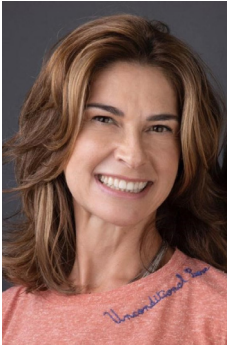


Orthodontic treatment combined with speech therapy using Invisalign First clear aligners for Phase 1 treatment of an early mixed-dentition open bite.



Dr. Nelly Sanseverino (São Paulo, Brazil)

Dr. Nelly Sanseverino (www.sanseverinoodonto.com.br) graduated with a dental degree from the University of Santo Amaro (UNISA) earned her specialty certificate in orthodontics and dentofacial orthopedics from São Francisco University. Dr. Sanseverino is an Invisalign Diamond Elite provider and has treated thousands of patients using Invisalign aligners. As one of the first Invisalign treatment providers in Brazil, she was the first Brazilian doctor to implement Invisalign Teen in Brazil, and she has been a member of Align's LATAM Education Faculty as a global speaker for growing patients since 2017. Dr. Sanseverino is also a professor and consultant at the Center for Specialization in Clinical Speech Therapy (CEFAC), and the author of numerous publications. She is a specialist in temporomandibular joint disorders and has been associated with the Dentistry Federal Council since 1995. She received a master's degree in laser therapy for TMJ disorders and orofacial pain from the University of São Paulo (USP) and a Ph.D. in teenage and children's healthcare from the University of Campinas (UNICAMP). She also lends her expertise to several non-governmental organizations providing dental care to underprivileged children, including the Acaia NGO (Instituto Acaia).

Executive summary:

1. Using Invisalign First aligners to treat anterior open bites at an earlier stage in younger patients will prevent them from getting worse and harder to treat later.
2. Correct dental positions are fundamental to achieving and maintaining a correct and stable orthopedic relationship. Invisalign First aligners enabled us to address the orthodontic problems which lead us to correct and stable orthopedic relationship.
3. Invisalign First aligners leave the palate uncovered throughout Phase 1 treatment, which makes the correction of the patient's tongue position for proper speech.
4. If a malocclusion is associated with functional disorders such as speech difficulty or breathing problems from an abnormal tongue position, multidisciplinary treatment in cooperation with a speech therapist may be needed (**please refer to the supplemental Clinical bonus section**).
5. Defining specific Phase 1 treatment goals from the beginning and effectively communicating these to the patient and parents throughout treatment are key contributors to treatment success.

Additional details about this case can be found online at the Invisalign Gallery: <https://global.invisaligngallery.com/treatment/t-1060/>

Case records:

Initial records:

Age of the patient:
7 years, 2 months old

Sex: Male

Patient/parent's chief concern(s):
"There are big gaps between the front teeth, and we would like him to have a more attractive smile."

Diagnosis:

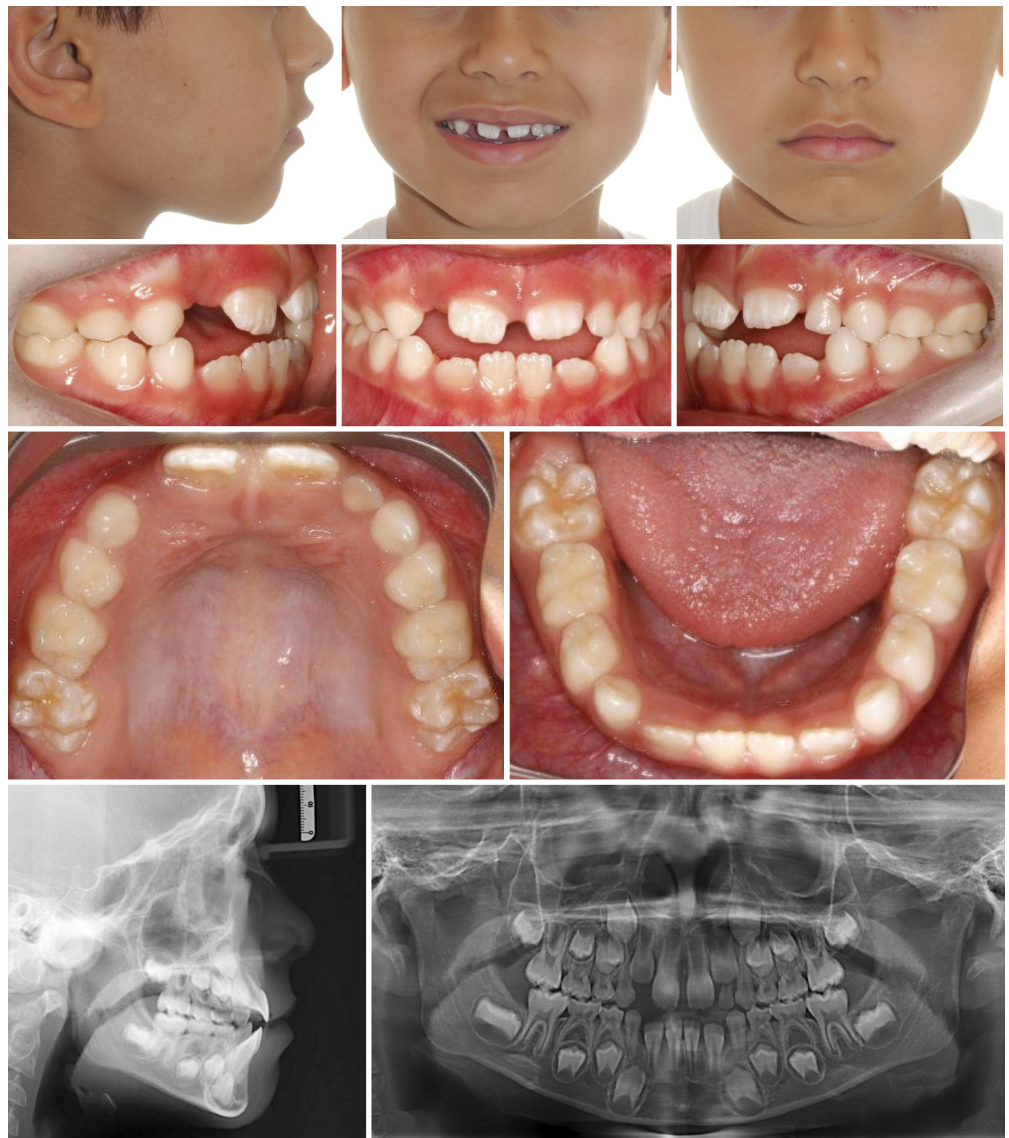
Skeletal

- Balanced facial profile
- Class I skeletal relationship

Dental

- Early mixed dentition (ideal time to start Phase 1 treatment with Invisalign First clear aligners)
- Moderate anterior open bite due to the tongue position during speech, swallowing, and rest. The patient also had a tongue thrust habit.
- Bimaxillary protrusion
- Right:
 - Class I canine relationship
 - Mild Class II molar relationship (mesially rotated)
- Left:
 - Class I canine relationship
 - Mild Class II molar relationship (mesially rotated)
- Upper: Mild upper spacing
- Lower: Moderate lower spacing
- Dental midlines: Centered
- TMJ: Asymptomatic (TMJ disorders in children are unusual and therefore important to note if detected)

Photos and radiographs:



Initial cephalometric measurements¹

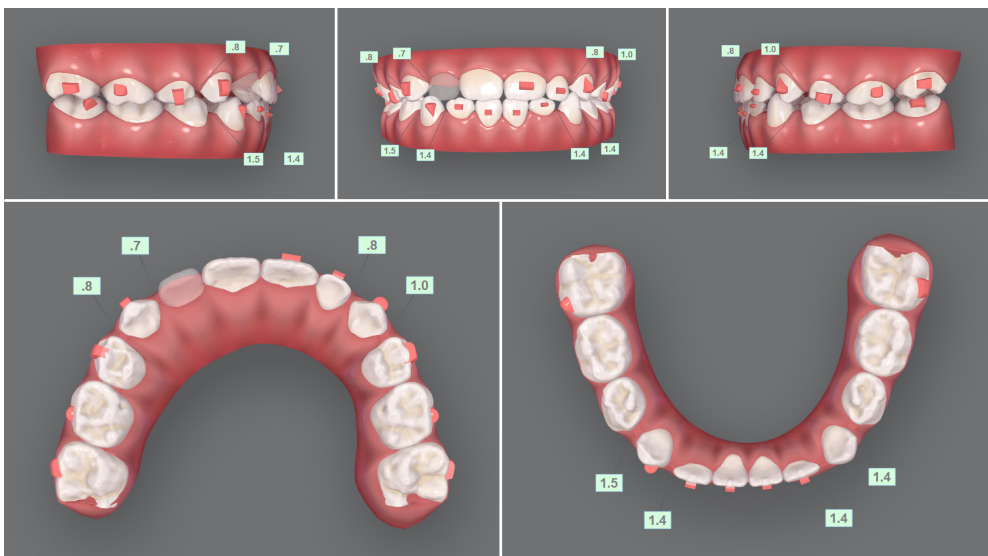
Measurement	Initial	Norm
SNA	76.5°	82°
SNB	73.7°	80°
ANB	2.8°	2°
Interincisal	117°	130°
U1/NA	27.5°	22°
L1/NB	32.7°	25°
FMA (FH/MP)	21.7°	25°
IMPA (L1/MP)	103°	95°

¹To reduce tracing bias, the lateral cephalometric films were re-traced by an independent third party lab (RMO data services).

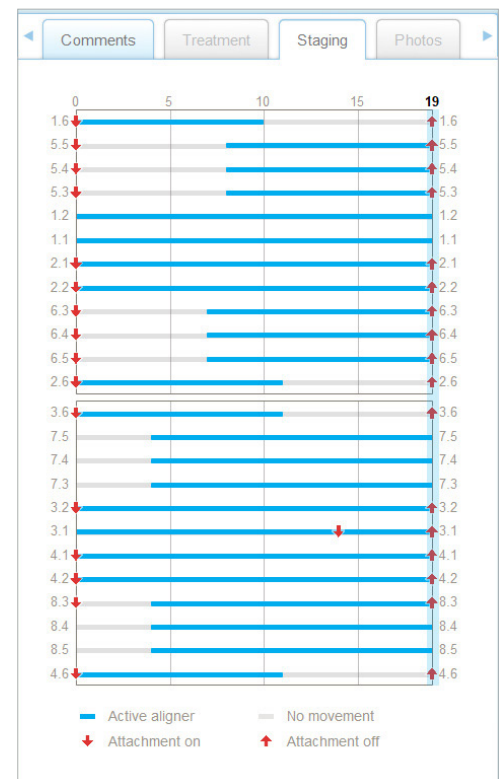
Treatment plan:

- Phase 1 orthodontics to eliminate the upper midline diastema and distribute the space, for normal eruption of the permanent upper lateral incisors to close the open bite. Expand the arches so the tongue does not need to rest as far forward.
 - Rotate the permanent upper first molars distally while the upper diastema is being closed. Stage the expansion by moving the permanent molars first, followed by simultaneous expansion of all the other teeth in the arch.
 - Use Optimized Extrusion attachments to assist in the closure of the anterior open bite. Add posterior attachments as needed to increase aligner retention.
 - Add an Eruption Compensation feature to the aligners for the permanent upper right lateral incisor.
- Speech therapy to normalize the tongue position (fundamental to correcting and stabilizing the malocclusion – see Clinical Discussion section).
- Retain the Phase 1 results with Klammt functional orthopedic appliances (which have reduced acrylic coverage of the palate), and adjust the acrylic as needed when the remaining permanent teeth erupt.

ClinCheck® set-up:



The amount of extrusion of the upper right central incisor was 0.4 mm, so automatic placement of an Optimized attachment was not triggered by the software.



