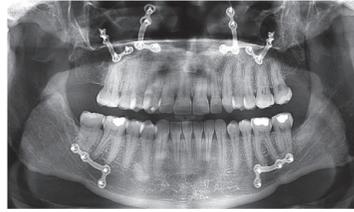


VII. Panoramic radiograph after treatment

VIII. Cephalometric radiograph after treatment


The Invisalign System provides an effective alternative to conventional braces and, in conjunction with surgery, is effective in treating Class III malocclusion and crossbites. Being removable, the Invisalign aligners enable patients to maintain proper oral hygiene and can facilitate effective healing following surgery.

IX. Start of the additional aligner ClinCheck treatment plan


orthognathic surgery is possible and much more accurate in comparison to other modes of treatment such as conventional braces. This is extremely convenient for both the patient and the treating team and can allow for better treatment planning and surgical timing.

- Although not done in this case, the doctor recommends that three extra aligners be used following surgery to ensure that no detrimental movements occur during the healing process, prior to the start of post-surgical treatment with the Invisalign System. It also ensures that fresh clean aligners are used, especially considering aligners are instructed to be worn during eating immediately post-surgery.
- After surgery, the aligners should not be removed for a few days to facilitate healing. After initial healing of surgical wounds, the patient can resume oral hygiene practises and consume food without the aligners in place.
- It is recommended that a scan or a polyvinyl siloxane (PVS) impression be taken at least 6 weeks after surgery to ensure that there is optimal access to the dentition and to minimise discomfort to the patient. This time period is important for ensuring that healing and stabilisation of the occlusion occurs with controlled elastic use.
- The use of bonded buttons allows for intermaxillary fixation via elastics.

Buttons on each tooth gives the surgeon and orthodontist the flexibility to deliver the most appropriate elastics; for example, posterior box elastics, class correction elastics and/or midline elastics, as used in this case.

Impact on clinical practice

The Invisalign System provides an effective alternative to conventional braces and, in conjunction with surgery, is effective in treating Class III malocclusion and crossbites. Being removable, the Invisalign aligners enable patients to maintain proper oral hygiene and can facilitate effective healing following surgery. The ClinCheck software enables clinicians to visualise both the dental and surgical outcomes digitally, which allows for effective treatment planning. The system is also very useful for initiating and maintaining a dialogue with all the medical and dental clinicians involved in the patient's treatment.

Conclusion

The patient, AM, was concerned with his underbite and misaligned anterior teeth, which were negatively impacting his quality of life. He was recommended orthognathic surgery together with treatment with the Invisalign System. A total of 21 and 31 sets of aligners were used for the initial and refinement phases, respectively. Following treatment, the patient's facial profile improved

significantly, along with achievement of a Class I occlusion. The patient was extremely happy with the treatment outcome. This case demonstrates that the Invisalign System is effective at correcting Class III malocclusion for patients who also require orthognathic surgery.

Author disclosure

Dr Igor Lavrin was provided an honorarium from Align Technology, Inc., for his contribution towards the creation of this case report.

Dr Igor Lavrin

Igor Lavrin completed a 3-year orthodontic specialist programme and Masters at the Harvard School of Dental Medicine, USA. He is currently in private orthodontic practice with his wife, Dr Sarah Lawrence, in Melbourne, Australia. In 2017, Drs Lavrin and Lawrence achieved Invisalign Black Diamond tier status. Dr Lavrin is a past-Federal Treasurer of the Australian Society of Orthodontists (ASO), and is currently serving as a Federal Councillor of the ASO and is immediate past President of the Australasian Society of Lingual Orthodontists. He is an accredited member of the Australasian Orthodontic Board.

Dr Lavrin received his Invisalign treatment training at Harvard and was one of the first providers in Australia to use the Invisalign System for his patients. He has been invited to lecture in Australia, Canada, South Korea, Indonesia, Singapore, Fiji and the USA, including at several American Association of Orthodontists Annual Sessions. Dr Lavrin has also presented at the ANZ Invisalign Orthodontists Forums in 2013, 2015 and 2017. He is an International Invisalign Clinical Speaker and a speaker for Invisalign Future Elite in Australia and New Zealand.



Correction of Class III Malocclusion with Orthognathic Surgery and the Invisalign System



Dr Igor Lavrin
BDS, MMSc

The patient, AM, was 37 years of age at the time of first presentation. The patient's chief complaint related to his underbite and misaligned anterior teeth. He had difficulty eating due to the malocclusion and was particularly keen on being treated with the Invisalign System due to the aesthetics of the appliance and benefits of good oral hygiene.

I. Intra- and extra-oral images before treatment



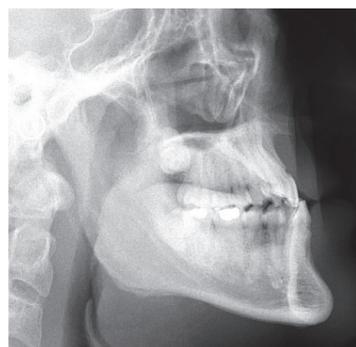
Clinical presentation

AM presented with a Class III skeletal and dental malocclusion and mandibular asymmetry resulting in the chin point and lower midline misaligned to the left. The overjet was -2 mm resulting in an anterior crossbite. The upper right second premolar was also in crossbite and mild upper and lower crowding was evident. The traumatic anterior occlusion resulted in incisal edge wear, particularly on the upper left lateral incisor. Calculus was evident, resulting in the need for a full check-up and clean before starting orthodontic treatment. The panoramic radiograph showed impacted third molars.

