

I, Mitra Derakhshan, declare as follows:

1. I am an orthodontist and an employee of Align Technology, Inc. (“Align”). I have personal knowledge of the facts set forth below.
2. I have worked at Align since August 2000. My current role is Senior Vice President in charge of Global Clinical. In 2003, I worked in research and development for Align, supporting clinical studies of Align’s orthodontics technology as well as development of clinical materials. I also provided instruction to orthodontists and dentists to certify them in the use of Align’s products, such as the Invisalign clear plastic aligners.
3. Align has long published various materials to orthodontists and other interested persons providing information about the Invisalign aligners and recommended methods of use in orthodontic treatment. In the 2000s, Align made many such materials available at invisaligncec.com, which was Align’s Online Clinical Education Center for Invisalign product and training materials.
4. As part of my duties at Align in the early-to-mid 2000s, I met with orthodontists and dentists interested in Invisalign and helped them complete training for the use of Invisalign products. I also reviewed and contributed to publications and educational materials published by Align via the invisaligncec.com website.

5. One of the documents published by Align to which I contributed was the Invisalign Clinical Monitoring Guide (“Guide”). Attached as Exhibit A is a copy of the Guide that was downloaded from the Internet Archive, at the URL http://web.archive.org/web/20030926024959if_/http://www.invisaligncec.com:80/consistent/pdfs/ICMG_Final.pdf, with an archive date of September 26, 2003. I was a contributing clinician to the Guide, and my name is listed on the Guide’s last page. As part of my contributions, I reviewed the Guide prior to its publication in 2003. As the Guide indicates, it was published via the Online Clinical Education Center at invisaligncec.com in 2003. I have reviewed the contents of the Guide attached as Exhibit A, and it is a true and correct copy of the document that was published via the Online Clinical Education Center in 2003, and which was made available to the public for many years after that date.

6. From 2003 onward throughout the 2000s, I used the Guide as part of my duties relating to the Online Clinical Education Center. I regularly provided orthodontists and dentists with printed copies of the Guide. These printed copies included the same contents as the copy attached as Exhibit A, although the printer’s marks around the borders were not included in the printed versions. I also provided the orthodontists and dentists with compact discs containing copies of the Guide and similar documents, and they could also download the Guide and other documents from the Online Clinical Education Center using credentials they

received after completing the certification process. Printed copies of the Guide were also available for purchase from Align no later than 2004.

7. I declare that all statements made herein of my knowledge are true, and that all statements made on information and belief are believed to be true, and that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Dated: October 13, 2023

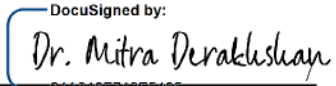
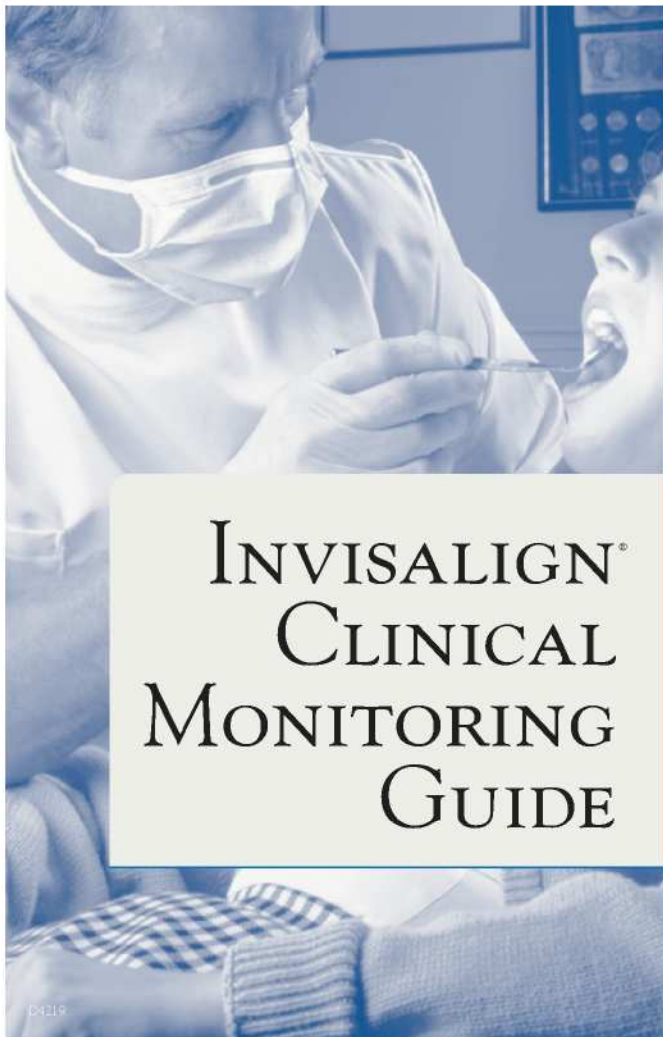
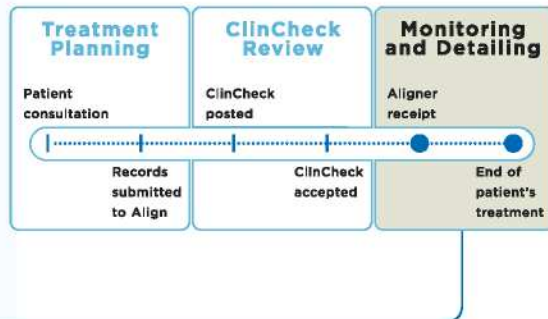
By: / 
Mitra Derakhshan, D.D.S., M.S.