To address the chief concern early, but also to enhance tooth movement control, the aligner staging started with upper diastema closure and distal rotation of the permanent first molars. The other tooth movements in the upper arch did not begin until aligner stage #7.

Progress records:

Months into treatment: 6 months

Aligner stage #:

- Upper #19
- Lower #19 (last stage of the initial series)

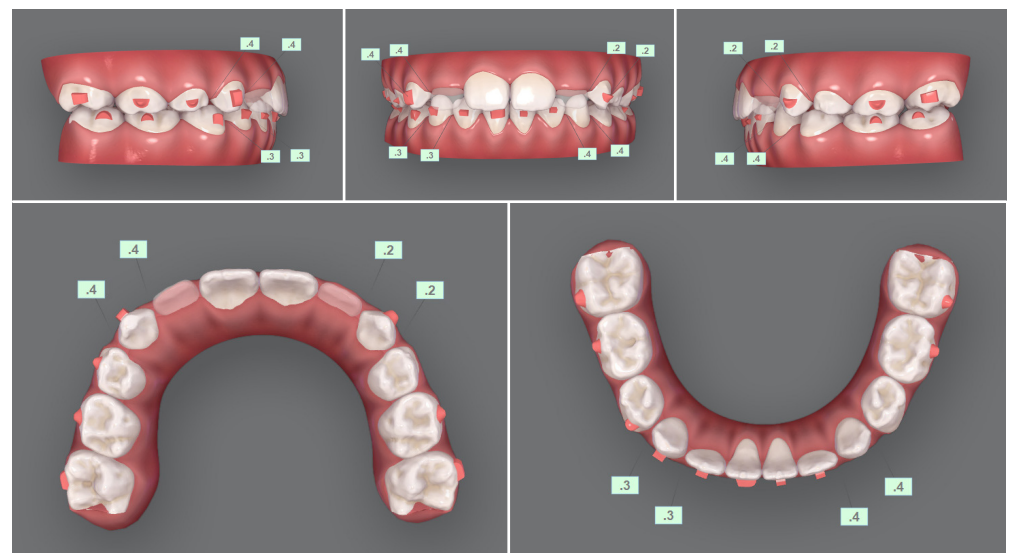
The open bite and upper midline spacing were corrected according to plan with the initial aligner series. The smile was more harmonious, and the parents were very happy with the treatment progress. However, we realized that the overbite could be improved even more, and that the arch width could also be improved to better maintain the correct tongue position, so Additional Aligners were ordered.

Progress photos:



After 6 months (19 U/L aligners), the patient's teeth and bite matched the ClinCheck® treatment goal very closely, but additional overbite and arch width improvements could still be made.

ClinCheck set-up:



ClinCheck set-up for the first set of Additional Aligners to deepen the overbite and widen the upper arch. Speech therapy was highly recommended to help stabilize the patient's tongue posture in a better position, given that he now had increased palatal space for the tongue, and positive overbite as an anterior guide.

Progress records:

Months into treatment: 10.5 months

Aligner stage #:

- Upper #17
- Lower #17

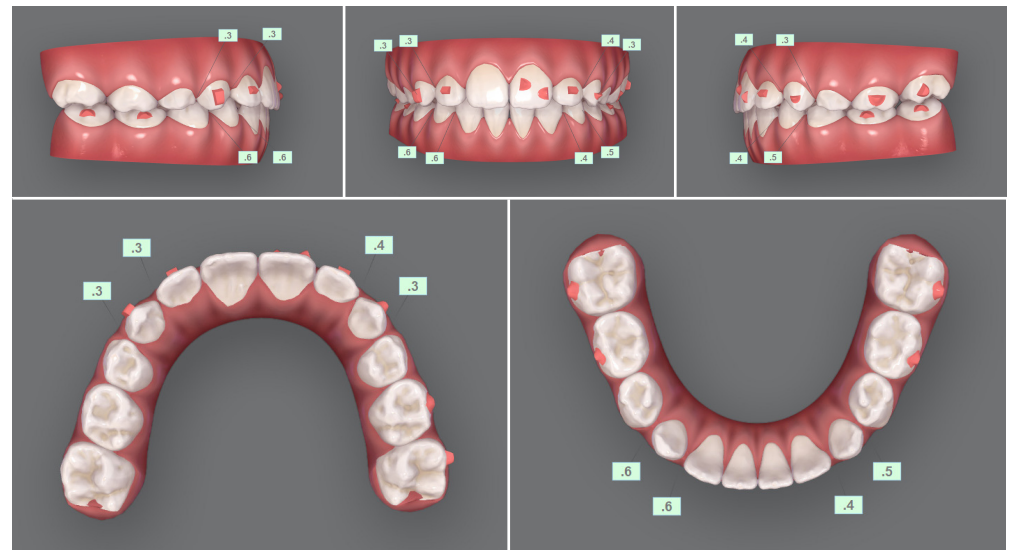
After 4.5 months of Additional Aligners, the shallow overbite was corrected to a normal overbite, the spaces for the permanent teeth to erupt were ideal, and the molar relationship was Class I. To allow the upper lateral incisors to erupt more, we waited 6 months before starting the second set of Additional Aligners.

Progress photos:



6 months after completing the first set of Additional Aligners, the upper lateral incisors were erupted enough to start a second set of Additional Aligners. Lingual crown torque was needed on the upper lateral incisors along with anterior space closure.

ClinCheck® set-up:



Treatment goal for the second set of Additional Aligners, with spaces left around the primary canines for easier eruption of the permanent canines.

End of Phase I treatment records:

Age of patient: 8 years, 11 months old

Treatment length: 14 months (not including 1 month before the initial aligner delivery and 6 months between the first and second Additional Aligners waiting for the upper lateral incisors to erupt more).

Number of aligners used:

- Upper: 19 + 17 + 11 = 47
- Lower: 19 + 17 + 5 = 41

Aligner change interval prescribed (days per aligner):

7-day aligner changes (1-week wear)

Auxiliaries used:

None.

Appointment scheduling:

- 4 sets of aligners were dispensed per visit
- Total number of visits from first aligner delivery to retainer delivery: 13*. The parents in our area feel more confident when we see their children more frequently, so our Phase 1 appointments are scheduled for every 4 to 6 weeks.
- # of Emergency visits: None

