IOF | International Orthodontics Foundation Clinical Showcase
LEARNING & REFLECTION

2026
FEB 03-06
KU Leuven University, Belgium

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Showcase stop 14
Treating medically complex cases with clear aligners

Dr. Sonia Coman, an orthodontic resident and Ph.D. student from KU Leuven, Belgium, presented two excellent case presentation under the theme “Treating medically complex cases with clear aligners”, followed by related discussions.

Case 1

Amelogenesis Imperfecta

Presenter: Dr. Sonia Coman

01 Basic Case Information

Female patient, who was 12 years and 1 month old at initial orthodontic visit

Chief Complaint: Referred from the Department of Prosthetic Dentistry for posterior bite opening to create space for posterior crowns.

Medical history: Healthy; no allergies, no relevant medication or dental trauma. Diagnosed with amelogenesis imperfecta (AI), primarily affecting the palatal/lingual surfaces of incisors, canines, and premolars.

Dental history:

- Aug 2014 First contact with pediatric dentist. No enamel on deciduous teeth. Diagnosed as hypoplastic and hypocalcified AI. Pediatric dentist recommended to monitor until all incisors have erupted, followed by composite veneer on anterior teeth.
- Dec 2015 Composite restorations on 16, 26, 36, 46; composite veneers on 11, 21; glass ionomer restorations on 55, 65; extraction of 74, 84. Due to the complexity of this case, all treatments were completed under general anesthesia.
- Jun 2016 Composite restorations on 12, 22.
- Aug 2017 Composite restorations on 31, 32, 41, 42; stainless steel crown on 36
- Sep 2019 Referred from Department of Prosthetic Dentistry to Department of Orthodontics.

Clinical examination
Extraoral analyses

- Symmetrical face
- Central, medial and lateral equal fifths
- Leptoprosopic face shape
- Long face
- Increased midfacial height
- Lip competence
- Nasal breathing
- Maxillary canine line parallel to interpupillary line
- Convex profile, nasolabial angle>90°
- Normal mentalis fold
- Hyperdivergent
- Reduced incisor proclination
- Full exposure of upper incisors when smiling
- Maxillary dental midline aligned to facial midline
- 2mm gummy smile
- Small buccal corridors

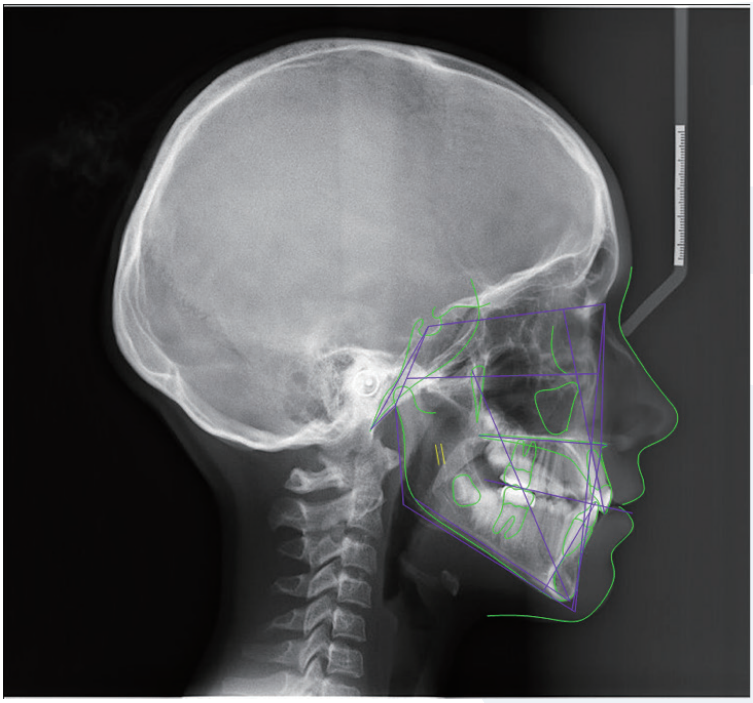
Intraoral analyses

- Late mixed dentition
- AI affected canine and premolars, as well as palatal/lingual surfaces of incisors
- Molar relationships: ½ cusp disto-occlusion on the right, ¼ cusp disto-occlusion on the left
- Canine relationships: ¼ cusp disto-occlusion on both sides
- Overjet: 1mm; overbite: 4.5mm
- Mandibular dental midline aligned to maxillary dental midline
- Pronounced Curve of Spee
- Overeruption of upper and lower incisors