EXHIBIT A

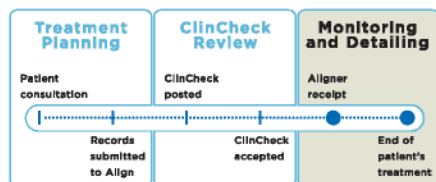


invisalign®



This Guide was published on August 8, 2003. As additional Tips & Techniques become available, this Guide will be updated first on the Online Clinical Education Center. An electronic and most current version of this Guide can be viewed or downloaded from the Online Clinical Education Center (www.invisalignce.com). Please check the website or with your Sales or Customer Support Representative to make sure you have the most recently updated version.

INVISALIGN[®] CLINICAL MONITORING GUIDE



Critical steps in the Invisalign process

This Guide was published on August 5, 2009. As additional Tips & Techniques become available, this Guide will be updated first on the Online Clinical Education Center. An electronic and most current version of this Guide can be viewed or downloaded from the Online Clinical Education Center (www.invisalignncc.com). Please check the website or with your Sales or Customer Support Representative to make sure you have the most recently updated version.

THIS GUIDE IS INTENDED TO HELP THE INVISALIGN PRACTITIONER successfully monitor Invisalign treatments and address issues that may arise between receipt of Aligners from Align to the completion of treatment.

Special attention has been given to possible root causes of issues that may be encountered, solutions to these issues, and measures that can be taken to prevent the issue from re-occurring in the future.

Invisalign is a technique. Invisalign is more than a set of Aligners; it is the Aligners plus other auxiliaries used to achieve desired results. Just as with fixed appliances, a clinician should carefully monitor, adjust and plan for use of auxiliaries for successful treatment outcomes with Invisalign.

The solutions in this Guide are considerations collected from your peers. These have not all been tested in clinical trials, but rather are tips and techniques from Invisalign-experienced colleagues. Some tips have been used on many cases and some on only a few. We have tried to list these in the order that clinicians recommend them and feel they work successfully. It is at your discretion to use them where appropriate to get the results you want with Invisalign.

We hope you find this Guide useful. Please do not hesitate to contact us with additional Tips & Techniques (tips may be submitted through the Online Clinical Education Center at www.invisalignncc.com) that will continue to expand the body of clinical knowledge around Invisalign.

With best regards,

Align Technology, Inc.

ALIGN
ALIGN TECHNOLOGY, INC.

Key considerations for using Invisalign effectively

This Guide will help you quickly address issues that you may encounter during Invisalign treatment.

WHEN MONITORING TREATMENTS, FROM TIME TO TIME YOUR patient's teeth may not track to plan. In these instances, it is good to generally keep in mind that this occurs for two fundamental reasons.