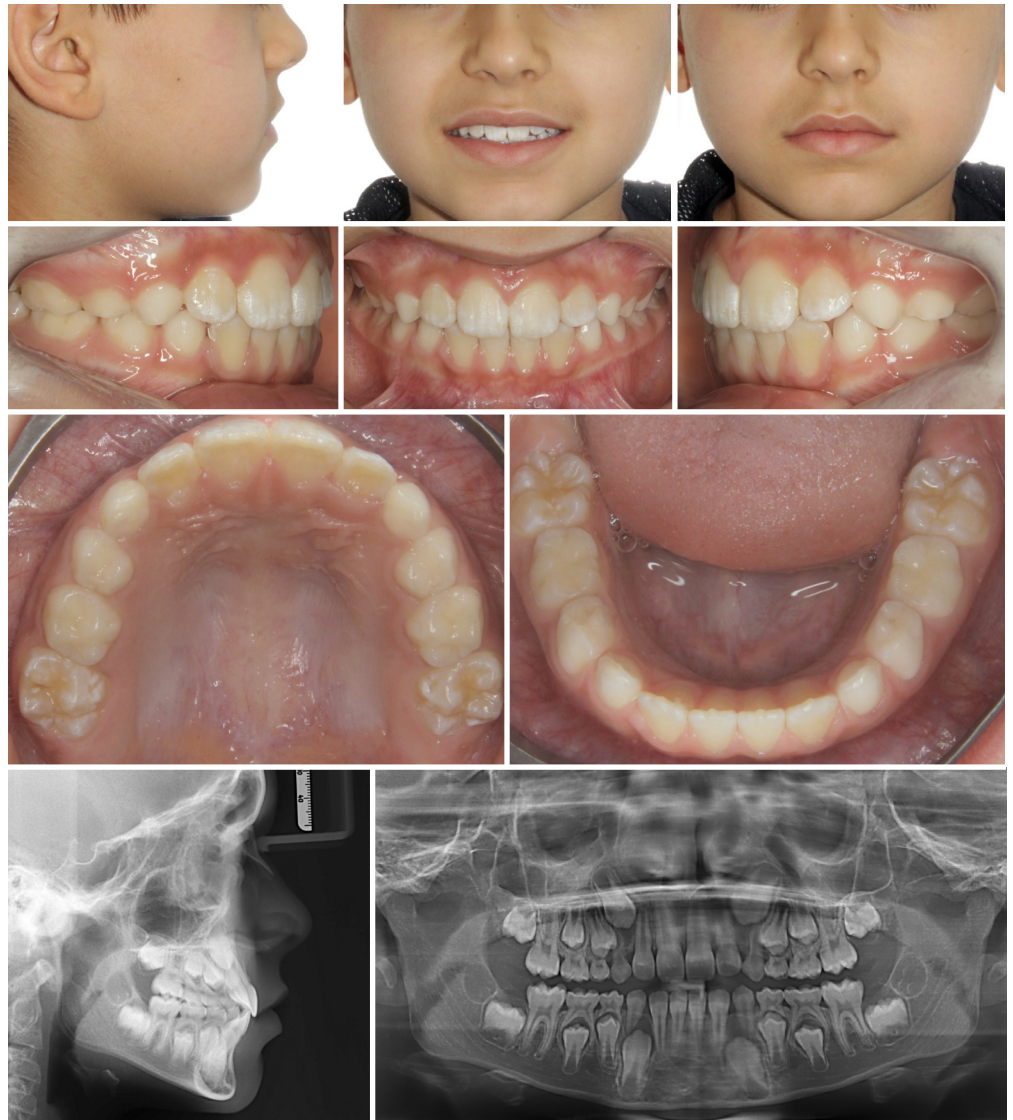
Dental restorations placed during/after treatment:

None.

Retention

- Upper: Klammt functional orthopedic appliance.
- Lower: Klammt functional orthopedic appliance.
- Retention protocol: Night-time use only until speech therapy is finished.
- Follow-up visits: Every 3 months until all the permanent teeth have erupted.

End of treatment photos:



After 3 months with a second set of Additional Aligners (U:11, L:5), the spaces around the incisors were closed.

Initial and final cephalometric measurements²

Measurement	Initial	Final	Norm
SNA	76.5°	74.8°	82°
SNB	73.7°	72.8°	80°
ANB	2.8°	2.0°	2°
Interincisal	117°	117.9°	130°
U1/NA	27.5°	27.6°	22°
L1/NB	32.7°	32.5°	25°
FMA (FH/MP)	21.7°	21.3°	25°
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²To reduce tracing bias, the lateral cephalometric films were re-traced by an independent third party lab (RMO data services).

Clinical discussion

For young patients with speech challenges related to their malocclusion, our responsibility as an orthodontist is to detect and diagnose the problem, treat the malocclusion, and refer the patient to a speech therapist if the patient struggles to develop normal speech. For these patients, interdisciplinary treatment is the best way to achieve predictable results. The speech therapist often uses electromyography for diagnosis and biofeedback for lip and tongue exercises as part of an individualized speech therapy plan for each child. Nasal breathing training may also be needed.

We were able to successfully close the open bite without incisor retraction and redistribute the spaces to appropriate locations for normal permanent tooth eruption. By maintaining the incisor inclination instead of retracting the incisors to close the bite, we did not reduce the anterior space for the tongue position. This is important for treatment stability, because the tongue can push any retracted teeth forward and the open bite can relapse if the tongue space is diminished.

For retention, we used the Klammt functional appliance because it can be adjusted and not disturb the patient's growth. In children, I always prefer functional retention, meaning, finishing the treatment with good occlusion and stomatognathic function. If speech therapy has not yet been completed, we will use a functional appliance as a retention device, but only for a short time, and under the periodic supervision of an orthodontist.