- Spacing between 13-14-15, 24-25, and 44-45
- Suboptimal oral hygiene with generalized gingivitis; visible calculus on maxillary second premolar and first molar
- Frenum and tongue within normal limits
- Reduced incisor inclination

Panoramic radiograph

Cephalometric analyses (Steiner & Downs Methods)



- Skeletal Class I relationship
- Hyperdivergent
- Vertical growth pattern
- Reduced maxillary incisor proclination
- Normal mandibular incisor proclination
- Clockwise rotation of occlusal plane

Steiner	Measurements	Norm
SNA	81°	82° +-4
SNB	77°	80° +-4
ANB	4°	2° +-3
+1 to NA	13°	22° +-7
-1 to NB	25°	25° +-5
+1 to -1	138°	131° +-8
Occl to SN	41°	14° +-4
GoGn to SN	41°	32° +-1
Wits	-1mm	0mm +-1
TWEED Mnd I	88°	88° +-1

Downs skeletal	Measurements	Norm
Facial Angle	83°	88° +-4
Angle of convexity	9°	0° +-5
A-B Plane Angle	-5°	-5 +-4
Mandibular plane angle	34°	22° +-3
Y to FH	64°	59° +-4
Downs dental	**Measurements**	**Norm**
Cant of occlusal plane	14°	9° +-4
+1 to -1	138°	135° +-6
-1 to occlusal plane	18°	15° +-4
-1 to mandibular plane	-2°	1° +-4
+1 to APg	5°	3° +-2

02. Treatment Goals

- To procline front teeth
- To open posterior occlusion to provide sufficient restorative space

03. Treatment Plan

Given the presence of amelogenesis imperfecta, fixed appliance treatment posed several concerns:

1.Relatively soft enamel may increase the risk of relatively frequent bracket debonding.

2.Irregular enamel surface may compromise bracket positioning and bonding.

3.Debonding may affect the remaining enamel.

Clear aligner was therefore selected.

04. Treatment Progress

After intraoral scanning, the clear aligner treatment plan was designed with the following technician instructions:

1.Avoid extrusion of posterior teeth, preferably no posterior movement

2.Procline incisors without intrusion

3.Avoid placing attachments on teeth affected by amelogenesis imperfecta

4.Design heavy occlusal contact on front teeth to open posterior occlusion by at least 2mm

There were 14 trays for this treatment phase.

Post-treatment evaluation showed improved incisor proclination and partial posterior disocclusion. However, the Department of Prosthetic Dentistry thought the space was insufficient for posterior crowns. Therefore, attachments on teeth were removed, and second clear aligner phase was initiated.

Technician instructions for the second phase:

1.Further incisor proclination without intrusion

2.Allow potential distal spacing of lateral incisors

3.Continue heavy occlusal contact on front teeth to open posterior occlusion by at least 2mm

There were 10 trays for the second treatment phase.

05. Orthodontic Treatment Outcome

Post-treatment evaluation demonstrated:

- Improvement of deep overbite
- Adequate posterior restorative space achieved

06. Prosthodontic Treatment Plan

The patient was referred back to the Department of Prosthetic Dentistry for crown restorations.

1. Digital wax-up fabrication
2. Minimally invasive crown preparation
3. Interim phase with provisional crowns on canines and premolars
4. Final restoration with lithium disilicate crowns on canines, premolars and molars

Unfortunately, we did not collect any post-prosthodontic records. Provisional crowns were shown in these photos.

07. Discussion

Amelogenesis imperfecta (AI) is a rare inherited genetic disorder caused mutations in genes such as AMELX, ENAM, MMP20, and FAM83H. The main types include hypoplastic, hypocalcified, hypomaturation, and mixed types. Clinically, affected teeth often present with enamel discoloration ranging from white and yellow to brown, fragile and rough tooth surfaces, rapid tooth wear, tooth sensitivity and a variety of associated esthetic and functional problems.