- 1. INSUFFICIENT SPACE**—Do the teeth have enough room to move? Often teeth get tied up due to lack of space, particularly due to contact binding. This may be due to insufficient interproximal reduction (IPR), other force systems within the Aligners, or treatment plans that have not been thought through sequentially, stage by stage.
- 2. INSUFFICIENT FORCE** (Aligner contact with tooth or attachment)—Are the necessary forces present to ensure movement? Insufficient force may be due to the prescribed treatment plan or ClinCheck in which certain movements were not included, lack of attachment engagement, insufficient time for the movement to express, or inherent difficulty overcoming selected movements:
 - a. An unengaged attachment will not provide sufficient force. *Not having an attachment engaged is like having a wire not fully engaged in the slot of a fixed appliance.*
 - b. Time to express—Teeth may “lag” behind the Aligner due to differences in bone biology from patient to patient, material stress relaxation, or lack of patient

compliance. Simply extending Align wear-time may allow the movement to be expressed more completely. *Moving ahead too fast in an Aligner is like changing a wire in fixed that has not fully expressed itself.*

- c. Challenging movements—Like fixed appliances, some movements with Invisalign are more predictable than others. Less predictable movements, such as absolute extrusions, rotation of round teeth and large translations, may require auxiliary appliances (buttons and elastics, sectionals, etc.)

CAREFUL MONITORING OF TREATMENT WILL HELP CATCH ISSUES before they become a problem. To prevent issues from occurring, we have found that thoughtful and successful Invisalign clinicians perform the following at every patient appointment:

1. Have patients arrive with the previous stage Aligner and the current Aligner, so you can evaluate any fit concerns that may arise.
2. At each appointment, review 4 things:
 - a. That the current Aligner is a good fit.
 - b. IPR instructions (track the amount of IPR performed according to the patient chart).
 - c. The condition and engagement of attachments. Teach the patient what to look for in attachment fit.
 - d. Evaluate for tight contacts with unwaxed floss and relieve with finishing strips if present.
3. Check actual results versus ClinCheck every 4-8 stages. Some doctors find it useful to print the patient's ClinCheck and place these in the patient's chart. Use this as a guide to track actual versus modeled progress regularly.

4. Use ClinCheck as a tool to educate your patient. Explain what is occurring and have the patient help monitor treatment (flossing to check for contacts and using a pencil to outline the attachments to ensure attachment engagement) [see p. 31].

5. Plan to Detail—the adjuncts, tips and chairside tools found throughout this Guide will help with final detailing and should cut down on the need for Refinement and Mid-Course Correction. Refinement and Mid-Course Correction may be used as secondary methods of achieving desired results. Neither option should be viewed as a failure and in fact may be needed in a portion of treatments, depending on the complexity of the case. [For definitions of terms used throughout this Guide, see the Glossary, pp. 40–41.]

6. After finishing treatment, learn from your results. Review your first ten ClinChecks against the actual results to help you plan treatment more effectively on future cases. There is a learning curve with Invisalign.

FINALLY, ALWAYS KEEP IN MIND THAT THE 4 KEYS TO ENSURING consistent, quality treatment outcomes require that doctors:

1. SUBMIT HIGH-QUALITY RECORDS (particularly PVS impressions and photos)

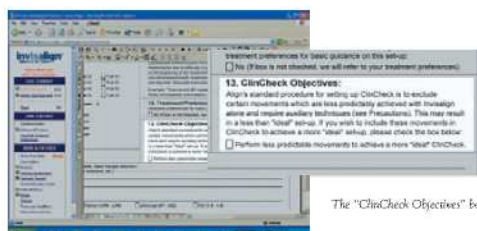
The #1 reason for poor Aligner fit is an incomplete or distorted impression.

- Poor dental data ultimately leads to poor-fitting Aligners which lead to sub-optimal outcomes.
- If your office needs help with impression or photo-taking or has had impressions sent back to you from Align, please contact your Sales Representative or read the guides¹ on the Online Clinical Education Center.

2. BE DETAILED WHEN TREATMENT PLANNING

- The more specific you are with your instructions, the better your Align technicians will be able to provide an initial setup that meets your expectations.
- Begin with the end in mind. Depending on the type of case or movements planned, you may need to plan ahead for the use of auxiliaries.
- Recognize the default ClinCheck setup standards and know how to overcome them.

You may override this setup by checking The “ClinCheck Objectives” box (Box 13, see below) on the Prescription & Diagnosis form. If you check “Perform less predictable movements to achieve a more ‘ideal’ ClinCheck,” you will override the standard setup. When you check this box, less predictable movements will be included in your treatment plan. While your desired goals might be achieved with Invisalign alone, they more than likely will require auxiliary work that you and your patient should expect.



