5-1-1991

Visual acuity and binocular function assessment of cocaine exposed infants

Paula J. Becker
Pacific University

Jeff L. Chapman
Pacific University

Recommended Citation
https://commons.pacificu.edu/opt/915

This Thesis is brought to you for free and open access by the Theses, Dissertations and Capstone Projects at CommonKnowledge. It has been accepted for inclusion in College of Optometry by an authorized administrator of CommonKnowledge. For more information, please contact CommonKnowledge@pacificu.edu.
Visual acuity and binocular function assessment of cocaine exposed infants

Abstract
With the increasing number of infants born exposed to cocaine, we are confronted with a problem whose extent has not yet been evaluated. In this study, the Preferential Looking Acuity Card Procedure was used to assess the visual acuity of four infants exposed to cocaine in utero. Binocular function was evaluated utilizing a cover test, Hirschberg, and Bruckner test for strabismus and amblyopia. No correlation was found between cocaine exposure and decreased visual acuity or increased incidence of strabismus.

Degree Type
Thesis

Rights
Terms of use for work posted in CommonKnowledge.
Copyright and terms of use

If you have downloaded this document directly from the web or from CommonKnowledge, see the “Rights” section on the previous page for the terms of use.

If you have received this document through an interlibrary loan/document delivery service, the following terms of use apply:

Copyright in this work is held by the author(s). You may download or print any portion of this document for personal use only, or for any use that is allowed by fair use (Title 17, §107 U.S.C.). Except for personal or fair use, you or your borrowing library may not reproduce, remix, republish, post, transmit, or distribute this document, or any portion thereof, without the permission of the copyright owner. [Note: If this document is licensed under a Creative Commons license (see “Rights” on the previous page) which allows broader usage rights, your use is governed by the terms of that license.]

Inquiries regarding further use of these materials should be addressed to: CommonKnowledge Rights, Pacific University Library, 2043 College Way, Forest Grove, OR 97116, (503) 352-7209. Email inquiries may be directed to: copyright@pacificu.edu

This thesis is available at CommonKnowledge: https://commons.pacificu.edu/opt/915
VISUAL ACUITY AND BINOCULAR FUNCTION ASSESSMENT
OF COCAINE EXPOSED INFANTS

By

PAULA J. BECKER
JEFF L. CHAPMAN

A thesis submitted to the faculty of the
College of Optometry
Pacific University
Forest Grove, OR
for the degree of
Doctor of Optometry
May 1991

Advisor: Dr. Paul Kohl
Paula Becker will graduate with a Doctor of Optometry degree in May 1991, from Pacific University, Forest Grove, OR. She received a B.S. in Chemistry from North Dakota State University in 1987. Future plans are to own a primary care optometric practice specializing in contact lenses, vision therapy, and pediatrics in the Minneapolis, MN area.

Jeff Chapman graduated from the University of Colorado, Boulder in May 1987 with a B.A. in Psychology. He will receive his Doctor of Optometry degree from Pacific University College of Optometry in May 1991. Upon graduation he plans to return to Denver, Colorado and work in a group practice providing comprehensive optometric care.
ABSTRACT

With the increasing number of infants born exposed to cocaine, we are confronted with a problem whose extent has not yet been evaluated. In this study, the Preferential Looking Acuity Card Procedure was used to assess the visual acuity of four infants exposed to cocaine in utero. Binocular function was evaluated utilizing a cover test, Hirschberg, and Bruckner test for strabismus and amblyopia. No correlation was found between cocaine exposure and decreased visual acuity or increased incidence of strabismus.
ACKNOWLEDGEMENTS

Our thanks to Pat McIntosh, Director of the SAFE program, at Oregon Health Science University Women's Health Clinic for assistance in recruiting our subjects, arranging for testing facilities, and for sharing her knowledge in the area of drug abuse.

Our thanks to our advisor, Dr. Paul Kohl, for introducing us to pediatric optometry, assisting us with his expertise in the technique of Preferential Looking, and the long hours spent proof reading and editing our numerous "rough drafts".
INTRODUCTION

The dramatic increase of cocaine use within the past fifteen years has had an impact on virtually every aspect of society. This usage has shown no prejudice either for rich or poor, male or female. An estimated 5 million people use cocaine on a regular basis, and 20 million people have tried the drug at least once. (1, 2, 3). The National Institute on Drug Abuse reported in 1986, that for the first time in the fifteen years it has collected data, cocaine became the most frequent cause of drug-related emergency visits, surpassing ethanol and narcotics (4). National mortality data from the National Institute on Drug Abuse has placed cocaine as the third most common agent identified in drug-related deaths (3). Due to the accessibility and relatively low cost of cocaine the toxicity may be underestimated by its users. Contrary to public belief, studies show that cocaine is three times more lethal than heroin (2).

