention with FAS individuals.

Of particular concern to physical therapists are the motor deficits often associated with FAS, including balance deficits and in-coordination.[36] Osborn and colleagues[36] suggested that physical therapists may become involved with cases of FAS through direct

intervention or on a consultative basis. If significant delays in motor and cognition are present, direct physical therapy services may be appropriate. However, if the child with FAS has only slight involvement and shows strengths in motor areas, these individuals may be candidates for community-based programs/activities.[28] To aid in assessment, standardized screening tests may be selected, depending on the age of the child, and may include: Denver Developmental Screening Test, Bruininks-Oseretsky Test of Motor Proficiency, Bayley Scales of Infant Development, and the Peabody Developmental Motor Scales.[36] The results of these screening tests can be used to identify areas of deficit and to develop treatment goals and a treatment plan.[36] Harris et al[28] noted that isolated test scores, such as the Bayley Motor Scale, should not be the only influential factor in the decision for referral and follow-up. A thorough musculoskeletal exam, posture evaluation and motor performance assessment, including the quality of skill and reflex development, should be included in the physical therapy assessment of children with FAS.[36] As with most disorders/diagnoses, physical therapy treatment is based on symptoms or deficits presented by the individual. Therefore, some case study examples will be presented and the treatment strategies used in those case studies or direct physical therapy services implemented. Additional strategies that focus on indirect services or areas that enhance physical therapy treatment will also be presented.

Direct Physical Intervention

Harris et al[28] presented a series of case studies that illustrated the treatment programs implemented for several individuals with FAS. Each of the five infants were enrolled in an Infant Development Program (IDP). The program was home-based and family

consultation occurred twice monthly. Three of the five infants received physical therapy services through their IDP. During the infants first 12-15 months, direct physical therapy service included activities such as promoting hands-to-midline and hands-to-knees; encouraging active trunk rotation and movement into and out of sitting; facilitating four-point position and half-kneeling activities; standing activities and independent ambulation. After walking was mastered, the focus shifted to balance activities on a balance beam. Gross and fine motor activities were also incorporated. These children lacked the ability to play spontaneously, therefore, play activities were incorporated into treatment sessions. Family members of one of the infants received consultation regarding feeding and behavioral concerns. It was recommended that the treatment techniques to influence target behaviors should be assessed, such as oral-motor therapy for feeding difficulties and balance activities to enhance balance or postural control.[28]

Another case study was provided by Sally Masinko, PT at the Child Evaluation and Treatment Program in Grand Forks, ND.[65] This case study presented a 13 year old male, who was initially diagnosed with autism, moderate mental retardation and seizure disorder and later diagnosed with FAS, similar treatment strategies were implemented. This individual presented with gait deviations and motor performance delays, for example, poor balance and poor bilateral coordination. His greatest area of difficulty was his inability to understand and follow directions. The recommendations for this child included: 1) continue participation in adaptive physical education class, 2) a running program or participation in simple relay races with a group of his peers, 3) balance beam activities, 4) encourage participation in a variety of ball skill activities, 5) a strengthening program

including long jumping, sit-ups, and pus-ups, and 6) target an area of interest for participation in the upcoming Special Olympics. These recommendations are focused on this individual's needs which were largely difficulty following directions and performance in all areas of gross motor skills.[66]

Osborn et al[36] stressed that pediatric physical therapists should be aware of the increased incidence of orthopedic abnormalities in children with FAS, such as congenital hip dislocation, clubfoot, radioulnar stenosis, elbow flexion contractures, cervical spine fusion, and scoliosis. Harris and associates[28] also stressed the importance of physical therapist's and occupational therapist's involvement in researching the efficacy of early management of children with FAS or FAE. The physical therapists who are involved in the treatment and care of FAS children could contribute greatly to the examination of treatment efficacy for children with FAS.[28]

Indirect Physical Therapy Intervention

Although motor concerns are the major focus for physical therapists, treatment of the child as a whole is equally important. The efficacy of treating the motor element will be affected by the other areas of involvement, such as behavior, self-esteem, environmental influences, social skills development and cognition. Therefore, it is necessary to address strategies in these areas that compliment and facilitate physical therapy intervention strategies. It should be noted that each of these areas overlap and a treatment strategy in one area may apply to another area as well.

