



Clinical efficacy of Invisalign® treatment with weekly aligner changes: Two case reports

Class II and deep bite correction with the Invisalign® System and weekly aligner changes. Dr Schupp and Dr Haubrich
 Treating a teenage patient with deep bite, increased overbite and impacted first premolar with the Invisalign® System and weekly aligner changes. Dr Castroflorio

Summary

Background and objective: The efficacy of using Invisalign® treatment to achieve major tooth movements and successfully treat a variety of complex malocclusions in adults and teenagers is documented in the published literature.¹⁻⁶ Align Technology now recommends orthodontists prescribe weekly aligner changes in their Invisalign® treatments; this may reduce treatment times by up to 50% compared with changes every 2 weeks.⁷ This recommendation is based on clinical analysis of more than 200 ongoing Invisalign® cases.⁸

The objective of these case reports is to describe the use of the Invisalign® System with weekly aligner changes in an adult patient and a teenage patient; then to show the clinical efficacy and impact of the new 1-week wear recommendation in these cases.

Methodology: For the first case in this document, Drs Werner Schupp and Julia Haubrich provide detailed accounts of the procedures undertaken in treating an adult patient with craniomandibular disorder (CMD) issues, Class II division 2 relationship and deep bite, with Invisalign® aligners and weekly aligner changes. In the second case report, Dr Castroflorio describes the treatment details of a teenage patient presenting with deep bite, increased overjet and an impacted first premolar, prescribed Invisalign® treatment with 1-week aligner wear. The authors provide clinical tips on how to optimise the treatment outcomes of the presented cases and comment on the likely impact of the weekly aligner changes compared with the previous recommendation of changing aligners every 2 weeks.

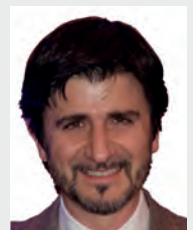
Dr Werner Schupp
 DDS, Ortho Spec.
 Prof. Capital Medical
 University Beijing



Dr Julia Haubrich
 DDS, Ortho Spec.



Dr Tommaso Castroflorio
 DDS, Ortho Spec., PhD



Results: These cases show the clinical efficacy of the Invisalign® System with weekly aligner changes in both a teenager and an adult patient (age 37) with complex malocclusions. All treatment goals were achieved in both patients, with similar results to those that would be expected from a 2-week wear treatment, and good tooth movement control as shown by the good aligner fit during the whole treatment. The reduced wearing time led to highly motivated patients, which was perceived as a major benefit – especially for teenage patients. The combination of Invisalign® aligners with auxiliaries such as buttons and elastics is shown as a fully compatible treatment approach to accomplish very complex tooth movements, such as orthodontic traction of impacted premolars.

Conclusions: The doctors all concluded that, for these cases, weekly aligner changes provided the same results in up to half the time that would have been anticipated for these patients had they been making aligner changes every 2 weeks. They highlighted major benefits of weekly aligner changes, including high acceptability to patients of reduced treatment time, and a reduction in office management costs.

References

1. Schupp W and Haubrich J, eds. *Aligner Orthodontics*. 2015, Quintessenz Berlin.
2. Boyd RL, Oh H, Fallah M, Vlaskalic V. An update on present and future considerations of aligners. *J Calif Dent Assoc* 2006;34(10):793–805.
3. Giancotti A, Mampieri G, Greco M. Correction of deep bite in adults using the Invisalign® system. *JCO* 2008;XLII(12):719–26.
4. Boyd RL. Esthetic orthodontic treatment using the Invisalign® appliance for moderate to complex malocclusions. *J Dental Educ* 2008;72(8):948–67.
5. Krieger E, Seiferth J, Marinello I, et al. Invisalign® treatment in the anterior region: were the predicted tooth movements achieved? *J Orofac Orthop* 2012;73(5):365–76.
6. Simon M, Keilig L, Schwarze J, Jung BA, Bourauel C. Treatment outcome and efficacy of an aligner technique – regarding incisor torque, premolar derotation and molar distalization. *BMC Oral Health* 2014;14:68.
7. Weekly aligner changes are recommended for all Invisalign treatments (with default staging protocol) for Invisalign Full, Invisalign Teen and Invisalign Assist products. The decision to prescribe weekly aligner changes is at the doctor's discretion. Monitor tooth movements such as rotations, extrusions, and significant root movements; particularly blue and black movements in the Tooth Movement Assessment (TMA). Depending on the patient response to treatment, particularly mature adults, consider longer periods between aligner changes. See: Align Technology introduces one-week aligner wear for Invisalign® Teen and Full products. Press release, 11 October 2016. Available at: <http://investor.aligntech.com/releasedetail.cfm?ReleaseID=992964>. Accessed 31 December 2016.
8. Align Technology, data on file.

