Artic at the mild level:

***Oral Mechanism Exam:***

An examination of the structure and function of XX’s oral mechanism was conducted. He showed good strength and range of motion during all the activities he was asked to perform, with no notable differences that would indicate difficulties producing speech. Both the structures and function of XX’s oral mechanism were considered to be within normal limits.

**Spontaneous Speech Sample**:

A speech sample was collected during a spontaneous conversation with the clinicians in the treatment room in an activity during which XX talked about baseball pictures. A sample of 100 utterances was analyzed for intelligibility (the ability to be understood). On average, an unfamiliar listener found XX to be 99% intelligible during this speech sample. By age seven and a half years, children are generally 100% intelligible to an unfamiliar listener. Subjectively, it was noted that XX’s speech during spontaneous conversation contained few errors; however, deletion of the final consonant (e.g., “poo” for “pool”), distorted vocalic /r/ (“huwt” for “hurt”), and inaccuracy in productions as words became more complex (e.g., “Eksix” for “Essex”) were observed.

*Goldman-Fristoe Test of Articulation-Second Edition (GFTA-2):*

The *GFTA-2* is designed to assess articulation ability of the consonant sounds of Standard American English. This test provides information about an individual’s speech patterns in various contexts. The first subtest, *Sounds-in-Words,* measures sound production at the word level. The second subtest, *Sounds-in-Sentences*, analyzes articulation during a contextual conversational speech task. Comparing the results of these two subtests provides information about the reliability of sound production from word level to conversational speech. The results are based on a mean standard score of 100 with a standard deviation of 15. XX received a standard score of 110 on the *Sounds-in-Words* subtest. When compared to age matched males ages 5 years, 2 months and 5 years, 3 months, XX scored in the 72nd percentile. A percentile rank indicates the percentage of individuals in the norm group who performed at or below XX’s performance. The results of XX’s performance are summarized in the tables below:

**Table 1. *GFTA-2* Sounds-in-WordsScore Summary**

|  |  |  |  |
| --- | --- | --- | --- |
| **Raw Score** | **Standard Score** | **Confidence Interval 90%** | **Percentile** |
| 02 | 110 | 104-116 | 72nd |

In the *Sounds-in-Words* subtest, XX produced two articulation errors out of 53 single-word responses. The table below represents speech production errors at the word level. The sound substitution, target production and actual productions are provided.

**Table 2. *GFTA-2* Changes in Sound Production**

|  |  |
| --- | --- |
| **Speech Production Errors** | |
| **Sound Substitutions** | **XX’s Productions** |
| Substitution of /g/ for /d/ in medial position | “wingo” for “window” |
| Substitution of /s/ for /z/ in initial position | “sipper” for “zipper” |

In the *Sound-in-Sentences* subtest, XX made consistent sound substitution errors at the sentence level when compared to the context in words. A story was verbally presented to XX in four segments, which he then retold. During this task, XX demonstrated four total errors of the target phonemes at the sentence level. XX displayed the ability to correctly produce the stimulus word when given a verbal model. He also demonstrated self-correction of a targeted word at the sentence level. This indicates that while some of his sound productions are inconsistent, he has increasing accuracy at the sentence level and emerging awareness of his sound productions.

Moderate issues:

**Oral Speech Mechanism Examination:**

A screening of XX’s oral-facial anatomy and musculature was done to assess the structure and functioning of his articulators and their adequacy for speech. XX’s facial structures appeared normal and symmetrical at rest. He demonstrated adequate tongue and jaw strength as well as sufficient range of motion of his tongue. XX’s upper jaw was observed to deviate to the left when moving into a closed mouth position, as well as left deviation upon protrusion of the tongue. In addition, when asked to pucker his lips, XX demonstrated reduced range of motion. Although slight differences were noted, XX displayed adequate movement and manipulation of his oral-facial structures required for accurate and efficient speech production.

During the oral mechanism exam, diadochokinesis (DDK) rates were assessed. DDK rates are used to assess coordination and control of the articulators through a hierarchy of productions of increasing length and complexity.