The “ClinCheck Objectives” box

¹ See: PVS 3-step Guide: <http://www.invisaligncc.com/consistent/pdf/pvs.pdf>;
PVS Troubleshooting Guide: http://www.invisaligncc.com/consistent/pdf/PVS_Troubleshoot.pdf;
Photography Guide: <http://www.invisaligncc.com/consistent/pdf/PhotographyGuide.pdf>

3. REVIEW CLINCHECK CAREFULLY

- ClinCheck is a virtual representation of a doctor's intended treatment plan.
- Align Technology is a lab with technicians who interpret the directions on your treatment plan. The more specific your comments and modifications, the closer you will get to your desired setup.
- Tips for comments: Be tooth/teeth specific; Specify size (mm) and direction of movement; Avoid non-specific instructions such as "align," "more," "a little," "a lot." Example: Instead of "improve anterior esthetics," improve communication by writing: "Add 5 degrees of mesial in rotation to the upper left central and 10 degrees mesial crown tip to the upper left canine."

4. MONITOR CAREFULLY AND PLAN TO DETAIL

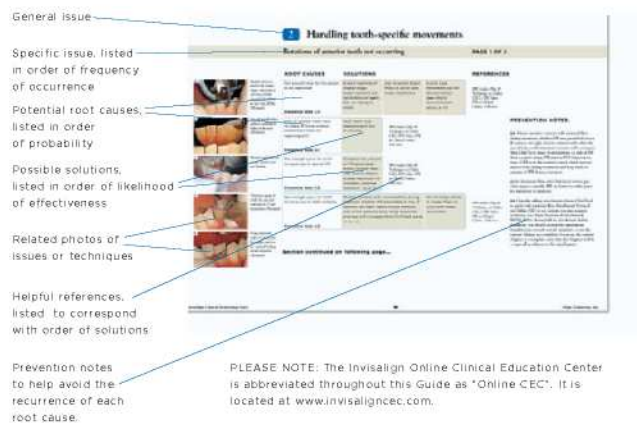
- Invisalign is a technique. Monitoring and detailing are critical to achieving consistent, quality treatment outcomes, whether you use Invisalign alone or with auxiliaries.
"I view my role as getting the teeth to fit into each Aligner."
 —Ray McLendon, DDS, Houston TX
- Keep this Guide handy to help address issues as they arise, and follow the keys outlined above to reduce the likelihood of their occurring in the first place.

How to use this Guide

Each page in this Guide is designed to assist you in identifying root causes and solutions for most of the issues you might encounter during the course of Invisalign treatment. In addition, references to in-depth instructional materials are provided in any instance where they are available, as well as notes that should help you prevent the recurrence of these issues.

Begin on the Contents page (page v), where all the issues addressed in this book are listed in order of frequency of occurrence. After identifying the general issue that best fits your situation, locate the page upon which your specific issue is presented.

The following format is used throughout the book to address the various issues:



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1 Managing Aligner fit and seating

General fit issues (Aligners are not seating well, >1 mm)

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If Aligner discrepancy is <1 mm, this is natural deflection that should occur so the Aligner can move the tooth. Continue treatment, continuing to monitor Aligner fit.

ROOT CAUSES	SOLUTIONS	REFERENCES
 <p>Aligner seating poorly, >1 mm</p>	Attachments may have excessive flash Prevention Note 1.1	BEGINNING TX ONLY: Remove excess flash and/or remove and rebond attachments with template fully seated. see fig. C, D. <i>Guide to Placing Attachments (Tips & Techniques on CEC)</i>
 <p>Aligner seating well</p>	Distorted initial impression <i>see fig. E</i> Prevention Note 1.2	BEGINNING TX ONLY: Must retake impressions and re-start treatment. <i>PVS Impression Guides (Tips & Techniques on CEC); PVS Troubleshooting Guide (Online CEC)</i>
 <p>Suler used to trim attachment flash as well as check retention. (Miller)</p>	Tooth movements may vary among patients due to differences in bone biology and tooth morphology.	Extend wear-time of Aligner; go back one stage
 <p>To minimize unwanted flash, drill a small hole (~0.75 mm wide) with a flame-shaped finishing bur or a sharp explorer in the middle of the attachment template so that excess composite is expressed out of the hole.</p>	Non-compliance - patient not wearing Aligners long enough for tooth to move Prevention Note 1.3	Extend wear-time of Aligner; go back one stage <i>Use the Patient Compliance Agreement</i>