Case 1: Class II and deep bite correction with the Invisalign® System and weekly aligner changes.

Dr Schupp and Dr Haubrich

Sex: Female

Age: 54 years

Chief complaint: The patient was in severe pain due to craniomandibular disorder (CMD)

The patient presented to the clinic with pain and CMD. She had previously been treated with a removable splint. Initially, the splint was removed and, after obtaining a pain-free position, initial records for Invisalign® treatment were taken.

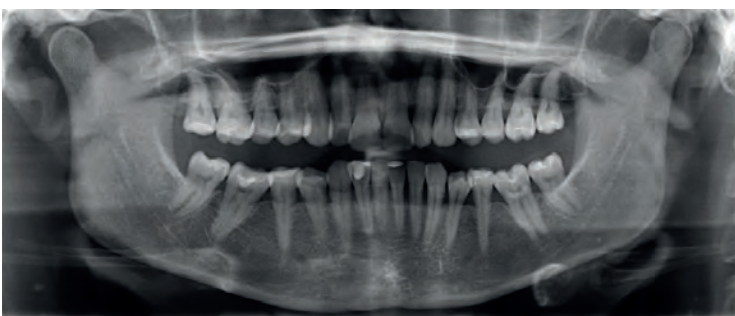
Clinical findings

- CMD issues
- Class II division 2 relationship
- Crowding and rotation in the upper and lower arch
- Retruded teeth: 11, 21 with pre-existing contact points on upper anteriors
- Protruded and rotated: 12, 22
- Deep bite with severe incisor contacts.

FIGURE 1. Intraoral and extraoral images before treatment



FIGURE 2. Panoramic radiograph before treatment



Treatment goals

- To correct Class II
- To improve deep bite
- To resolve crowding
- To end with a 0.5 mm overjet (Shimstock foil open incisor area)
- To end with canine guidance without hyperbalance contacts.

Treatment plan

- Distalization in the upper arch with Class II elastics
- Torque on upper central incisors
- Derotation of upper laterals
- Intrusion of lower anteriors and extrusion of lower premolars to reduce the dental deep bite
- Interproximal reduction and distalization to resolve crowding.

Treatment details

- Total treatment time
 - 15 months.
- Number of aligners
 - 49 + 10
 - A total of 59 aligners were prescribed (49 aligners Phase 1, 10 aligners Phase 2), with a change of aligner every 7 days.
- Attachments
 - Attachments were bonded prior to scans on teeth 13, 23, 33, 34, 35, 43, 44, 45
 - Vertical rectangular attachments were bonded on teeth 13 and 23, hooks for Class II elastics were also placed on the gingival region of these teeth. In patients with hooks on canines, we also bond attachments on these teeth to avoid undesired rotations or angulations due to the elastic force
 - In the lower arch, the patient had horizontal ellipsoid/bevelled shaped attachments to secure anchorage on the lower premolars and canines for intrusion and alignment of the lower anteriors.
- Interproximal reduction
 - Interproximal reduction was performed during the first phase on the upper-right and lower anteriors, as well as on the upper anteriors in the second phase to aid alignment.
- Use of auxiliaries
 - Class II elastics from hooks on the upper canines to buttons on the lower molars (36, 46). The patient was instructed to wear elastics at night, and for 2–3 hours during the day for anchorage during the distalization in the upper arch.
- Retention
 - After two phases of Invisalign® treatment, retention was ensured with a removable retainer in the upper arch for night-time wear; in the lower arch, a fixed lingual retainer was bonded from first premolar to first premolar.