**Table 1. DDK Results**

|  |  |  |  |
| --- | --- | --- | --- |
| **Target Sound** | **Number of Repetitions** | **Time** | **Cut-off time scores for age 7** |
| /pʌ/ “puh” | 20 | 4.59 | 4.8 |
| /tʌ/ “tuh” | 20 | 5.10 | 4.9 |
| /kʌ/ “kuh” | 20 | 5.65 | 5.3 |
| /pʌtʌkʌ/“puhtuhkuh” | 10 | 5.10 | 10.0 |

XX’s productions during the DDK tasks were rhythmic and accurate. Although his time for the production of /tʌ/ and /kʌ/ were slightly below the cut-off times for a child his age, XX demonstrated typical and expected coordination and control of his articulators.

**Connected Speech Sample:**

A sample of XX’s connected speech was recorded when he was asked to describe the movie Toy Story 3. This sample was reviewed by two unfamiliar listeners who rated the first 100 words and answered “yes” or “no” as to if they could determine what he was saying per word. Intelligibility ratings are reflected below in Table 2.

**Table 2. Unfamiliar Listener Intelligibility Ratings of XX’s Connected Speech Sample**

|  |  |
| --- | --- |
| ***Unfamiliar Listener*** | ***Rating out of 100%*** |
| Listener #1 | 76% |
| Listener #2 | 63% |

It was noted that there was a higher level of breakdown at the level of connected speech as opposed to when XX produced words in isolation. This is expected for a child who has speech sound errors due to the complexity and rapidity of connected speech.

***Goldman Fristoe Test of Articulation 2nd Edition (GFTA-2)****:*

The *GFTA-2* is a standardized assessment designed to measure articulation ability of consonant sounds across initial, medial and final positions of single words. This assessment evaluated XX’s speech sound production at the word and sentence level.

XX produced /r/ in error by substituting /w/ in all positions. Blends containing /r/ were produced accordingly: /tr/🡪/tw/, /kr/🡪/kw/, /gr/🡪/gw/, /fr/🡪/fw/.

XX produced a standard score of 92. An average score on this test is based on a mean of 100 and a standard deviation of 15. The confidence interval of 90% places XX in the 15th percentile rank when compared to age matched peers. XX’s score is within one standard deviation below the test mean.

**Table 3. *GFTA-2* Sounds-in-WordsScore Summary**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Raw Score** | **Standard Score** | **Confidence Interval (90%)** | **Percentile Rank** | **Standard Deviation (SD) Below the Mean** |
| x | xx | xx-xx | xxth | Within one SD of the mean |

Portions of the stimulability section of the *GFTA-2* were also administered. This section is intended to determine if the child is able to produce sounds with a direct model that were produced in error during the “sounds-in-words section. All words containing /r/ were produced for XX. For all items, XX was unable to repeat the model given with a distinct /r/.

**Trial Therapy:**

XX demonstrated stimulability for the /r/ phoneme in isolation. Clinicians used the “retroflexed” or “tip /r/” and “back/bunched /r/” techniques to test XX’s production of the /r/ phoneme. The “back/bunched /r/” technique involves the middle portion of the tongue to bunch within the central portion of the mouth, facilitating /r/ production. The “retroflexed/tip /r/” is produced with the tongue tip pointing up and slightly back within the oral cavity. This technique was taught by first having XX produce /l/, a glide consonant created by touching the tongue tip to the alveolar ridge, (the area just behind the upper teeth). XX was then instructed to progressively move the tongue tip further back along the hard palate, until the target area was reached. XX required drawings of tongue placement within the oral cavity as well as specific verbal instruction and modeling from clinicians to practice production of /r/ in isolation. XX was not able to achieve an accurate production or close approximation of /r/ in isolation while attempting the “back /r/” technique. He presented with difficulty consistently using the “tip /r/” technique, but could achieve accurate placement with verbal and visual cuing. He was able to demonstrate accurate production or close approximation of /r/ in isolation intermittently throughout trial therapy using “tip /r/” production.