Behavior

Burd[61] suggested that the primary focus for intervention involves the neurobehavioral symptoms of FAS. Behavior problems are usually addressed through behavioral and environmental methods, which involves four steps: identify undesirable behaviors, prioritize problem behaviors, identify baseline for the frequency of problem behaviors, and monitor the effects of intervention over time.[61]

The goal in behavior management is to increase the frequency of desirable behaviors, while decreasing the frequency of unacceptable behaviors.[61] One method of behavioral intervention, which will increase the frequency of desired behaviors is the use of positive reinforcement. Positive reinforcement will assess the current behavior level which provides a baseline for frequency of that behavior.[61] Different items or systems can be used with positive reinforcement/positive reward system, such as token programs in which tokens can be used to purchase certain items and/or privileges. Token exchanges should include activities or privileges that are significant to the child.[61] This method can increase desired behavior, decrease undesired behavior, and increase attendance to an activity.

Systematic praise is another way to diminish inappropriate behavior or increase desired behavioral responses.[67] Some examples of systematic praise include: to praise for good behavior and focus on this positive behavior; to ignore inappropriate behavior; and to grant privileges for appropriate behavior.[67] This method can be beneficial by increasing achievement tests, increasing attention to a task, and decreasing the time for transition from one activity to another.[67] The latter two may enhance efficiency and effectiveness of physical therapy treatment time.

Contracting or having written contracts that detail performance expectations or requirements and possible consequences, may also be beneficial. This method has four parts: 1) specification of responsibilities or performances to be reinforced, 2) specification of privileges or rewards to be earned, 3) specification of sanctions for failure to live up to contract, 4) specification of a monitoring system.[68] A behavior modification method to decrease the frequency of undesirable behaviors, while increasing desirable ones, will be discussed in the a future section on social skills.

The use of stimulant medication combined with positive reinforcement is another strategy used to treat behavior problems in children with FAS, especially those with attention deficit-hyperactive disorder (AD-HD).[61] AD-HD occurs in more than 60% of children diagnosed with FAS, and stimulant medication is used to treat the symptoms of this disorder. However, by using positive reinforcement together with medication, target behaviors can be improved and over time, the dosage of medication may be reduced.[61] Target behaviors should be rated two times per week in order to monitor change.[61] The benefits of this combination of drug therapy with positive reinforcement, may enhance physical therapy intervention by timing treatment sessions to correspond with drug treatment.

Self-esteem

Self-esteem is another important area of consideration. A child's self-esteem can be damaged in several ways, but for the child with FAS, the focus on negative behavior is usually the cause.[61] Therefore, it is important to use positive reinforcement appropriately and reduce negative consequences or punishment for misbehavior.[61] Frequent criticism of

the behaviors of the child with FAS is usually a result of lack of understanding that the behaviors of these affected children are under the child's control only for brief periods of time if at all.[61] Making the child with FAS feel important and valued for who they are and not for the behavior they display is a key concept.[61]

Family and Home environment

Consideration of the family and home environment of the child with FAS is important. A good environment can foster development and offer protection for the child against the negative outcomes of prenatal alcohol exposure.[7] As stated earlier, most FAS children do not stay with their biological mother, therefore finding them a stable foster home as soon as possible is helpful. If the FAS child remains with their biological mother, early recognition can uncover the mother's drinking problem, so that she may receive intervention as well.[7] Warmth, nurturance, and behavior management are key factors that children with FAS need early on in their lives.[7] There needs to be a balance between allowing the child some control and setting limits for the child.[7] The parents may need help to learn different parenting strategies and better ways of coping for both the parents and the child with FAS.[7] It may be beneficial for the parents of children with FAS to learn strategies to manage difficult or disruptive behavior and reinforce appropriate behavior.[61] Some of these strategies include: careful supervision, positive reinforcement, training in anger management, clearly defined schedules, careful screening and development of appropriate peer groups, getting their child involved in community/social activities, and parent involvement in support groups.[61] The focus for adolescents will be to enhance independent living and work.[61] The physical therapist can assess the family environment,

stress, and coping strategies and connect the family to appropriate resources including: parent support groups, Supplemental Security Income (SSI), respite care and counseling.[56] The family, as well as the physical therapist, needs to learn to advocate for the child and work with the systems in place to develop an optimal and comprehensive program to meet the child's needs.[56]