Patients with AI usually exhibit thicker and more fibrotic gingival tissues, which may contribute to delayed tooth eruption and impacted tooth. In addition, anterior or posterior open bite may be seen, partly as a consequence of eruption disturbances and difficulties in occlusal establishment. Related genes may also affect craniofacial development, particularly by increasing the lower anterior facial height, therefore predisposing patients to or exacerbating patient's open bite. Furthermore, due to tooth sensitivity, patients may develop protective tongue habits, such as shielding the teeth with the tongue to reduce thermal stimuli, which over time can lead to tongue thrust habits, abnormal tongue posture, and atypical swallowing patterns, ultimately contributing to the development or progression of open bite.

AI may occur as an isolated condition or in association with various syndromes, including Jalili syndrome (cone-rod retinal dystrophy combined with AI) and EDHFH syndrome (enamel dysplasia with hamartomatous atypical follicular hyperplasia syndrome). Dental practitioners should therefore screen for associated systemic findings (e.g., visual impairment, atypical hyperplastic dental follicles) and initiate early referral when indicated.

Tooth sensitivity in patients with AI may lead to avoidance or reduction of tooth brushing, resulting in compromised oral hygiene. Additionally, for esthetic reasons, the margins of anterior composite veneers are placed subgingivally, further complicating plaque control. Therefore, regular oral hygiene monitoring is recommended. Dr. Coman recommends the use of plaque disclosing agents to visualize plaque accumulation and enhance toothbrushing efficacy.

Considering the compromised enamel quality in this patient, clear aligner was selected. One major advantage of this approach is the reduced need for bracket bonding. In the present case, attachment placement was intentionally minimized on teeth affected by AI; however, in general, bonding attachments to affected teeth is feasible. Although attachments can be bonded to AI-affected teeth if a thin enamel layer remains and surface preparation is adequate, attachment failure remains more frequent than in normal enamel, requiring careful monitoring.

Due to compromised enamel quality, many patients with AI have some restorative treatment completed prior to orthodontic referral. When attachments must be bonded to teeth with composite restorations, meticulous surface preparation is required. This includes mechanical roughening of the bonding area using diamond burs or sandblasting, followed by etching, application of bonding agents, and conventional attachment placement. When performed properly, the bonding procedure does not differ substantially from that used in patients with healthy enamel.

Clear aligners may also provide thermal insulation, thereby reducing tooth sensitivity and improving patient compliance. While correction of malocclusion is important in patients with AI, the primary objective of orthodontic treatment is to position teeth optimally in order to maximize subsequent restorative outcomes. In this case, anterior proclination and extrusion were preferred over intrusion to manage deep bite. However, the expression of anterior extrusion and deep-bite correction was suboptimal. Dr. Van Elst proposed several contributing factors: first, attachment placement was deliberately limited to protect compromised enamel, resulting in reduced anterior tooth control; second, the biomechanical efficiency of clear aligners is inherently less than 100%, necessitating planned overcorrection and close clinical monitoring; and third, in cases of insufficient tooth movement efficiency, the use of temporary anchorage devices (TADs) may be considered. Ultimately, for this patient, orthodontic treatment alone did not completely resolve the deep bite, and subsequent crown restoration played a primary role in achieving definitive occlusal correction.

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Case 2

16 congenitally missing teeth

Presenter: Dr. Sonia Coman

01.Basic Case Information

Female patient, who was 14 years and 1 month old at initial orthodontic visit.

Chief Complaint: Referred by a general dentist for esthetic improvement and pain during mastication

Medical History: Healthy; denied allergies, relevant medication use, and dental trauma history. Diagnosed with oligodontia, congenitally missing 16 permanent teeth

Extraoral analyses

- Symmetrical face
- Central, medial and lateral equals fifth
- Mesoprosopic face shape
- Competent lips
- Nasal breathing
- Convex profile, biprotrusive profile
- Nasolabial angle < 90 degree
- Hyperdivergent
- Normal mentalis fold
- Normal lip relationship
- Increased incisor proclination
- Full incisor display on smiling
- 1mm gummy smile
- Mesial of tooth #11 aligned to facial midline
- Maxillary canine line parallel to interpupillary line