***Khan-Lewis Phonological Analysis - 2: (This example is based on a different child)***

The *Kahn-Lewis Phonological Analysis-2 (KLPA-2)* is a norm-referenced measure designed to provide an extensive analysis of phonological processes at the word level. This test is a companion tool to the *GFTA-2* and provides additional information about the 53 target words assessed in the *Sounds-in-Words* subtest. This assessment yields normative data for the ten most commonly occurring phonological processes and a qualitative analysis for an additional 34 processes. Phonological processes are sound patterns that children use as they learn the rules of spoken language and are an expected occurrence in the development of speech and language. Examples of phonological processes include: distortions, omissions, and substitutions of phonemes (sounds) in a word. Most of these processes typically resolve on their own by the age of five. The analysis of XX’s performance is summarized in the tables below:

**Table 4. *KLPA-2* Score Summary**

|  |  |  |  |
| --- | --- | --- | --- |
| **Total Raw Score** | **Standard Score** | **True Score Range at 90% Confidence Interval** | **Percentile** |
| xx | xx | xx-xx | 11th |

Within the *Sounds-in-Words* subtest of the *GFTA-2*, XX produced sound substitutions consistent with eight of the ten most common phonological processes as defined by the *KLPA-2*. The chart below provides examples of the phonological processes observed in Aiden’s speech, the percentage of occurrence in the *GFTA-2*, as well as normative data indicating when the phonological processes typically resolve.

**Table 5. *KLPA-2* Sound Changes**

|  |  |  |  |
| --- | --- | --- | --- |
| **XX’s Phonological Processes** | **Examples of XX’s Speech** | **XX’s Percent of Occurrence in Target Words** | **Typical Age that Phonological Process Resolves\*** |
| Deletion of Final Consonants | “cu**p**” 🡪 “cu” | 27% | *Age 2.6* |
| Syllable Reduction | “te**le**phone”🡪“tephone” | 12% | *Age 3.0* |
| Stopping of Fricatives & Affricates:  i.e. substitution of stop consonants or affricates for fricatives | “sho**v**el” 🡪 “sho**b**el” | 13% | *Age 4.6* |
| Cluster Simplification:  i.e. simplification of a consonant sequence | “**sp**oon” 🡪 “**p**un” | 42% | *Age 3.0* |
| Liquid Simplification:  i.e. substitution of /w/ and /j for /r/ and /l/ | “**r**ing” 🡪 “**w**ing” | 42% | *Age 7.0* |
| Velar Fronting:  i.e. substitution of alveolars for velars | “fro**g**”🡪 “fa**t**i” | 11% | *Age 3.5* |
| Initial Voicing:  i.e. substitution of voiced consonant for voiceless consonant in the initial-word position | **“kw**ack”🡪 “**gw**ack” | 8% | *Age 3.0* |
| Final Devoicing:  i.e. deletion of voicing in word-final voiced consonants | “fi**v**e”🡪 “fi**f**e” | 9% | *Age 3.0* |

Cluster simplification, liquid simplification, and deletion of final consonants were the most frequently occurring phonological processes present during the Sounds-in-Words subtest and were subsequently observed throughout the evaluation during unstructured play activities. The *KLPA-2* also revealed additional phonological processes and sound changes that were present in XX’s speech: consonant harmony, stridency deletion, initial devoicing, medial devoicing, gliding of nasals, labialization, frication, and nasalization. The additional phonological processes are summarized in the chart below.