Social Skills

Children with FAS have difficulties with social interaction, which results in poor peer relations, social isolation and discipline problems.[61] The reasons for this lack of social skills are the disorder itself or the initial brain damage and incontinuity of care during developmental periods. An unstable early life of neglect and deprivation, that children with FAS often experience, interferes with acquisition of skills to develop social relationships and to learn to follow societal rules.[61] There are two factors that classify these social skills problems: the frequent invasion of inappropriate behaviors and an actual skill deficiency, where the child does not know what to do or how to behave in a particular situation. In order to help the child learn appropriate behaviors, the behavioral deficiencies need to be identified and prioritized. Next, a target skill should be selected and the child should rehearse the skill, identify the benefits, practice the skill in a social setting and then the child's correct behavior should be reinforced. The last step is to allow "peer practice" which involves selecting social situations for the child to use the learned behavior, and reinforce and monitor progress. Use of a behavior modification method to decrease inappropriate behavior, involves the identification and prioritization, by severity and frequency, the undesired behaviors. Next, select a target skill and identify the

consequence, reinforce alternative skill, and select setting and time for intervention. The last step is to implement "peer practice" by selecting social situations for the child to use the skill, and reinforce and monitor progress.[61]

Teaching the correct interactive signals by constant modeling of correct behavior and interaction skills is extremely important. The use of physical cues, such as touching the child to gently redirect him/her is often beneficial and eye contact should always be made.[68] Physical therapists should be aware that some children with FAS may show hypersensitivity to touch, taste, texture and sound.[69] Using techniques such as sensory integration and monitoring the physical therapy environment closely are strategies to address this hypersensitivity.

"Dealing with consequences, learning from their mistakes and having the ability to generalize consequential information to other circumstances is an area of difficulty[70]" noted by caregivers of children with FAS. These caregivers found that "house rules" are beneficial, but can be problematic as well.[70] Children with FAS tend to resist rules due to emotional and perceptual perservation and the inability to create and maintain an internal structure or discipline, therefore providing structure, teaching interactive skills, and teaching appropriate social behavior is important. These children also have the inability to gauge cause and effect or have impaired predictive skills, however, individuals with FAS can be trained to use deductive logic. It should be noted that children with FAS have difficulty selecting potential choices and may need direction and input in this area.[69] All of the techniques mentioned in this section can be incorporated into the physical therapy treatment sessions, to enhance the therapy session and treatment outcome.

Cognition

Children with FAS have limited problem solving strategies and therefore, teaching the child to experiment with other choices needs to be modeled for the child several times.[68] The child with FAS will also have difficulties with transitions and show state rigidity.[69] This may be reflected in the child's inability to initiate a play activity and also coming out of that play activity and moving to another.[68] The inclusion of play activities in physical therapy sessions was presented in the case studies early on. Children with FAS rely heavily on the daily routine and rearranging the physical therapy environment may cause them anxiety, therefore, establishing a routine may be beneficial.[69] The child with FAS will also exhibit sporadic mastery, in which the child will know how to complete a task one day and not be able to complete it the next. This can result in an extremely frustrated child and may also affect the child's self-esteem. The reason for this is that the child with FAS may be aware that they were able to do the task before and not being able to do the task now may be difficult for the child to understand.[68] Due to this memory deficit, children with FAS will often require reteaching and constant repetition of tasks[69], for example reteaching the child specific exercises or activities. By having the child verbalize the steps in the activity, the child is able to internalize information and retain it on a long-term basis.[68] The child with FAS may be unable to follow verbal directions for exercises, due to audio processing problems, therefore written exercise programs and instruction by physically assisting the child and talking through the steps of the activity may enhance learning.[68]