FIGURE 3. Intraoral images of aligner 19 in situ, showing a good fit



Clinical tips

The aligner fitting was documented and controlled in appointments every 7–10 weeks. Two scans were performed during Weeks 10 and 19 to monitor progress, and a final scan was performed at the end of the treatment.

During treatment, the aligners showed a perfect fit on all teeth except a small discrepancy on teeth 12, 22 as shown in the intraoral pictures with aligners in situ at Stage 19 (FIGURE 3). Teeth 12, 22 demonstrated good aligner fit during the later aligner numbers.

A 22-hour wearing time is crucial in complex aligner treatments.

Treatment outcome

Following treatment with 59 aligners over a 15-month period, the planned treatment goal of the distalization of the upper arch was achieved.

The patient showed a Class I relationship with aligned arches in the upper and lower anteriors, with physiological canine guidance and incisor relationship (FIGURE 4). The patient was pain-free and showed no further signs of CMD.

Comparison of this case with patients prescribed aligner changes every 2 weeks

Distalization with the Invisalign® System is highly predictable using additional anchorage. However, due to the sequential distalization protocol of the ClinCheck® Software, this can result in a high number of aligners; in this case 59. With an aligner change every 2 weeks, the overall treatment time in this case would have been 29 months, with a potential additional phase for refinement. Changing the aligners every 7 days was successful for this patient, with no reported problems; there was a good aligner fit during the whole treatment. In addition, a minimal second phase of only 10 aligners was required for finishing in detail.

FIGURE 4. Intraoral and extraoral images after treatment



Impact of weekly aligner changes on clinical practice

Long treatment periods with complex movements, such as distalization of upper molars, can be time consuming and may lead to reduced patient motivation.

Reducing the aligner wear time to 7 days instead of 14 can reduce the overall treatment time by up to 50%. We found that, in this patient, there was a higher motivation to comply with the Invisalign® System.

Conclusion

The patient was suffering from CMD presenting a Class II division 2 relationship with pre-existing contacts on anteriors and deep bite. Following removable splint therapy, orthodontic treatment with Invisalign® aligners with weekly aligner changes was initiated to solve the pre-existing anterior contacts and distalize the upper arch into a full Class I relationship, with torque of the upper retruded central incisors and alignment of the arches.

All treatment goals were achieved and good aligner fit was documented during the whole treatment. The patient did not report any issues with the faster aligner change. No temporomandibular joint issues, muscle pain, headache or back pain were reported.

Case 2: Treating a teenage patient with deep bite, increased overbite and impacted first premolar with the Invisalign® System and weekly aligner changes.

Dr Castroflorio

Sex: Female

Age: 12.9 years

Chief complaint: Missing lower-right first premolar and spacing in the upper arch

Clinical findings

Clinical examination revealed a dental Class I malocclusion with increased overjet due to proclination of the upper incisors. Deep bite related to an increased Curve of Spee with extrusion of the lower incisors. Furthermore, there was extrusion of the upper-right premolars. Both the arches were constricted on the frontal plane and the upper molars were rotated mesially. A dento-dental discrepancy was also detected with a mandibular excess of about 1 mm.

The radiographic examination showed a skeletal Class I malocclusion in a normodivergent patient and a circular, well-defined unilocular radiolucent area (follicular cyst) surrounding the crown of the mandibular right first premolar without tooth displacement (FIGURES 5–7).