**Table 6. *KLPA-2* Additional Phonological Processes**

|  |  |
| --- | --- |
| **XX’s Additional Phonological Processes** | **Examples of XX’s Speech** |
| Consonant Harmony:  i.e. production of one consonant is affected by the place of articulation of another consonant in the word | “**yellow**”🡪 “ye**y**ow” |
| Stridency Deletion:  i.e. substituting strident phonemes (/f, v, s, z, ʃ“sh”, tʃ “ch”/) for any other consonant | “**v**acuum”🡪 “**b**acum” |
| Initial Devoicing:  i.e. deletion of the voicing in the word-initial voiced consonant | “**z**ipper”🡪 “**s**ipper” |
| Medial Devoicing:  i.e. deletion of the voicing in the word-medial voiced consonant | “wa**g**on”🡪 “wa**k**on” |
| Gliding of nasals:  i.e. replacing nasals (/m, n, and ŋ/) with glides (/w and j/) | “ba**n**ana”🡪 “ba**y**ana” |
| Frication:  i.e. sound substitution of fricatives | “**t**ree”🡪 “**s**i” |
| Nasalization:  i.e. substituting a nasal (/m, n, and ŋ/) consonant for any other consonant | “ba**ll**oons”🡪 “ba**n**oons” |

While these additional sound changes are not characteristic of phonological development, children with typically developing language may use these processes occasionally as they learn adult speech patterns. The frequent occurrence of these phonological processes in XX’s speech may negatively impact his overall intelligibility. Additionally, he experiences communication breakdowns at the phrase level as he verbalizes longer and more complex sentences.

Severe Issues:

***Oral Mechanism Exam:***

An examination of the structure and function of XX’s oral mechanism was conducted to assess symmetry, coordination, range of motion, and strength of the articulators. At rest, XX’s facial musculature was observed to be symmetrical. Several differences were noted during the exam in coordination and range of motion.

XX had difficulty puckering her lips, at first puffing her cheeks out with air, and needed additional cuing to achieve the correct position. Limited range of motion was observed when she was asked to smile. When asked to alternate between a smile and a pucker, XX had a difficult transitioning from one facial position to the other. XX exhibited limited range of motion when asked to move her tongue right and left and up and down. She was observed to turn her whole head to the side to achieve lateral movement, and used her lower jaw to assist in raising her tongue towards her nose. When XX was asked to move her tongue around the outside of her teeth while keeping her mouth closed, she was observed to have marked difficulty coordinating her jaw movement.

When asked to open her mouth and say ‘ah’, the movement of XX’s velum was observed to be reduced and inconsistent in its range of motion. This reduction in movement may have been partially due to the position XX was sitting in during this portion of the exam. With the head tilted back, the velum does not have to move as much to make contact with the posterior pharyngeal wall (back of the throat). However, parent report and observations made throughout the evaluation support inconsistency in XX’s velar movement as she is often observed to have a nasal quality to her voice. This is caused by air escaping up into the nasal passageways as a result of insufficient velar closure.

***Connected Speech Sample:***

During the evaluation, a sample of XX’s connected speech was recorded as she told a story to the clinicians about cleaning up her toys. This sample was reviewed by two unfamiliar listeners who rated the first 100 words on whether or not they could determine what XX was saying. By four years of age children are expected to be 100% intelligible. XX’s intelligibility ratings are provided in the Table 1 below:

**Table 1. Intelligibility Ratings** (Can alternatively be reported in narrative)

|  |  |
| --- | --- |
| **Unfamiliar Listener** | **Rating out of 100%** |
| Listener #1 | x% |
| Listener #2 | x% |

The *Goldman-Fristoe Test of Articulation- Second Edition (GFTA-2)* provides information regarding an individual’s articulation of Standard American English consonant sounds in the initial, medial, and final positions of words. The first subtest, *Sounds-in-Words,* analyzes production at the word level. The second subtest, *Sounds-in-Sentences,* analyzes productions in the context of a story. The *Stimulability* subtest uses the sounds made in error from the previous subtests to assess an individual’s ability to produce those sounds when given a correct visual/verbal model. Stimulability is examined at the syllable, word, and sentence level. The *GFTA-2* score is based on a mean of 100 and a standard deviation of 15. All three subtests were administered. Results of the testing are recorded in the table below:

**Table 2. *GFTA-2* Sounds-in-Words Score Summary**

|  |  |  |  |
| --- | --- | --- | --- |
| **Raw Score** | **Standard Score** | **Confidence Interval 90%** | **Percentile** |
| 38 | 60 | 54-66 | 2nd |