Treatment Modifications

Simple modifications can be made in the approach to treatment of individuals with FAS that may help make treatment more successful. Along with the strategies stated in the sections above, additional strategies to enhance success are provided in the following segements. The therapist may want to begin at a level where the child is going to be successful, continue to focus on positive behaviors, and make modifications as necessary to ensure some degree of success.[61] This will help the child's self-esteem and aid in behavior management. Children with FAS are hypersensitive to criticism, therefore, positive reinforcement is important.[70] Other strategies include empathy, acceptance, patience, guidance and acknowledgment for all they can do.[1]

Some strategies that address distractibility include: planning a careful schedule, providing a quiet environment, and implementing a positive reinforcement system.[61] This structured environment is necessary to control and change behaviors.[70] Structure can be defined as: "...putting things in order, teaching limits and sequences, clarifying, dramatizing, simplifying, concretizing... bringing the foreground sharply into focus, blocking out non-essentials... touching, feeling, looking, listening, outlining and underlining... help the child to hear, to see, to understand--take meaning out of chaos--for until we structure the world for some of these children, it is just that--chaos."[71] Some ways to promote structure include: 1)removal of excessive stimuli; 2) help the child to slow down, decrease impulsivity, and learn to do one thing at a time; 3) establish routines for children who lack organization; 4) give few or no choices initially; 5) ascertain whether the child is paying attention and have the child repeat what was said and make eye contact;

6) provide the child with cues, such as mnemonic devices, which are in the child's repertoire, not too vague, and eventually fade out; and 7) sequence the instructional tasks.[71] In the home, this would be a systematic schedule that is followed consistently, including all activities of the day and a set pattern of consequences for problems.[70] In the physical therapy setting, this would be similar including a systematic schedule of treatment session and consequences for inappropriate behavior. Alerting the child with FAS to potential changes in schedule ahead of time may help with transitions.[70] There should also be minimal exposure to visual and auditory stimulation, for example two many objects around the room can distract and even confuse the child with FAS.[68] Providing a consistent environment in physical therapy is needed to maximize the potential of the individual with FAS.[70]

At the heart of implementing a successful physical therapy treatment plan is behavior control, effective communication, and targeting functional skills.[1] Functional skills are reflected in daily living skills and pre-vocational skills. Functional skills will vary depending on the age and cognitive ability of the child with FAS. The key for physical therapy is to focus on both the present and future environments in which the child will function, live and work, and apply appropriate activities specific to those settings.[72] "Communication skills should be developed in the context of social skills instruction because the two are inseparable" and are essential to living and working in the community.[1] Communication includes all verbal, gestural, and behavioral skills that allow us to participate in social environments.[72] Children should be allowed to express themselves about their feelings, concerns, or fears. Then, strategies can be given to the

child to help then deal with their anxieties.[68] Another aspect of communication is making choices, which is a skill individuals with FAS often lack.[72] The ability to make choices can be taught, however, by beginning with a few concrete choices and gradually moving to more abstract ones. When the child has obtained the skill of making choices, his/her choices should be honored, or the child will learn that his/her decisions are meaningless.[72]

Managing challenging behaviors can be a problem, but realization that these behaviors are forms of communication for the child with FAS can be beneficial.[72] First, try to figure out the child's message that is meant by a specific behavior. Then, choose an alternative form of communication and teach the child to use it. An example of an alternative form of communication may be as simple as teaching the child to state how they feel. Teaching the children more appropriate ways to communicate their message that they were expressing through a particular behavior may reduce challenging behaviors.[72] The opportunity to practice newly learned communication skills and honoring those attempts is also important. Another way to manage challenging behaviors is to plan ahead. By planning ahead, better preparation in handling a challenging situation and more consistent reactions can result.[72] It is critical to establish a balance between structure and independence, so that the child is allowed to use the skills that they have learned. If the child's life is too rigid, he/she can never learn self-management.[72] Consistent praise for accomplishments gives feedback that is needed in order for the child to learn to distinguish whether or not their behavior is appropriate.