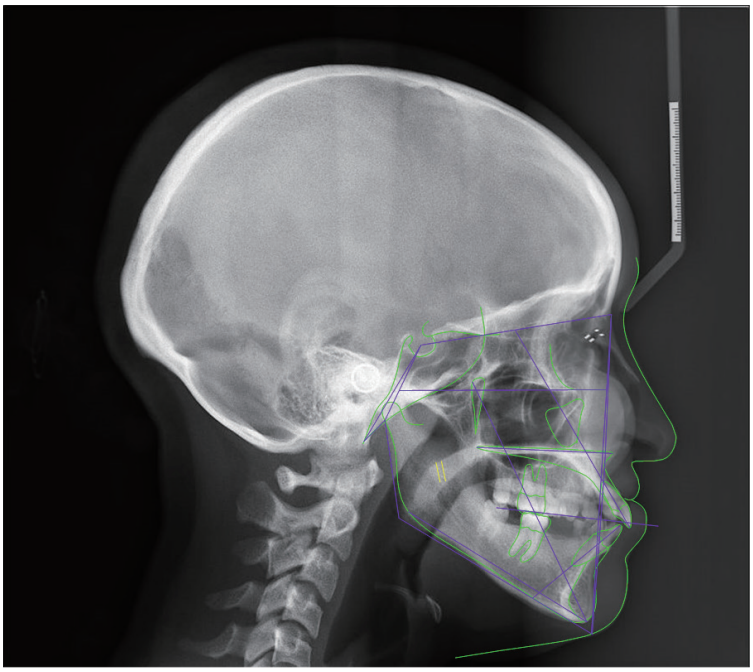
Intraoral analyses

- 16 congenitally missing permanent teeth; 11 retained primary teeth
- Increased incisor proclination with generalized spacing
- Molar relationships: neutron-occlusion on the right, ¾ cusp mesio-occlusion on the left
- Overjet: 5mm, overbite: -1mm
- Mesial of tooth #11 aligned to facial midline
- Mandibular dental midline deviated 3mm to the left
- Good oral hygiene
- Strong tongue muscle with tongue thrust habit

Panoramic radiograph findings

- Congenital absence of 16 permanent teeth: 13, 14, 15, 23, 25, 31, 32, 33, 34, 35, 37, 41, 42, 43, 44, 45

Cephalometric analyses (Steiner & Downs Methods)



- Skeletal Class I relationship
- Retroposition of maxilla and mandible
- Slightly increased proclination of maxillary and mandibular incisors
- Hyperdivergent, vertical growth pattern

Steiner	Measurements	Norm
SNA	78°	84.6° +-3.6
SNB	77°	81.0° +-3.2
ANB	1°	3.7° +-2.0
+1 to NA	33°	28.8 +-7.0
-1 to NB	40°	38.0° +-7.2
+1 to -1	107°	109.5° +-10.3
Occl to SN	16°	15.2° +-4.6
GoGn to SN	41°	32.0° +-6.4
Wits	-1mm	0mm +-1
TWEED Mnd I	109°	102.5° +-8.4

Downs skeletal	Measurements	Norm
Facial Angle	85°	89.8° +-2.7
Angle of convexity	-1°	8.9° +-5.1
A-B Plane Angle	0°	-4.8 +-3
Mandibular plane angle	32°	25.1° +-5.6
Y to FH	61°	58.8° +-3.4
Downs dental	**Measurements**	**Norm**
Cant of occlusal plane	8°	5.8° +-3.6
+1 to -1	101°	109.5° +-10.3
-1 to occlusal plane	43°	31.8° +-7.2
+1 to APg	11°	11.2° +-2.6

02.Treatment Objective

- Position teeth appropriately to facilitate future implant placement and restorative treatment

03.Treatment Plan

Clear aligner was selected due to:

1.Good patient compliance

2.High risk of archwire fracture with fixed appliances due to large edentulous spaces

3.Avoidance of bonding brackets on primary teeth

Because the patient is relatively young and still growing, long-term retention after orthodontic treatment was anticipated. The long-term plan included preservation of retained primary teeth as long as possible, autotransplantation of tooth #27 to the mesial of #36 after orthodontic treatment, and use of removable partial dentures supported by #36, #73, #84, #46, and #47 until implant placement became feasible.