PREVENTION NOTES:

- 1.1 Make sure attachment template is properly seated prior to bonding attachments. Try Aligner #1 to check fit, then bond attachments.
- 1.2 Improve quality of initial records. If third molars are present, decide whether to include in treatment or not (virtually extract or not).
- 1.3 Instruct Staff to thoroughly review patient compliance (>22 hrs a day); if you feel a patient is not compliant, extend wear-time of each Aligner stage. Emphasize to your patients never to dispose of their Aligners and instruct them that the Aligners should be fitting well at the end of the 2-week period.

Section continued on following page...

1 Managing Aligner fit and seating

General fit issues (Aligners are not seating well, >1 mm)

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ROOT CAUSES	SOLUTIONS
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Not enough space due to inadequate IPR	IPR according to patient's reproximation chart
With extraction cases, site may need adequate time to heal to obtain best fit (due to inflamed tissue)	Allow site to heal longer (make sure patient wears interim retainer)
Position of teeth effects Aligner path of insertion/removal (example: Class II Div II)	Seat Aligner starting with area of greatest crowding/undercut
Severe Undercuts	(See Severe Undercuts section, page 5)
Lack of extrusion, or unintended intrusion of one tooth	(See Incomplete Extrusions, page 19, or Unintended Intrusion, page 24)

Section continued from previous page.

1 Managing Aligner fit and seating

Aligner popping up when forced down, or anterior/posterior rocking

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	ROOT CAUSES	SOLUTIONS	REFERENCES
<div>A</div>  <p>Trim Aligner with InstaAlign EZ-Trim trimming bur.</p>	<p>Potential tissue impingement; inflamed gingiva distal to the 2nd molars (typical in teens); inflamed incisal papilla</p> <p>Prevention Note 1.4</p>	<p>Relieve Aligner impingement by trimming Aligner. Use Trimming bur to adjust Aligners. see fig. A</p>	<p>IPR Guides (Tips & Techniques on Online CEC); IPR Video; IPR in Clinical Update, Fall 2001</p>
<div>B</div>  <p>Situation where doctor took PVS impressions for a Mid-Course Correction and did not retain patient.</p>	<p>IPR being done is less than reproximation form indicates; therefore Aligner is smaller than actual arch dimension</p>	<p>IPR according to patient's reproximation chart</p>	
<div>C</div>  <p>Aligners were delivered two weeks later but tooth had slipped, leading to a need to backrack in treatment.</p>	<p>Teeth drifted due to lack of interim retention between Pre-PVS IPR/Extraction/ PVS impression and initial Aligner delivery (common with teens)</p> <p>Prevention Note 1.5</p>	<p>Must take new impression and resubmit to Align with treatment form (Mid-Course Correction for which doctor will be charged) see fig. A-C</p>	<p>Guide to extractions (Tips & Techniques on Online CEC); IPR (Tips & Techniques on Online CEC); IPR Video; See Case Studies *Crowding 1, 2 and 3) on Online CEC</p>
	<p>Sub-optimal initial PVS impression</p> <p>Prevention Note 1.6</p>	<p>BEGINNING TX ONLY: Must retake impressions and re-start treatment (Mid-Course Correction)</p>	<p>PVS Impression Guides (Tips and Techniques on Online CEC); PVS Troubleshooting Guide (Online CEC)</p>
	<p>Short clinical crowns without undercuts</p>	<p>Use detail pliers for retention</p>	<p>Detail Pliers (Tips & Techniques on Online CEC)</p>

PREVENTION NOTES:

- 1.4 Assess gingiva in ClinCheck vs. actual gingiva position. If a discrepancy exists, request modifications in ClinCheck.
- 1.5 For Pre-PVS IPR or extraction cases, retain teeth between PVS impression and initial Aligner delivery with Vacuform retainers. See Guide to Extractions and IPR information (Online CEC.)
- 1.6 Improve quality of initial records.

Section continued on following page...

1 Managing Aligner fit and seating

Aligner popping up when forced down, or anterior/posterior rocking

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Trim Aligner with Invisalign EZ Trim trimming Bar.