The keys for appropriate intervention include: 1) develop and maintain realistic expectations for the child and yourself as the clinician, 2) think long-term, 3) learn to

"reframe" childhood behaviors, 4) keep an open mind about goals and strategies for working with children with FAS and their families.[56]

CHAPTER 4

SUMMARY

Long-term Prospects

"Fetal alcohol syndrome is not just a childhood disorder. There is a predictable, long-term progression of the disorder into adulthood in which maladaptive behaviors present the greatest challenges to treatment.[14] Long-term follow-up investigations have provided evidence that changes in some features of the syndrome occur with time, but most affected children can still be identified as suffering from FAS in late childhood and adolescence, by using the three diagnostic criteria and medical history.[14] Initial diagnostic features tended to persist in the severely affected individuals with FAS.[16] Streissguth and colleagues[14] "traced the natural history into adulthood and demonstrated the profound, pervasive and persistent nature of the biopsychosocial manifestations of the disorders" (FAS and FAE). Lemoine[18] found that in all cases of FAS at follow-up behavior disorders and marked instability persisted, as did mental retardation and severe learning disabilities. Growth deficiency, mental retardation, and developmental delay persist even in some patients with moderate or mild FAS.[2] One follow-up study found that "all children remained growth deficient with respect to height, weight, and head circumference."[16] Girls tend to put on weight during puberty, which increases their height to weight ratio.[73] Spohr et al[12] found some catch up growth occurred in height and weight of the children with FAS at follow-

up, however, microencephaly persisted in 65%. Lemoine[18] also found microencephaly to be more pronounced in older victims of FAS. Individuals with severe FAS showed no improvements in head circumference upon follow-up.[12] The facial dysmorhpism also changes over time, and begins after puberty with presentation of a long face, and a bulky nose and chin.[18,73]

One of the most devastating and persistent effects of fetal alcohol exposure is its impact on the CNS.[35] Spohr and associates[12] found that mental retardation is the major consequence of maternal alcohol consumption during pregnancy and "environmental and educational factors do not have strong compensatory effects on the intellectual development of affected children." CNS dysfunction underlies several of the problems of people with FAS.[7] "The severity of the disorder, in terms of physical abnormalities, during the preschool years was highly predictive of the IQ scores at the follow-up."[16] IQ scores remained stable across time and any small systematic increase is most probably a result of a marked decrease in hyperactivity, which would enhance testing situation.[37] Those with cognitive deficits "maintained subnormal intellectual functioning" with specific arithmetic deficiency.[14] The average academic functioning level was at the second to fourth grades. These individuals had extreme difficulty with abstractions, including time and space, cause and effect, and the ability to generalize one situation and apply it to another.[14] There is a prolonged impairment in the mastery of basic educational skills that lasts well into adolescence and adulthood.[37] Streissguth et al found no improvement of IQ, achievement or adaptive living scores upon follow-up of older individuals with FAS.[4] Superficial verbal skills often hide the underlying severe arithmetic problems and this played a key role in

difficulties with living independently, and demonstrated poor judgement and generally dysfunctional lives.[4] Many older FAS victims have significant trouble holding a job and living independently.[2] Streissguth et al[14] found that none of the subjects in their study were found to be independent in terms of both housing and income. Psychosocial problems may be more evident in the adolescent and adult, but have "their root in early cognitive deficits."[37] Persistent maladaptive behaviors included poor judgment, distractibility, and difficulty perceiving social cues.[14] Inattention, poor concentration, memory deficits, impaired comprehension, poor abstract reasoning, and impaired judgement, were present in older individuals with FAS.[14]

The individuals whose IQ scores are above 70, they may be denied governmental services in communities and education for the disabled, because they fall above the level which qualifies mental retardation.[4] This would mean that only 52% of FAS patients would be eligible for special education by these criteria.[37] Additionally, appropriate services may be more available and accessible to the young child with FAS than the older child.[56] Early intervention professionals may be able to break down "systematic barriers to services," by helping the older child obtain later services, for example, vocational training or "alternatives to juvenile correction systems."[56]