04.Treatment Progress

Pain during mastication was attributed to extensive caries on tooth #54. Symptoms were resolved after extraction tooth #54.
Digital scan was performed and the aligner treatment plan was designed with the following technician instructions:

1.Maintain neutro-occlusion on the right side

2.Mesialize tooth #26 to achieve neutro-occlusion with #36

3.Perform virtual extract tooth #65

4.Retract maxillary and mandibular anterior teeth

5.Correct midline discrepancy

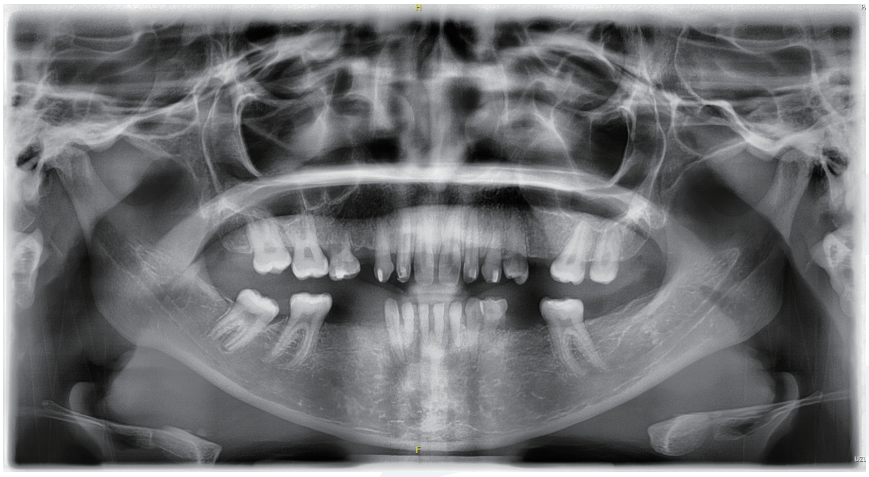
6.No use of elastics required

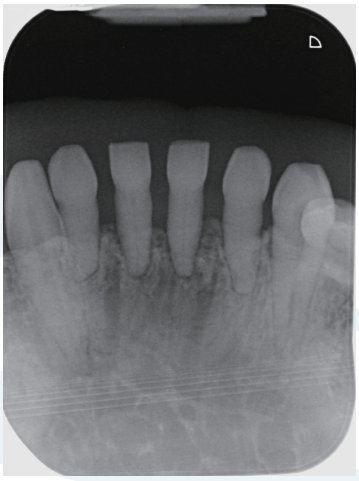
7.Avoid precision cuts

There were 25 trays for this treatment phase.

05.Orthodontic Treatment Outcome

- Bilateral Class I molar relationships achieved
- Incisor retraction accomplished





However, panoramic imaging revealed mesial tipping of teeth #16, #17, #26, #27, and #47. Periapical radiographs showed no significant root resorption of primary mandibular incisors, allowing for a second orthodontic phase.

Second phase objectives:

1.Upright molar roots

2.Mesialize tooth #24 to achieve neotro-occlusion with #74

3.Increase torque on tooth #16 and #26

4.Retract lower incisors slightly more

The treatment plan has been finalized, but treatment has not yet resumed.

06.Discussion

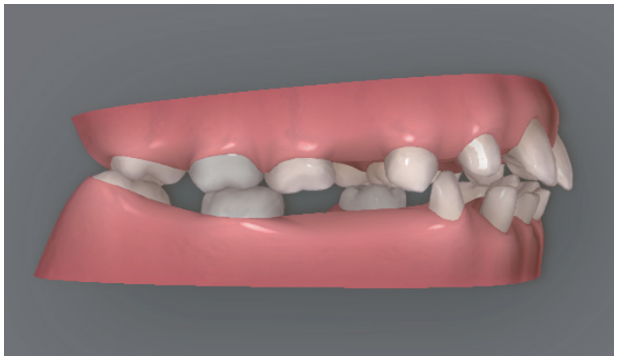
Oligodontia is defined as the congenital absence of six or more permanent teeth, excluding third molars. Owing to the absence of multiple permanent teeth, affected patients may present with esthetic concerns, impaired mastication, speck difficulties, and abnormalities in jaw development. Management of oligodontia typically requires a multidisciplinary approach, most commonly involving orthodontics, prosthodontics, and oral surgery. The orthodontist is responsible for positioning the remaining teeth appropriately, the surgeon for implant placement, and the prosthodontist for definitive crown restoration.