With Invisalign First clear aligners, the palate remained uncovered throughout the entire Phase 1 treatment, which helped the patient correct their tongue position for proper speech. An appliance that covers the palate tends to keep the tongue from learning the correct position while the patient is speaking. Before I started treating patients with Invisalign First clear aligners and was using traditional appliances, the speech therapist frequently requested that a hole be made in our palatal-coverage acrylic appliances, to allow the children to position their tongue better while using the appliances.

Another advantage of using Invisalign First clear aligners for this patient's Phase 1 treatment was the ability to adjust the treatment plan to the patient's rapid dental changes. Since the patient's teeth responded very nicely to the first series of aligners, we continued to deepen the overbite with Additional Aligners. After the upper lateral incisors erupted, a small diastema also appeared, so we easily closed it with a few more aligners. Our younger patients tolerate intraoral scanning for Additional Aligners very well, so having the iTero® scanner in my office lets us order Additional Aligners conveniently, and without much delay in the treatment. We are also able to easily add aligner features like Eruption Compensations as the primary teeth exfoliate.

Establishing proper expectations with the parents about what their child can experience during Phase 1 is important for maintaining a good connection with them throughout treatment. Letting them know that Additional Aligners may be needed to reach the treatment goal is also important. They also need to know that leaving spaces in between teeth at the end of Phase 1 is completely normal, in order for the remaining permanent teeth to erupt without interference. We will explain these details to the parents from the start, and remind them periodically along the way, so that they are not surprised later. The patient and parents were satisfied with the results and happy because the length of the treatment was much shorter than they expected. Based on what they heard from friends and what they saw with treatments from family members, they thought the malocclusion and speech problems would have taken longer to resolve.

Invisalign First treatment is my preferred way to treat orthodontic disorders as I can correct dental positions in growing patients which is, in my belief, fundamental to achieving and maintaining a correct orthopedic relationship. In this case, Invisalign First clear aligners definitely helped me optimize the results with precision and efficiency.

Clinical bonus section: Interceptive orthodontic treatment and speech development

Dr. Nelly Sanseverino (São Paulo, Brazil)

The production of different speech sounds occurs when physical barriers are formed between the tongue, teeth, cheeks, and lips. During growth and development, the interaction between these parts within the oral cavity is reinforced and refined in order to clearly differentiate the different sounds used during speech. If this interaction is disrupted due to an imbalance or impairment, then normal speech development can be delayed.

We can therefore say that the role of the tongue and teeth is fundamental for the correct development of speech sounds. The location and position of the tongue when the lips touch whenever we are not talking is also very important. Ideally, the tip of the tongue will be positioned on the upper palatine papilla at rest, which helps keep the mouth closed and also allows the patient to breathe through their nose instead of through their mouth. Constant disruption of this ideal tongue position may lead to chronic mouth breathing, which can lead to negative effects on the teeth (e.g., supraeruption and open bite tendency) and the surrounding oral mucosa (e.g., dryness, infections from cracked skin).

The proper positioning of the teeth, and the correct spatial relationship between the maxilla and the mandible, are essential for the tongue to have the right balance of space and barriers in the oral cavity during the production of speaking sounds. For example, when we are trying to speak the /ka/ sound, the back of the tongue needs to rise and touch the hard palate, whereas when we are trying to pronounce the /ta/ sound, the tip of the tongue needs to rise and touch the upper palatine papilla. If the tongue is unable to reach either structure easily, or if a proper barrier cannot be formed between the tongue and the structure, then key speech sounds will be affected.

Some speech problems occur due to a lack of adequate mobility of the tongue due to the attachment location of the lingual frenulum. For example, a shortened tongue due to an improper frenulum insertion can alter speech due to a lower position of the tongue in the oral cavity. Lingual frenulum attachment problems can also affect infants when an inability to raise the tongue prevents proper attachment to the mother's breast for normal breastfeeding. In Brazil, a neonatal tongue screening test has been instituted, which is performed while newborns are still in the maternity ward, to identify problems with the lingual frenulum early. When a problem is detected, a frenectomy is performed immediately so that normal breastfeeding can be restored.