Spohr et al[12] did a 10-year follow-up study and found that there were significant improvements in internal organ malformation, skeletal abnormalities, and neurological dysfunction in individuals with mild FAS. Streissguth and colleagues[16] found that cardiac anomalies had resolved spontaneously or had become insignificant. Congenital hip dislocation was managed successfully, in which casts and or abduction splints were used in

two patients and by surgery in the third.[16] Most of the children have been in reasonably good health since infancy, according to one follow-up study.[16] "Although immunological deficiency in some children with FAS has been reported[74], none of the patient's we followed up had a high frequency of chronic or recurrent infection."

The long-term sequela for FAS individuals indicates a need for intervention from birth, especially for individuals with FAS who remain with their alcoholic mothers that continue to drink. These individuals often experience a high frequency of abuse and neglect during the first year of life.[16]

Recommendations

Lewis and Woods[10] recommended complete abstinence during pregnancy, "since alcohol in each trimester has been associated with abnormalities and the lowest innocuous dose is not known." Major efforts need to be made to develop quality educational programs.[34] Pediatricians, Obstetricians and other health care professionals should increase their own awareness about FAS and its prevention.[34] Pediatricians should increase awareness of maternal alcohol consumption and help identify possible causes and identify other adverse fetal outcomes in future pregnancies.[34] Health care professionals, early childhood care and education providers and other personnel need to be trained in FAS and substance abuse recognition.[56] Children who are suspected to have FAS should be evaluated by a competent, knowledgeable and skilled pediatrician and referral made for early educational services.[34] Pediatric care, high-risk monitoring systems and screening within early childhood agencies need to be set up to identify children with FAS, without stigmatizing them.[56] Continued care from infancy through adulthood needs to be

guaranteed.[56] Systems to identify "at risk" parents would be beneficial.[56] These systems would focus on identifying individuals who may be substance-using, fetal-alcohol affected and/or developmentally disabled. Information about FAS should also be made available.[34]

This preventable form of developmental disability can be tamed by encouraging prevention by raising public awareness, providing alcohol abuse treatment programs, and educating professionals.[56] Information packets including articles and fact sheets are available from ARC (association for Retarded Citizens), the March of Dimes Birth Defects Foundation, and the National Council on Alcoholism and Drug Dependence, Inc. ARC: P.O. Box 6109 Arlington, TX 76005. March of Dimes Birth Defects Foundation: Education and Health Promotion Division 1275 Mamaroneck Ave., White Plains, NY 10605. NCADD, Inc.: 1511 K Street NW Suite 926, Washington, DC 20005.[8] Further information may be obtained by contacting Larry Burd: 1300 S. Columbia Road, Grand Forks, ND. 58202.[61]

Conclusion

Prenatal alcohol exposure results in a wide variety of effects including intellectual impairment, learning disabilities, behavioral problems, attentional and memory deficits, difficulty organizing and problem solving, and gross and fine motor problems. Continued research is necessary to provide physical therapists and other professionals with a better understanding of FAS and methods to effectively develop assessment and treatment programs to meet their patients' needs. More research also needs to be conducted to identify the commonly occurring neuromotor, balance, and postural deficits exhibited by

children with FAS. "Informed early intervention can bring hope to all parents and children dealing with prenatal alcohol exposure."[7]

Although there are many consequences of FAS, the focus for physical therapy is the neuromotor abnormalities associated with FAS, that may require consultation or intervention. However, when treating a patient it is important to treat the whole individual and not just their diagnosis. The purpose of this paper has been to bring attention to this preventable syndrome and offer information on diagnosis and treatment of FAS. FAS is 100% preventable and the effects of maternal alcohol intake are lifelong. "The goal for health care professionals should be education and prevention at the earliest possible point to combat this devastating, costly, and preventable set of birth defects."[2]

The impact of prenatal alcohol exposure is long-lasting, raising challenges at each level of development, continuing beyond puberty. "In the most heart-breaking situations, alcohol-affected children are raised with no awareness of their disabling brain damage."[7] The following is a passage from the book, The Broken Cord, by Michael Dorris[75], which illustrates what life is like for victims of FAS and their parents. The tragedy is clear in the words of a father who adopted a child with FAS:

> "My son will forever travel through a moonless night with only the roar of wind for company. Don't talk to him of mountains, of tropical beaches. Don't ask him to swoon at sunrises or marvel at the filter of light through the leaves. He's never had time for such things, and he does not believe in them. He may pass by them close enough to touch on either side, but his hands are stretched forward,

grasping for balance instead of pleasure. He doesn't wonder where he came from, where he's going. He doesn't ask who he is, or why. Questions are a luxury, the province of those at a distance from the periodic shock of rain. Gravity presses Adam so hard against reality that he doesn't feel the points at which he touches it. A drowning man is not separated from the lust for air by a bridge of thought--he is one with it-- and my son, conceived and grown in an ethanol bath, lives each day in the act of drowning. For him there is no shore."

APPENDIX A

Breen Screen Revised

BREEN SCREEN, REVISED (7/1/92)

A PROPOSED FAS SCREEN FOR EARLY ELEMENTARY STUDENTS THAT CAN BE APPLIED BY THE LAY COMMUNITY.

NAME_____ DOB___/___/___ AGE____ M F DATE OF EXAM___/___/___

HEIGHT_____	< 5%	Y____ N____	10
WEIGHT_____	< 5%	Y____ N____	10
HEAD CIR._____	< 5%	Y____ N____	10

HEENT	PROTRUDING AURICLES (EARS STICK OUT)	Y____ N____	4
	EPICANTHAL FOLDS (SKIN FOLDS NEAR INNER EYE)	Y____ N____	5
	PTOSIS (DROOPING OF EYELIDS)	Y____ N____	4
	STRABISMUS (CROSS-EYED, ONE OR BOTH EYES)	Y____ N____	3
	HYPOPLASTIC MAXILLA (FLAT MIDFACE/CHEEKS)	Y____ N____	7
	LOW NASAL BRIDGE (FLAT/LOW BETWEEN EYES)	Y____ N____	2
	UPTURNED NOSE	Y____ N____	5
	FLAT PHILTRUM (UPPER LIP GROOVE IS FLAT OR SHALLOW)	Y____ N____	5
	THIN UPPER LIP	Y____ N____	4
	CLEFT LIP/PALATE (SPLIT, REPAIRED FROM BIRTH DEFECT)	Y____ N____	4
NECK	SHORT, BROAD NECK	Y____ N____	4
UPPER LIMB	LIMITED JOINT MOBILITY (FINGERS, ELBOWS)	Y____ N____	4
	CLINOMICRODACTYLY (PERMANENTLY CURVED, MIDGET FINGERS, ESPECIALLY PINKIES)	Y____ N____	1
	DEEP OR ACCENTUATED PALMAR CREASES	Y____ N____	4
	HYPOPLASTIC NAILS (SMALL NAILS/NAIL BEDS)	Y____ N____	1
CHEST	PECTUS EXCAVATUM (FUNNEL CHEST)	Y____ N____	3
	PECTUS CARINATUM (PIGEON CHEST)	Y____ N____	1
	HISTORY OF HEART MURMUR OR MALFORMATIONS	Y____ N____	4
SKIN	CAPILLARY HEMANGIOMAS, MULTIPLE OR RAISED (RAISED RED BIRTHMARKS)	Y____ N____	4
	HIRSUTISM (GREATER THAN NORMAL BODY HAIR, HAIR ALSO ON FOREHEAD AND BACK)	Y____ N____	1
MS/CNS	SCOLIOSIS (CURVATURE OF THE SPINE)	Y____ N____	1
	HISTORY OF NEURAL TUBE DEFECT, MENINGOMYELOCELE	Y____ N____	4
	MILD TO MODERATE MENTAL RETARDATION (IQ<70)	Y____ N____	10
	FINE MOTOR DYSFUNCTION (TREMULOUS, POOR FINGER AGILITY)	Y____ N____	1
	HYPERACTIVITY/EXCESSIVE IRRITABILITY/↓ ATTENTION	Y____ N____	7