ROOT CAUSES	SOLUTIONS
<p>Gingiva is simulated in ClinCheck and may be higher in posterior region than actual anatomy</p> <p>Prevention Note 1.7</p>	<p>Relieve Aligner pressure points by trimming Aligner with trimming bur. <i>see fig. A</i></p> <p>BEGINNING TX ONLY: Call Align Customer Support. Solution may require photos or additional clarifications.</p>
<p>Change in patient's dental anatomy from new restorations.</p> <p>Prevention Note 1.8</p>	<p>Mid-Course Correction with new impressions (fee charged)</p>
<p>Teeth not intruding as indicated</p>	<p>(See Intrusion Not Occurring section, page 33.)</p>

PREVENTION NOTES:

- 1.7** Assess gingiva in ClinCheck vs. actual gingiva position. If a discrepancy exists, request modifications in ClinCheck.
- 1.8** Make sure all dental work is completed prior to beginning Invisalign treatment. Be sure dentist is aware of the consequences of any change to the dental anatomy mid-treatment.

Section continued from previous page.

1 Managing Aligner fit and seating

Severe undercut

ROOT CAUSES

Severely tipped teeth

Prevention Note 1.9

Other Root Causes:
Bridges/Pontics
Severe Recession
Flared Teeth
Periodontically
compromised teeth

SOLUTIONS

Trim away Aligner in undercut region with trimming bur so the Aligner will seat. May require doing this with subsequent Aligners until tooth position improves and Aligner can fully seat.

Trim Aligner with trimming bur; try seating Aligner from different angle

PREVENTION NOTES:

1.9 For severe undercuts, request to have Aligners trimmed at the CEJ in your treatment planning instructions to avoid having to trim every Aligner.

1 Managing Aligner fit and seating

The Aligners don't fit at all.



Aligners that do not fit properly



Aligner imperia

ROOT CAUSES	SOLUTIONS	REFERENCES
<p>BEGINNING TX ONLY: Check to make sure patient was given correct Aligner <i>see fig. 8</i></p> <p>Prevention Note 1.10</p>	<p>BEGINNING TX ONLY: Try next Aligner first (read imprint on Aligner); otherwise, call Customer Support for additional troubleshooting; may require new impressions and Mid-Course Correction</p>	
<p>Teeth drifted due to lack of interim retention between Pre-PVS IPR/Extraction and initial Aligner delivery</p> <p>Prevention Note 1.11</p>	<p>Must retake impressions and re-start treatment (Mid-Course Correction)</p>	<p>Guide to extractions (Tips & Techniques on Online CEC); IPR (Tips & Techniques on Online CEC); IPR Video; Case Studies, (Crowding 1, 2 & 3) on Online CEC</p>
<p>Patient's dental anatomy changed—e.g., restorations, crowns, fillings</p> <p>Prevention Note 1.12</p>	<p>Must retake impressions and re-start treatment (Mid-Course Correction)</p>	
<p>Patient may not have received or be wearing the correct sequence of Aligners</p>	<p>Verify that patient was given the correct Aligners</p>	

PREVENTION NOTES:

- 1.10** Make sure you are taking quality initial records, particularly photos and impressions.
- 1.11** For Pre-PVS extraction or IPR cases, retain with vacuum retainers after taking impressions while waiting for Aligners to arrive. See Guide on Extractions and IPR information (Online CEC.)
- 1.12** Make sure patient gets all dental work done prior to PVS impressions.

1 Managing Aligner fit and seating

Aligners are too tight or can't be removed (too retentive)



Image A: Guitar pick to aid with Aligner removal



Image B: Sectioning Aligner template to apply attachments at subsequent appointments

ROOT CAUSES	SOLUTIONS			
Too many attachments	Consider having patient rinse mouth first with warm water before removing Aligner	Consider not bonding all attachments at first Aligner delivery. Section attachment template into tooth-specific templates, or use the current Aligner as a template (NOTE: current Aligner may be rigid/retentive) and apply attachments at subsequent appointment <i>see fig. B</i>	Some doctors suggest patient use a guitar pick to aid in removal of the Aligner <i>see fig. A</i>	Consider having the patient move to new stages before going to bed. The initial movements are the most noticeable and can occur when the patient is asleep. He/she can sleep through the initial discomfort.
Prevention Note 1.13				
Severe Undercuts	(See Undercut section, page 5)	Consider having patient rinse mouth first with warm water before removing Aligner	Some doctors suggest patient use a guitar pick to aid in removal of the Aligner <i>see fig. A</i>	
Severe crowding	Some doctors suggest patient use a guitar pick to aid in removal of the Aligner <i>see fig. A</i>			

PREVENTION NOTES:

1.13 Reduce the number of attachments during ClirCheck review (guideline: try to stay away from more than four attachments per arch). Consider placing attachments at stage 2. Teeth may be more mobile and Aligner will be easier to remove when attachments are placed at this time. See Attachment protocol (Tips & Techniques on Online CEC).