Oligodontia may occur as an isolated condition or in associated with various syndromes, including ectodermal dysplasia, Axenfeld-Rieger syndrome, Witkop syndrome, Ellis-van Creveld syndrome, and branchio-oculo-facial syndrome. Dr. Coman placed particular emphasis on ectodermal dysplasia, an X-linked or autosomal recessive disorder that affects the development/homeostasis of two or more ectodermal structures, including hair, teeth, nails, and certain glands. Common clinical features include fine and sparse hair, reduced or absent eyelashes, reduced sweat and sebaceous glands, fewer or conical teeth, decreased lower facial height, missing salivary glands, and nail abnormalities. Therefore, when dental practitioners encounter patients with extensive congenital tooth absence, it is recommended to evaluate for accompanying dental abnormalities (such as conical teeth or taurodontism) as well as non-dental manifestations, in order to facilitate early diagnosis of associated syndromes and prompt referral for appropriate management.

At KU Leuven, a structured treatment timeline is followed for patients with oligodontia. Around the age of eight, during the mixed dentition stage, an initial panoramic radiograph is obtained to establish the diagnosis. At this stage, clinical measures may be implemented to maintain vertical facial height. During the permanent dentition phase, temporary restorative solutions may be provided to delay definitive treatment as long as possible. Once craniofacial growth is complete and the patient becomes eligible for implant placement, a comprehensive interdisciplinary treatment sequence is initiated, consisting orthodontic treatment, implant placement, and prosthetic restoration.

In this case, clear aligner offered several advantages. First, the patient exhibits extensive congenital tooth absence and is in adolescence, a period during which esthetic demands are relatively high. Clear aligners allow for the incorporation of pontics within edentulous spaces, thereby improving esthetics during orthodontic treatment. In addition, aligners help avoid certain limitations associated with fixed appliances, such as bonding braces to primary teeth and the increased risk of archwire bending or fracture in the presence of long edentulous spans. Furthermore, because the patient requires multidisciplinary care and might need additional tooth movement during subsequent treatment phases, clear aligners provide greater flexibility for adaptive orthodontic intervention.

Analysis of the orthodontic treatment outcomes reveals that mesial movement of teeth #11 and #21 was relatively successful, with a marked reduction in the interproximal space and near-normalization of crown inclination. In contrast, tooth #47 exhibited pronounced mesial tipping. According to Dr. Van Elst, teeth #11 and #21 demonstrated distal crown inclination prior to treatment, making mesial tipping during aligner therapy relatively easy to achieve, even in the absence of attachments. When teeth are initially more upright, attachment placement may be required to achieve adequate root control. In the case of tooth #47, a possible scanning error resulted in a significantly shorter virtual crown in the treatment setup compared with the actual clinical crown, leading to insufficient aligner coverage. Combined with an upright root position and the absence of attachments, this discrepancy likely caused uncontrolled mesial tipping rather than bodily movement. Correction of such movement patterns is relatively challenging and may require the use of attachments, power arms, temporary anchorage devices (TADs), or segmental arch mechanics in subsequent treatment phases.



(As shown in the figure, the virtual representation of tooth #47 in the treatment plan did not correspond to the patient's actual intraoral condition.)

Given the patient's young age, implant placement and definitive prosthetic treatment may not be feasible for several years following completion of orthodontic treatment, making retention strategy critically important. Dr. Van Elst recommends first discussing retention preferences with the patient; however, she personally favors the use of fixed retainers in the anterior segment, combined with pontics in edentulous spaces and adjunctive removable retainers. Considering the patient's tongue thrust habit, persistent tongue pressure on the anterior teeth is possible. Fixed retainers can help prevent reopening of anterior spaces and may also reduce mobility of retained primary teeth.

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