II. Panoramic radiograph before treatment



III. Cephalometric radiograph before treatment



IV. Initial ClinCheck treatment plan



Clinical findings

- Skeletal and dental Class III malocclusion.
- Overjet of -2 mm.
- Anterior crossbite.
- Upper right second premolar in crossbite.
- Mild upper and lower crowding.
- Presence of calculus.

Treatment goals

- Obtain Class I occlusion.
- Correct alignment.
- Relieve upper and lower crowding.
- Obtain a positive overjet and overbite.
- Correct crossbites.
- Improve facial profile.
- Long-term retention.

Treatment approach

Initial treatment phase

Pre-surgery

The patient had an iTero Element scan prior to treatment with the Invisalign Full treatment option. Initial treatment with the aligners was to decompensate the arches and set up for orthognathic surgery. The initial treatment plan included 21 sets of aligners with added button cutouts. The posterior attachments were removed at aligner 20

in preparation for orthognathic surgery. The aligners were changed every 14 days until aligner 5, after which they were changed every 10 days. The anterior crossbite was effectively worsened with arch decompensation prior to the surgery to allow for correction of the occlusion, as well as for improved facial aesthetics after the orthognathic surgery. At aligner 20 self-cut button cutouts were added to the anterior teeth on the aligner as the posterior button cutouts were pre-planned for aligner 20 as per the ClinCheck treatment plan. This allowed buttons to be bonded to each tooth for post-surgical elastic wear. The buttons were co-ligated with white ligature wire to prevent the risk of aspiration that could occur should the buttons debond during surgery.

Surgery

The surgical procedures included a LeFort I advancement and downgraft, along with mandibular setback and rotation for correction of the asymmetry. The third molars were

V. Extra-oral images before surgery



The patient had an iTero Element scan prior to treatment with the Invisalign Full treatment option. The initial treatment phase with aligners was planned to decompensate the arches and set up for orthognathic surgery.

also extracted. Genioplasty was initially planned, however, this was not required. The patient and surgeon were instructed to ensure that the aligners were fitted in the operating room, immediately following surgery, with Class III and anterior midline elastics added as specified by the surgeon.

Post-surgery

Following surgery, the patient was advised to keep the aligners on for 2-3 days and to only consume soft food during this period. Thereafter, he was encouraged to remove the aligners to resume a normal oral hygiene regime and diet.

The patient returned for follow-up 2 weeks after surgery whilst continuing treatment with the Class III vector and anterior midline elastics. At this stage the midline was fully corrected. The patient also presented with Class I malocclusion, but exhibited a bilateral posterior open bite. He was immediately treated with posterior rectangular box elastics from his

upper and lower canines to molars (Unitek Elliot 1/4" 4 oz elastics, 3M). Around 6 weeks following surgery, all the attachments and buttons, except on the canines and first molars, were removed for another iTero Element scan for additional aligners to refine the occlusion post-surgery (Figure IX).

Refinement phase

Aligner 21 was worn along with the posterior box elastics at night whilst waiting for the additional aligners to arrive. An additional 31 aligners were used without buttons and elastics to further correct the occlusion and alignment. The aligners were changed every 7 days. Once aligner 31 was completed, the upper and lower aligners were cut distal to the canines to allow for further posterior settling of the occlusion for approximately 4 weeks. Composite resin build-up of the heavily worn incisal edge of the upper left lateral incisor was also completed. Following this, laboratory-made clear retainers were issued. The patient returned 3 months later for Vivera retainers which provided a superior fit for long term retention.

Treatment details

Active treatment time

- Initial treatment phase: 8 months.
- Refinement phase: 10 months.

Aligners used

- 21+31 upper aligners.
- 21+31 lower aligners.

Attachments

Initial treatment phase

- Optimised Rotation Attachments on teeth 14, 24, 33, 34 and 35.
- Optimised Root Control Attachments on teeth 13, 23, 43 and 44.
- Optimised Extrusion Attachments on teeth 11, 12 and 22.
- Optimised Deep Bite Attachment with Extrusion Attachment on tooth 45.
- Conventional horizontal rectangular attachment (4 mm) on tooth 27.

Refinement phase

- Optimised Rotation Attachments on teeth 15 and 35.

- Optimised Root Control Attachments on teeth 11, 13, 14, 33, 34, 43 and 44.
- Optimised Multi-plane Attachment on tooth 22.
- Optimised Deep Bite Attachment on tooth 45.
- Conventional horizontal rectangular attachments (3 mm) on teeth 12, 21, 23, 24 and 25.
- Conventional horizontal rectangular attachments (5 mm) on teeth 16, 26 and 27.

Retention

Vivera retainers were used.

Treatment outcome

Undergoing treatment with surgery and the Invisalign aligners (Invisalign Full treatment option) resulted in AM being able to achieve a Class I occlusion along with correction of his crossbites. The patient's facial profile significantly improved. A reduction genioplasty was not needed, although initially considered by the surgeon. The mandibular asymmetry was also improved. The small restorative build-up to the upper left

lateral incisor provided an exceptionally well-balanced smile line. The patient was delighted with the treatment outcome.

Clinical tips

- Orthognathic surgery is a viable option alongside treatment with the Invisalign System to correct Class III malocclusion and crossbites.
- If a patient needs to have orthognathic surgery in combination with the Invisalign System, it is important that the Oral and Maxillofacial Surgeon is supportive and understands the process of treatment. The surgeon should be informed that a surgical splint can be used following the surgical procedure for improved outcomes.
- Communication with the surgical team should ensure that aligners are taken to the operating theatre and fitted immediately post-surgery together with the elastics. Aligners should be prepared in advance as per the ClinCheck treatment plan along with any additional features, such as button cutouts.
- Due to the ClinCheck treatment plan, estimation of the optimal timing for

VI. Intra- and extra-oral images after treatment