Language acquisition starts at 6 months of age through the babbling of babies, and is completed at around 7 years of age, which is around the initial mixed dentition phase of dental development. When we talk about form and function, we have to be aware that the two always go together, and that one depends on the other for proper performance. When the teeth are nicely aligned and the oral cavity allows the tongue to move freely, correct movements performed by the tongue during speech production will be easier to achieve. As such, orthodontic and facial orthopedic treatment performed as soon as a potential speech problem is detected will allow language acquisition to occur with less interference and fewer compensations.

Orthodontic conditions that can pose speech development challenges include open bites, excessive spacing, excessive overjet, and severe negative overjet. Each of these situations keep the tongue from interacting with the teeth to form the barriers needed for proper sound formation. Children who constantly breathe through their mouths also tend to keep their tongues low in the oral cavity. They may have dark circles around their eyes and a longer face. In younger children, saliva accumulation in the mouth and saliva escaping during speech are also common with mouth breathers.

Certain orthodontic appliances may also pose speech challenges as well. Specifically, anything that constricts the tongue space or prevents the tongue, lips, and cheeks from maneuvering around the teeth in a comfortable and timely manner can have an impact on speech. To minimize interference with speech development, we prefer to use orthodontic appliances that have minimal palatal coverage and minimal protrusion, so that the tongue does not have to adapt to a constricted space. Smooth appliances are also preferred over appliances with sharp edges, because the tongue and the lips will naturally try to avoid anything with sharp edges.

As health professionals, we have to study each case carefully and diagnose the problem first. We want to understand what triggered the problem. For example, there is no point for a speech therapist to work correcting the position of the tongue if the patient's palatal width is constricted, if the lingual frenulum is short, or if an anterior open bite is present. In general, the form must be corrected first to restore the function so that the therapist can achieve better results. But having the proper function at the end of the orthodontic treatment is also essential. Once the problem and root cause are identified, we will talk to the parents and request an evaluation by a speech therapist in order to jointly determine the best time to start speech therapy. There is no rule for when to begin speech therapy. Timing really depends on each child and each problem.



The patient's problematic lower resting initial tongue position.



The patient's tongue in an improved position after correction of the malocclusion and speech therapy.

Clinical bonus section: Interceptive orthodontic treatment and speech development (cont.)

Dr. Nelly Sanseverino (São Paulo, Brazil)

As previously mentioned, form and function always go hand in hand and are interdependent. When the correction of the skeletal bases and the positioning of the teeth does not occur, speech and chewing and swallowing can function inappropriately or even contribute to the worsening of the condition. This is an evolving process, so early treatment is essential for the proper development of the entire stomatognathic system in children.

Observation of the following clinical conditions are useful to note when considering a referral to a speech therapist:

1. High and narrow palate where the tongue does not fit properly
2. Protrusion of the incisors
3. Presence of an anterior or posterior open bite
4. Low tongue posture during the speech, swallowing, and rest
5. Inability to place the dorsum of the tongue on the palate (check for attachment of the lingual frenulum near the tip of the tongue)
6. Accumulation of saliva in the mouth
7. Saliva leakage when speaking
8. Open mouth posture
9. Phoneme exchange errors (pronouncing words using the wrong sound). The most frequent speech problem with anterior open bite malocclusion is replacing the “s” and “z” with a “th” sound).
10. Difficulty in pronouncing certain sounds
11. Mouth breathing (also check for dry perioral mucosa)
12. Recurrence or relapse of malocclusion after being treated with orthodontics/facial orthopedics (suggests that speech musculature imbalance may be contributing to instability of the occlusion).
13. Lipping (a very common condition in children, with numerous reasons why they develop it. However, if the child continues lipping by the age of seven, professional speech assistance should be sought, because the longer the delay before treating the problem, the harder the problem will be to correct)

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 submit.InvisalignGallery.com