Treatment goals

- To remove the follicular cyst and bring the lower-right first premolar into the arch
- To close the upper spacing
- To correct the proclination of the upper incisors
- To correct the Curve of Spee
- To increase orthopaedic stability.

Treatment plan

1. First Invisalign® treatment phase

An initial Invisalign® treatment phase was conducted to expand the arches on the frontal plane and derotate the upper first molars. When the upper molars were in their final position, the intrusion of the upper-right premolars was completed. When the premolars were in their final position, en-masse retraction of the upper canines and incisors was conducted. The lower incisors and second molars were intruded to flatten the Curve of Spee.

FIGURE 5. Intraoral and extraoral images before treatment



FIGURE 6. Panoramic radiograph before treatment

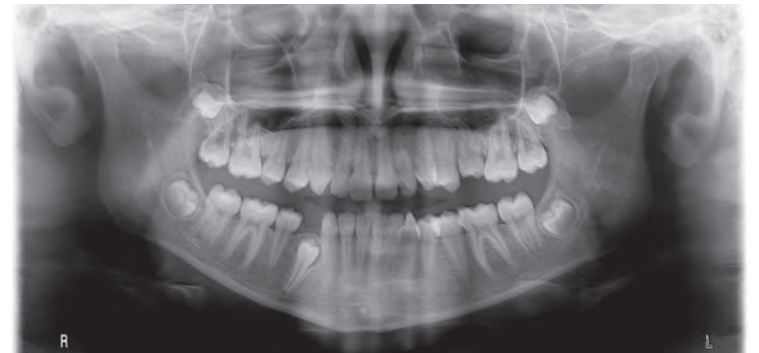


FIGURE 7. Pre-treatment tracing

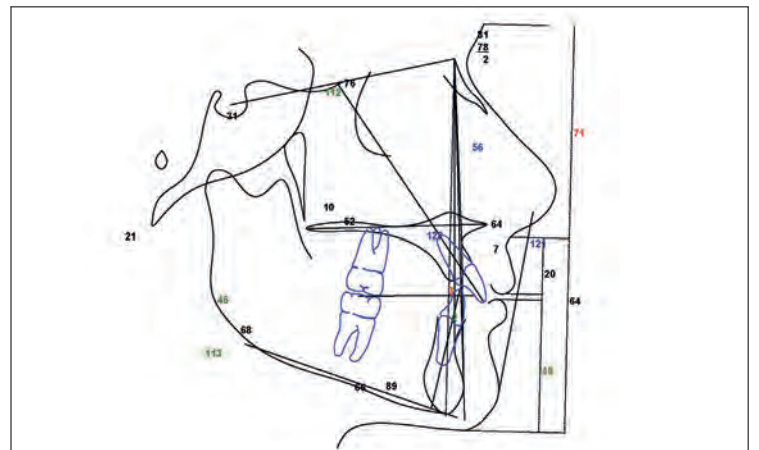


FIGURE 8. Buttons and elastics in place with Invisalign® aligners during treatment



2. Surgical removal of follicular cyst and traction of implanted premolar

After the upper premolars were intruded, the lower follicular cyst was surgically removed and, once the tooth had been isolated, a gold chain was bonded to the coronal aspect. The chain emerged through the incision at the mid-crestal region and an elastic traction was fixed to the lower aligner. When the tooth was partially extruded and the chain was no longer useful, it was removed and a button was bonded on the buccal aspect of the lower first premolar and upper premolars. Aligners were modified to receive buttons and a 3/16" 3 oz. elastic was used with a triangle geometry to complete the extrusion movement (FIGURE 8).

3. Second Invisalign® treatment phase

The second and final treatment phase started when the lower first premolar was fully extruded and was conducted to complete the en-masse retraction of the upper incisors and the alignment of the lower canines and incisors.