IF MATERNAL DRINKING HISTORY DURING PREGNANCY KNOWN

Choose one:	DID NOT DRINK DURING PREGNANCY	-5
	QUANTITY UNKNOWN	2
	AT LEAST WEEKLY OR BINGES	3
	DAILY	5

SCORE TOTAL _____

EVALUATE FURTHER IF TOTAL SCORE ≥ 20

ADDITIONAL QUESTION: PAINT SNIFFING DURING PREGNANCY Y____ N____

APPENDIX B

FAS Screening Form

FAS SCREENING FORM: RETURN TO SCREENING ORGANIZATION

NAME_____ DOB__/__/__ AGE_____ SEX(circle one) F M DATE OF EXAM __/__/__

SOCIAL SECURITY NUMBER ____/____/____ CHILD'S RACE_____

HEIGHT_____	INCHES	<5%	Y____ N____	10
WEIGHT_____	POUNDS	<5%	Y____ N____	10
HEAD CIR._____	CM	<5%	Y____ N____	10

HEAD AND FACE	EARS STICK OUT (Protruding Auricles)	Y____ N____	4
	SKIN FOLDS NEAR INNER EYE (Epicanthal Folds)	Y____ N____	5
	DROOPING OF EYELIDS (Ptosis)	Y____ N____	4
	CROSS-EYES, ONE OR BOTH EYES (Strabismus)	Y____ N____	3
	FLAT MIDFACE/CHEEKS (Hypoplastic Maxilla)	Y____ N____	7
	FLAT/LOW NOSE BETWEEN EYES (Low Nasal Bridge)	Y____ N____	2
	UPTURNED NOSE	Y____ N____	5
	GROOVE BETWEEN LIP & NOSE ABSENT OR SHALLOW (Flat Philtrum)	Y____ N____	5
	THIN UPPER LIP	Y____ N____	4
	CLEFT LIP OR CLEFT OF ROOF OF MOUTH (present or repaired)	Y____ N____	4
NECK AND BACK	SHORT, BROAD NECK	Y____ N____	4
	CURVATURE OF THE SPINE (Scoliosis)	Y____ N____	1
	SPINA BIFIDA (History of Neural Tube Defect)	Y____ N____	4
ARMS AND HANDS	FINGERS, ELBOWS (Limited Joint Mobility)	Y____ N____	4
	PERMANENTLY CURVED, MIDGET FINGERS, ESPECIALLY PINKIES (Clinomicrodactyly)	Y____ N____	1
	DEEP OR ACCENTUATED PALMAR CREASES	Y____ N____	4
	SMALL NAILS/NAIL BEDS) (Hypoplastic Nails)	Y____ N____	1
	TREMULOUS, POOR FINGER AGILITY (Fine Motor Dysfunction)	Y____ N____	1
CHEST	SUNKEN CHEST (Pectus Excavatum) 〉 OPTIONAL	Y____ N____	3
	CHEST STICKS OUT (Pectus Carinatum)/	Y____ N____	1
	HISTORY OF HEART MURMUR OR ANY HEART DEFECT	Y____ N____	4
SKIN	RAISED RED BIRTHMARKS (Capillary Hemangiomas)	Y____ N____	4
	GREATER THAN NORMAL BODY HAIR, HAIR ALSO ON FOREHEAD AND BACK (Hirsutism)	Y____ N____	1
DEVELOP MENT	MILD TO MODERATE MENTAL RETARDATION (IQ < 70)	Y____ N____	10
	SPEECH AND LANGUAGE DELAYS	Y____ N____	2
	HEARING PROBLEMS	Y____ N____	1
	VISION PROBLEMS	Y____ N____	1
	ATTENTION CONCENTRATION PROBLEMS	Y____ N____	2
	HYPERACTIVITY	Y____ N____	5

COMMENTS:

SCORE TOTAL_____

Circle Total Score

0 10 20 30 40 50 60 70 80 90 100 110 120 130

REFER FOR FURTHER ASSESSMENT

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