XX had a number of unusual errors on the *Sounds-in-Words* subtest, including the substitution of /bv/ and /dz/ for various consonant sounds (“bvu” for “blue”, “dzis” for “this”), and she had consistent difficulty with all consonant blends. The /r/ sound was noted to be very difficult for XX to produce, although this is considered a later developing sound that can emerge as late as eight years of age. Although vowels are not scored on the *GFTA-2*, XX was observed to distort many of her vowel sounds, and demonstrated a pattern of adding neutral vowel sounds to words, increasing the overall syllable length (“cayadit” for “carrot”). On the *Sounds-in-Sentences* subtest, XX had difficulty coordinating her articulators, and her intelligibility was decreased. XX was able to produce a number of consonant sounds correctly on the *Stimulability* subtest at the syllable, word, and sentence level when given a direct visual/verbal model by the clinician, including /m/, /n/, /w/, and /dʒ/.

As there was no score obtained on the *GFTA-2* from last year’s evaluation, Table 3 compares a selection of XX’s responses to demonstrate changes in her articulation:

**Table 3. Comparison of XX’s *GFTA-2* Productions**

|  |  |  |
| --- | --- | --- |
| **Target Word** | **April 2010 Production** | **July 2011 Production** |
| Spoon | /svuv/ “svoov” | /pun/ “poon” |
| Zipper | /kiʌfo/ “key-a-fo” | /siəpo/ “see-a-poh” |
| Plane | /fei/ “fay” | /pen/ “pane” |
| Fishing | /fliəseɪ/ “flee-a-say” | /fiəsɪŋ/ “fee-a-sing” |
| Jumping | /dʒʌfə/ “juffa” | /dʒʌmpeɪ/ “jum-pay” |
| Pajamas | /pʌsɪz/ “puh-siz” | /pətzaməz/ “put-zamas” |
| Five | /faɪf/ “fife” | / faɪv/ “five” |

As can be seen in the table above, XX has made progress in her articulation of sounds in words as measured by the *GFTA-2*. While her productions are not accurate for the most part, they are much closer approximations to the target words.

***Khan-Lewis Phonological Analysis 2 (KLPA-2):***

The *Kahn-Lewis Phonological Analysis – Second Edition* *(KLPA-2)* is designed as a companion tool to analyze articulation errors made on the *GFTA-2.* It examines phonological processes, and can reveal patterns in a child’s production errors. Phonological processes are rule-governed errors that children make that are used to simplify adult productions. These errors typically resolve on their own as the child matures.

The *KLPA-2* score is based on a mean of 100 with a standard deviation of 15. XX’s standard score on the *KLPA-2* was 59, placing her in the 3rd percentile for her age group. Table 4 provides a description of each of these processes in detail as they pertain to XX’s speech sound production:

**Table 4. KLPA-2 Sound Changes**

|  |  |  |  |
| --- | --- | --- | --- |
| **XX’s Phonological Processes** | **Examples of XX’s Speech** | **XX’s Percent of Occurrence in Target Words** | **Typical Age that Phonological Process Resolves\*** |
| Cluster Simplification:  i.e. simplification of a consonant sequence | “tee” for “tree” | 61% | *Age 3.0* |
| Liquid Simplification:  i.e. substitution of /w/ and /j for /r/ and /l/ | “**r**ing” 🡪 “**w**ing” | 38% | *Age 7.0* |
| Palatal Fronting:  i.e. substitution of alveolars for velars | “orange”🡪 “owid” | 55% | *Age 3.5* |
| Deaffrication:  i.e. Deletion of the feature of “ch” and “j” that requires airflow to stop momentarily | “watch”🡪 “wash” | 50% | *Age 6.0* |

The *KLPA-2* also examines additional phonological processes that are not taken into consideration in calculating the standard score, but can provide important descriptive information about what a child is doing during speech. XX’s additional processes include frication, labialization, addition of stridency, and addition of nasality.