Women, aged 20 to 35, are among the most frequent users of cocaine. Current studies show that cocaine is the primary illicit drug used by women of child-bearing age (5). Reports show infants born to drug abusing mothers increased from 6.7 per 1000 live births in 1981 to 20.3 per 1000 live births in 1987, with abuse of cocaine accounting for most of the rise (6). National studies have estimated 10-15% of women use cocaine at least once during their pregnancy (3,7). This population is now a major focus of concern. Although the immediate effects of cocaine on an individual are understood, the
teratogenic effects of cocaine exposure during pregnancy are relatively unexplored.

Cocaine has multiple pharmacological effects, including local anesthesia, pyrexia, hyperglycemia, and mydriasis. The most notable action is stimulation of the central nervous system, including vasoconstriction (8). Cocaine intoxication in adults has produced tremors, seizures, toxic psychosis, respiratory paralysis, cardiac arrhythmias, myocardial infarction, hypertension, cerebrovascular accidents, intestinal ischemia, and sometimes death (9).

These effects are consistent regardless of the method of intake, which include 'snorting' a powder of hydrochloride salt intranasally, and smoking or injecting intravenously an alkaloid commonly called "crack" (10). Cocaine, in any form, is quickly addictive, producing an immediate sensation of intense euphoria, which lasts less than 45 minutes. Following the euphoric state is the crash, a state of severe depression and agitation (10).

Cocaine is absorbed readily across mucous membranes and the gastrointestinal tract. It also freely crosses the placenta by simple diffusion and it is metabolized by plasma and liver cholinesterases to water soluble metabolites that are excreted in the urine. Immature fetal liver and kidneys are slow to metabolize the drug and may remain in the system for as long as a week after exposure (5,11,12,13). In association with the direct effect of the actual deposition in the tissues of the fetus, there is also a secondary effect
from peripheral vasoconstriction in the mother. A placental vasoconstriction results, decreasing blood flow and oxygenation to the fetus (5,14). The relationship between decreased oxygen availability, fetal anomalies, and growth retardation has been demonstrated (15,16,17). Unstable systemic and metabolic functioning of the organ systems as a result of cocaine use in utero lead to an increase in complications to the fetus and the newborn. Studies of fetal effects have shown an increased rate of spontaneous abortions, abruptio placentae, high rate of premature labor and delivery, intrauterine growth retardation, and malformations of the genitourinary tract in cocaine exposed infants (1,10,12,13,18,21,22). Perinatal consequences documented include low birth weight, decreased head circumference, apnea, seizures, tremors, hyperflexia, hyperirritability, abnormal respiratory patterns, neonatal behavioral deficiencies, lower than normal Apgar scores, and increased death due to SIDS (1,2,3,6,11,18,19,20,21). The studies make it evident that cocaine use in pregnancy places the pregnancy and neonate at high medical and neurobehavioral risks.

The majority of evidence on cocaine exposure during pregnancy stressed the neurologic damage to the infant, inappropriate behavioral responses, characteristic motor deficits, and poor growth patterns (2). In addition, studies of performance on neonatal behavioral assessment scales such as the Brazelton and MAI, which provide an assessment of risk for motor dysfunction, revealed that infants exposed to cocaine showed significant depression of interactive behavior and poor organization responses to
environmental stimuli. The ability to attend to and actively respond to auditory and or visual stimuli was also decreased (7,11,13,20,21). These infants demonstrated none to very poor visual attention and tracking (24). Also, there were significant differences in muscle tone, primitive reflexes, and volitional movement (20,21). In addition, cocaine exposed infants demonstrate poor quality of movement. They have difficulty establishing midline orientation or attaining antigravity flexion to overcome the extensor tone (11). Most of the cocaine exposed infants could be classified as "fragile" infants, who are easily overloaded by environmental stimuli (22).

Although significant data has been obtained for newborns very little research is available concerning the long term physiological or developmental effects of cocaine exposure during pregnancy. Hill and Tennyson suggest that neurological and behavioral abnormalities are a reflection of intrauterine neurological insult, which may become evident later and can be manifested by poor organization, reading problems, and difficulties in acquiring satisfactory mathematical skills (23). It is feared that prenatal drug abuse may cause long-term effects in childhood such as behavior disorders and learning disabilities (11).

