Will Diagnostic Systems in FAS Work in Adolescents and Adults

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Five Methods for Clinical Diagnosis of FASD


Fetal Alcohol Syndrome (FAS)
(Based on the criteria established by Hoyme et al 2016)

• 2 or more facial anomalies:
  Short palpebral fissures (≤10%), smooth philtrum (rated 4 or 5 on the Astley-Clarren Lip - Philtrum guide), thin vermilion border (rated 4 or 5 on the Astley-Clarren Lip-Philtrum guide).

• Growth deficiency ≤ 10th centile

• Head circumference ≤ 10th centile

• Cognitive and/or behavioral impairment
  - Global impairment ≥ 1.5 SD below mean or
  - Cognitive deficit in ≥ 1 neurobehavioral domain ≥ 1.5 SD below mean or
  - Behavioral deficit in ≥ 1 behavioral domain of self-regulation ≥ 1.5 SD below mean
Parameters To Be Discussed

• Growth
• Occipital Frontal Circumference
• Palpebral Fissure Length
• Philtrum
• Vermilion Border
In normal children, there is very little growth after 15 years in girls and 17 and 6/12 in boys. This strongly suggests that growth for adolescent girls beyond 15 years and boys beyond 17 and 6/12 with FAS would plateau as well.
43 Adolescents and 18 Adults

Ages 12 to 40

Mean height 2 SD below population mean – Weight less affected

Mean weight for height age 48% - Varied from 3% (very thin) to 90% (very heavy)

Onset of Puberty - WNL

The Value of Growth in Diagnosis of Adolescents and Adults with FAS

• Height can be helpful in diagnosis of FAS in Adolescents and Adults – Weight is Less Helpful

• Based on a publication by Carter et al (confirmed in a recent report by Chambers et al), prenatal growth restriction is perhaps the most important predictor of intellectual performance in children with FAS, particularly when it occurs in the absence of postnatal catch-up growth.
In humans, 38% of fontanels close by the 1st year and 96% by the 2nd. They close because the brain no longer pushes them apart. Therefore, most of brain growth occurs by the 2nd yr of life.

The fontanels and sutures allow the brain to grow.

Therefore it would be expected that the head circumference in an adolescent or adult would continue to be a good diagnostic sign of FAS.

In a study of 43 adolescents and 18 adults mean OFC > 2SD below mean but 28% had normal OFC.

Stressguth et al. 1991

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NORMAL HEAD CIRCUMFERENCE

OFC at Birth – 35cm
12 months – 45 cm
24 months – 47.5 cm
16 years - 54.5 cm
• The palpebral fissure is a dependent structure which depends on the optic vesicle which is an out-pouching from the frontal brain.

• Shortness of the palpebral fissure is a function of decreased volume of the optic vesicle.
## Palpebral Fissures in Newborns with FAS

% deviation relative to controls

<table>
<thead>
<tr>
<th>Case #1</th>
<th>Case #2</th>
<th>Case #3</th>
<th>Case #4</th>
<th>Case #5</th>
<th>Case #6</th>
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<td>-0.9</td>
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<td>-1.3</td>
<td>-1.6</td>
<td>-2.1</td>
<td>-7.9</td>
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<td>-13.6</td>
<td>-14.8</td>
<td>-15.4</td>
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<td>-20.0</td>
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<td>-32</td>
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Ocular Volume in Newborns with FAS
% deviation relative to controls

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<tr>
<th>Case #</th>
<th>Deviation</th>
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<tbody>
<tr>
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<td>-31.7</td>
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<tr>
<td>#16</td>
<td>-37.5</td>
</tr>
</tbody>
</table>

Mean: -16.6%
Palpebral Fissure Length in Normal Males and Females

After 4 years of age, the palpebral fissure increases by 1 mm in normal children.

The in utero insult to optic vesicle volume, which determines PFL in FAS, remains constant following birth, resulting in a PFL that does not continue to grow past 4 years.

Therefore, it would be expected that the PFL in an adolescent or adult would continue to be a good diagnostic sign of FAS.
NORMAL DEVELOPMENT OF THE PHLTRUM AND VERMILION BORDER
STRUCTURAL BASIS OF PHILTRUM

• Normal philtral anatomy:
  32 fetuses from 8 to 21 fetal weeks

• Specimens lacking lateral philtral ridges:
  Holoprosencephaly
  Prolabium of bilateral cleft lip
  Heavy Prenatal Alcohol Exposure

Normal Development of the Philtrum

Medial Nasal Processes

Secondary Structures
(Frenulum Associated Connective Tissue)

Maxillary Processes

Secondary Structures
(Orbicularis Oris Muscle Fibers)

Interaction

Normal Philtrum
NORMAL 9 WEEK HUMAN FETUS
LIP SECTION: 9 WEEK FETUS
NORMAL 12 WEEK HUMAN FETUS: SECTION THROUGH UPPER LIP
NORMAL 13 WEEK HUMAN FETUS: SECTION THROUGH UPPER LIP
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Arrow indicates the absence of orbicularis oris fibers despite the presence of FACT
Heavy Prenatal Alcohol Exposure
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Normal Philtrum
Conclusions

• The smooth philtrum and thin vermilion border of the upper lip are helpful for diagnosis of FAS in adolescents and adults up to 60 years of age.

• However, smoothness of the philtrum in normal adults over 60 years of age is common and results from hypotonia of muscles derived from the maxillary processes associated with older age.

• Prior to 60 years of age the philtrum and vermilion border are consistent diagnostic features of FAS.
SMOOTHNESS OF PHILTRUM AND THINESS OF VERMILION WITH INCREASING AGE IN NORMAL
SUMMARY

- Height can be helpful in diagnosis of FAS in Adolescents and Adults. Weight is less consistent.
- Decreased brain growth manifest by a decrease head circumference remains a good diagnostic sign of FAS in the majority of Adolescents and Adults.
- PFL in Adolescents and Adults continue to be a good diagnostic sign of FAS.
- The smooth philtrum, and thin vermillion of upper lip remain useful for diagnosis up until 60 years of age when the philtrum and vermilion border become smooth and thin in normal individuals.