Treatment details

- Total treatment time
 - 54 weeks
 - The orthodontic traction of the impacted lower-right first premolar tooth lasted for 6 months.
- Number of aligners
 - 32 + 18
 - The patient was instructed to wear the aligner for at least 21 hours per day
 - For this patient, the first two stages were prescribed for longer wear time with close monitoring to assess tooth tracking and patient compliance. From the third aligner, a regimen of weekly aligner changes was adopted.
- Attachments
 - Rectangular and horizontal attachments were bonded to the upper molars and the lower second molars. Rectangular and

- vertical attachments were bonded to the upper canines and the lower first molars
- Optimised attachments were located on the premolars and the lower canines
- In Phase 2, conventional and optimised attachments were located on the same teeth as in Phase 1 and were used for finishing purposes.
- Other features
 - During the first treatment phase, Precision Bite ramps were used on the upper incisors to facilitate the posterior disclusion for levelling the Curve of Spee and, thus, the expansion of the arches and derotation of posterior teeth
 - Pressure areas and Power Ridge features were located on the lower incisors to control the intrusion movement and the lingual root torque of those teeth. Precision cuts were applied to use Class II elastics (1/4" 4 to 1/2 oz.) to facilitate the en-masse retraction of the upper incisors.
- Retention
 - Retention was provided with Vivera® retainers.

Treatment outcome

The case was finished in canine and molar Class I relationship, with functional overbite and overjet. The impacted lower-right first premolar was tractioned into the arch without braces or archwires. The chain was anchored to the aligner with 1/4" 4.5 oz. elastics. The aligners were modified with clear aligner pliers to create hooks to anchor the elastics. The patient was instructed to change the elastics at least three times per day in order to maintain a constant force on the impacted premolar. Once the occlusal third of the buccal surface was erupted, buttons were placed on the buccal aspects of the lower impacted premolar and the upper premolars in order to use elastics to complete the guided eruption of the lower premolar (3/16", 3 oz.). Aligners were modified using clear aligner pliers to allow the positioning of the buttons. A good final intercuspation was achieved to guarantee orthopaedic stability. Furthermore, the smile was improved considerably with perfect control of the buccolingual inclination of the upper and lower incisors, as demonstrated by the cephalometric analysis (FIGURES 9–11).

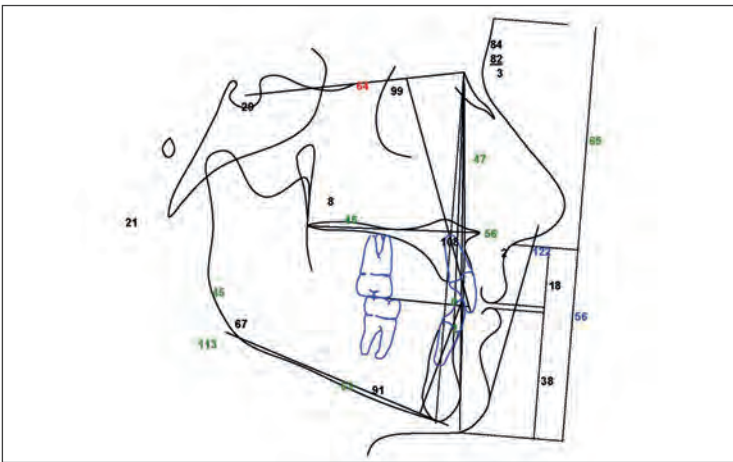
FIGURE 9. Intraoral and extraoral images after treatment



FIGURE 10. Panoramic radiograph after treatment



FIGURE 11. Post-treatment tracing



Clinical tips

The use of attachments on all premolars and molars is useful to control the maxillary expansion during buccal movement, which releases an extrusive force on those attachments. The result is the creation of a couple of forces generating a movement, thereby facilitating the buccolingual control of premolars and molars. In other words, a controlled buccal movement of their roots can be achieved. In addition, the extrusive force will improve the final intercuspation in the premolar and molar areas, reducing the bite-block effect described for aligner orthodontics.

This case shows how it is possible to perform the orthosurgical traction of an impacted lower premolar with aligners, buttons and elastics, without braces and wires. This was greatly appreciated by the patient and the parents. Comfortable and aesthetic solutions can be a fundamental requirement for teenagers.