***Kaufman Speech Praxis Test (KSPT):***

The *Kaufman Speech Praxis Test (KSPT)* was developed specifically to identify and evaluate progress in children with characteristics consistent with childhood apraxia of speech (CAS). Items on this test are presented in a hierarchical fashion from simple to complex motor speech movements. The child is asked to imitate the model presented by the clinician administering the test. In this way, it serves to identify the level of complexity at which the child is breaking down and no longer able to coordinate speech movements. Part 1 (Oral Movement) was administered during the oral mechanism exam. Part 2 (Simple Phonemic/Syllable Level) and 3 (Complex Phonemic/Syllable Level) were also administered to XX.

XX’s errors on this assessment included the vowels /ɛ/ “eh”, /ɪ/ “ih”, /eɪ/ “ay”, /aʊ/ “ow”, and /æ/ “a” (as in map), and consonants /b/, /d/, /n/, /r/, “sh”, “ch”, “th” (as in thumb), “th” (as in this), /w/, /l/, and “j”. Once again, consonant blends were difficult for XX, although she was able to imitate almost all blends with additional cuing apart from /r/ blends. XX gave multiple responses for some items on the test, and her productions were observed to improve across multiple attempts (i.e. “topt” then “tot” for ‘tot’). Overall however, XX’s errors seemed consistent even as syllable complexity increased. Table 5 provides an overview of XX’s scores on the *KSPT:*

**Table 5. XX’s *KSPT* Results**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Subtest** | **Raw Score** | **Standard Score (normal)** | **Percentile (normal)** | **Standard Score (disordered)** | **Percentile (disordered)** |
| Oral Movement | 4 | n/a | n/a | 34 | <3 |
| Simple Sound Production | 46 | n/a | n/a | 50 | 3 |
| Complex Sound Production | 43 | n/a | n/a | 90 | 28 |

The *KSPT* was administered to two different populations during its development. The “Normal Sample” consisted of children without a speech impairment, while the “Disordered Sample” consisted of children who had already been identified as speech impaired by an independent speech language pathologist. As a result there are two sets of standard scores reported for this test which allows clinicians to get a better overall picture of a child’s speech development.

***Informal Speech Assessment & Observations:***

Throughout the diagnostic evaluation, informal assessments and observations of XX’s speech were conducted. To further examine XX’s consistency across multiple productions, she was given 10 stimulus items and asked to repeat them each three times. She was consistent in her productions of 9/10 words across three trials. The one word that gave her some difficulty was “pajamas”.

XX’s speech intelligibility varied depending on what sort of task she was engaged in. When she was speaking to the clinicians and there was a supporting context, she was more easily understood. Her intelligibility decreased during connected speech and most notably when she was conversing with yyy during free play; however, practiced words such as “because” were very clear. XX’s mother described her daughters’ speech as “lazy talk” when they play, because it becomes less intelligible to others besides the twins. It is not entirely clear whether XX and yyy revert to “lazy talk” when they are together. Another possibility is they are using more complex language with each other resulting in an increase of distorted sounds. However, because they have such a good understanding of each other’s speech there are fewer breakdowns in their communication.

A number of factors contributed to XX’s decreased intelligibility, including uncontrolled jaw movements, nasality, and epenthesis (the addition of extra syllables). XX’s jaw was observed to have a lateral (side to side) “sliding” quality to it when she spoke. The constant change in the shape of the oral cavity caused by sliding the jaw resulted in distorted consonants and dynamically changing vowel sounds. The nasal quality to XX’s voice likely stems from the inconsistent velar closure observed during the oral mechanism exam. If the velum does not close at the right time, air will escape up into the nasal cavity, resulting in a nasal sounding voice. Conversely, XX had some trouble with sounds that are supposed to be nasal (m, n). These two factors together, point to an overarching difficulty with coordination and timing of the articulators. Finally, the addition of extra syllables made it difficult at times to determine what XX intended to say (i.e. “sigh-didi face” for smiley face).