In accordance with the developmental problems mentioned above studies suggests these infants have significant alterations in visual function (13). Dixon et. al. (24) reported that flash evoked visual potentials were abnormal in 11/12 infants studied. The findings were gross hemispheric asynchrony with major positive wave
component delays, no interpretable response, and abnormal latency of major wave forms. EEG's were also abnormal in 11/12 infants. Gross disturbances were noted in state organization. Also noted were excess sharp wave activity, and distinct pattern of bursts of theta rhythm. These findings were observed even after cocaine was no longer detected in urine. Preliminary observation of six infants indicates that visual disturbances remain at four to six months.

Health care professionals will be in contact with this population as infants, preschool, and school age children. It is imperative that we are aware of the problem and its consequences in order to give the patient the best care available.

METHODS

The purpose of this study was to assess binocular function and visual acuity of infants who were exposed to cocaine during pregnancy.

The study population was composed of cocaine exposed infants delivered to women enrolled in the SAFE program at Oregon Health Sciences University, Portland, Oregon. The SAFE program facilitates the termination of substance abuse during pregnancy and rehabilitation after delivery. Due to the disappointingly low number of subjects we were able to recruit the results cannot be generalized nor can specific trends be stated.
Four infants, ranging from two to eight months of age, participated in our study. A brief case history was obtained, including: date of birth, birth weight, present weight, due date, delivery method, complications of both infant and mother before, during, and following delivery, extent of exposure to cocaine, use of other substances, and the general health of the infant. Confirmation of the above information and other pertinent data including APGAR score, gestational age, and head circumference were obtained through medical records.

Entrance testing followed the case history. This consisted of notation of the infant's general appearance, ocular structure and adnexa, ocular motility, ocular media via direct ophthalmoscopy, pupil evaluation, and IOP measurement using the Keeler Pulsair Non-Contact Tonometer.

Binocular function was assessed utilizing monocular light fixation, Hirschberg test, and Bruckner test for detection of strabismus and amblyopia (29).

Monocular and binocular assessment of visual acuity was performed on each of the subjects. The Acuity Card Procedure for the preferential looking cards was used. The apparatus was previously constructed according to the specifications set by the University of Washington, Department of Psychology (30).
A coverlet patch was used for occlusion during monocular testing. A test distance of 34 cm was used for the testing. All infants were tested in the "flying hold" position before the apparatus. The "flying hold" position allows the trained holder to be in control of the infant's head position. The infant was presented the cards straight ahead while a trained observer evaluated the fixation pattern form a small hole behind the cards. The Snellen equivalents of the square wave gratings for the available cards were 20/3200, 20/1600, 20/800, 20/400, 20/300, 20/200, 20/150, 20/100, 20/80, 20/50, 20/30. The initial presentation was one octave below the acuity norms found by Kohl et al (31). The observer presented each card with a random position of the grating until a judgement could be made concerning fixation pattern of the infant. All results were bracketed and a final acuity recorded.
Subject KZ was a 10 week old female. Her acuity, both monocular and binocular, was within the normal range. There were no apparent signs of strabismus or amblyopia. Her mother used crack cocaine as much as six times per day starting in the initial trimester and lasting up until the fifth month of pregnancy. There were no complications reported at the time of delivery.

Subject BH was a 32 week old male with congenital malformations listed as a minor broad nasal bridge and a skin tag 3mm on the left ulner surface. He was delivered by cessarian section. We found the acuities within the normal range and no apparent strabismus or amblyopia. The intra uterine exposure started in the first trimester approximately five times per week and was tapered in the third trimester. Other drugs used during pregnancy were alcohol and tobacco.
Subject DS was a 12 week old male who with a congenital ventricular septal defect, jaundice, polycythemia, and hypoglycemia. We, again, found acuities within the normal range and no apparent strabismus or amblyopia. The extent of exposure to cocaine was daily throughout the first trimester. Other substances used during pregnancy were alcohol and tobacco.

Subject JJ was a 13 week old female with congenital meconium. Her mother experienced three episodes of premature labor. The cocaine exposure was at least daily for the first and second trimesters. Other substances used during pregnancy were alcohol and tobacco. The acuities were within the normal range and there was no apparent strabismus or amblyopia.

**DISCUSSION**

The literature findings indicate that increasing cocaine abuse has had a significant impact on the pediatric population. The abnormal developmental processes reported would suggest possible visual system anomalies or delays. In this study we found no significant deviations in visual acuity as compared to standarized norms. It is our opinion that abnormalities may be present but may be undetectable using this method of testing, may manifest at a later age, or were not present in our very small population. Testing should also be considered to uncover possible defects in perception or motor skills.
This is the beginning of a long struggle to piece the effects of prenatal exposure to cocaine on the developing child. Obviously, it's not clear precisely how the prenatal drug exposure and then postnatal child rearing environment contributes to the overall disability of the child. Further longterm studies with larger populations are clearly indicated as this is a problem of endemic proportions.
REFERENCES