Comparison of this case with patients prescribed aligner changes every 2 weeks

A regimen of aligner changes every 2 weeks could provide similar results but would extend the treatment time by up to twice the duration. Furthermore, the orthodontic traction of impacted teeth can be extremely variable in terms of required time. This is the main reason why, in cases where no complex movements are required to prepare the traction, weekly aligner changes are recommended, in order to avoid a long treatment duration and to bring the impacted tooth into its final position.

Impact of weekly aligner changes on clinical practice

The major benefits of weekly aligner changes in teenage patients are the higher acceptability of the shorter treatment time to these patients, as well as reduced time over which management costs for the treatment are incurred by the practice.

Conclusions

This case was treated with 50 aligners over a period of 54 weeks. A further 24 weeks was needed to complete the impacted lower first premolar traction. Total treatment time was therefore 19.5 months. A longer treatment time for a regimen of aligner changes every 2 weeks would be expected, in the region of 39 months. This estimated difference in treatment time is important from both the patient's and clinician's perspective.



Dr Werner Schupp graduated in Dentistry in 1985 from the University of Münster, Münster, Germany, and continued his studies there as a postgraduate student of Orthodontics. Since 1990, he has been in private practice as an orthodontic specialist in Cologne, Germany. He is certified in Invisalign® treatments and in Manual Medicine and Osteopathy for Orthodontics. Dr Schupp is a foundation member and Past President of the German Board of Orthodontics and Orofacial Orthopedics and board member of the German Society for Aligner Orthodontics. He has authored several articles and two books concerning orthodontics, aligners, function and pain therapy. He has lectured in Europe, Brazil, the USA, China, Taiwan and Japan. Dr Schupp is visiting professor at the Capital University, Beijing, China.



Dr Julia Haubrich studied Dentistry at the University of Freiburg, Freiburg, Germany, in 2002 and was a postgraduate student in Orthodontics from 2003–2005. She then studied as a postgraduate student in Orthodontics at the University of Berlin, Berlin, Germany, and became a certified specialist of Orthodontics in 2007. Since then, she has been working in private practice with Dr Werner Schupp. She has authored several publications and two books concerning orthodontics, aligners, function and pain therapy. Dr Haubrich is a founding member and Conference President of the German Society for Aligner Orthodontics and has spoken in both Europe and Asia. She is currently a lecturer at the Medical University of Innsbruck, Innsbruck, Austria.



Dr Tommaso Castroflorio is an orthodontist living and working in Torino, Italy. He obtained his DDS degree and postgraduate degree in Orthodontics from the University of Torino, and a PhD in Human Anatomy from the University of Milan, Milan, Italy. Since 2008, Dr Castroflorio has run a private practice in Torino where he has focused his work on orthodontics and temporomandibular disorders. He started to work with aligners in 2007. Since 2012, he has been an adjunct professor of the Postgraduate School of Orthodontics at the University of Torino where he teaches “Orthodontics with Thermoplastic Aligners”. He is a founding member and the Scientific Chairman of the European Aligner Society. Since 2011, he has lectured in Europe, South America and Japan.

Author disclosures

Drs Haubrich and Schupp are both clinical speakers for Align Technology BV.

Dr Castroflorio is a member of the European Advisory Board of Align Technology and he has given lectures and contributed to courses for Align Technology since 2011. In 2015, he received research funds from Align Technology.



Align Technology BV
Arlandaweg 161,
1043 HS Amsterdam
The Netherlands
Other (English): +31 (0)20 586 3615

www.invisalign.eu

© 2017 Align Technology (BV). All Rights Reserved.

Invisalign®, ClinCheck® and SmartTrack®, among others, are trademarks and/or service marks of Align Technology, Inc. or one of its subsidiaries or affiliated companies and may be registered in the U.S. and/or other countries.

200961 Rev A