1 Managing Aligner fit and seating

The Aligners are not retentive enough



This image is from a case where composite attachments were not initially placed for appliance retention. Since the dental crowns are somewhat short (especially in the

lower right), Aligner retention is evaluated by placing pressure points in the appliance in the interproximal areas. Points that are made too deep for complete seating of the appliance can be flattened using the Envers Pliers.



Aligner with retention dimples

ROOT CAUSES

Retention potentially due to short clinical crowns, common with teens

Prevention Note 1.14

Attachments may have come off

SOLUTIONS

Use Detail Pliers for retention see fig 4

When current stage is completed, segment Aligner as an attachment template to rebond attachments.

REFERENCES

Detail Pliers (Tips & Techniques on Online CEC)

PREVENTION NOTES:

1.14 Add extra attachments for retention when modifying ClinCheck or plan to use Detail Pliers.

1 Managing Aligner fit and seating

Short Aligners

Definition: If the Aligner trim >1 mm from FGM (free gingival margin) in more than 2 consecutive teeth...



Short Aligners on lower anterior arch



Distorted initial impression



Aligners of proper length and fit

ROOT CAUSES

SOLUTIONS

REFERENCES

Suboptimal initial impressions that did not capture full clinical crowns see Fig. 8

Prevention Note 1.15

BEGINNING TX ONLY:
Have Aligners remade by retaking impressions and send back to Align along with new photos and original Aligners that did not fit

PVS impression taking technique (Tips & Techniques on Online CEC), Photo guide (Tips & Techniques on Online CEC)

Suboptimal photos were submitted that didn't allow technician to compare clinical position of gingiva with the virtual gingiva

Prevention Note 1.16

BEGINNING TX ONLY:
Have Aligners remade by retaking impressions and send back to Align along with new photos and original Aligners that did not fit

PVS impression taking technique (Tips & Techniques on Online CEC), Photo guide (Tips & Techniques on Online CEC)

During Middle of Treatment: Improvement in gingival health may cause gingiva to shrink down during treatment which may look like Aligners are short

Prevention Note 1.17

MIDDLE TX ONLY:
Continue treatment unless movements effected, in which case Mid-Course Correction may be warranted

Aligners were trimmed too short during manufacturing (rare)

BEGINNING TX ONLY:
Call Align Customer Support; Ask for Aligners with repositioned gingival line—do not resubmit impressions—and ask for warranty replacement Aligners. Submitting photos are helpful to Align to correct the problem

During Middle of Treatment: Short Aligners caused by tooth-specific movements not occurring (When tooth does not track with the Aligner the Aligner may appear short in that area)

MIDDLE TX ONLY:
(See Tooth-Specific Movement sections [pp. 11-30] in this Guide)

PREVENTION NOTES:

1.15 Make sure you are taking quality initial records, particularly photos and impressions.

1.16 Check position of virtual gingiva in ClinCheck to ensure accuracy.

1.17 Consider chlorhexidine gluconate rinse for one week prior to Invisalign PVS impressions to reduce any effects of gingivitis.

1 Managing Aligner fit and seating

Long Aligners



A Trim Aligner with Invisalign EZ-Trim trimming Bar.



B EZ-Trim polishing wheel

ROOT CAUSES

Suboptimal initial impression. Technician had to guess location of gingival line during Aligner manufacture

SOLUTIONS

Trim and polish Aligners see eg. A & B

BEGINNING TX ONLY:
If all Aligners affected, send Aligners back to Align with photos of problem areas to have Aligners remade (warranty Aligner)

2 Handling tooth-specific movements

Rotations of anterior teeth not occurring

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Mouth mirror to protect the tongue. Single-sided disk is spinning labially towards the mirror at very low RPMs. (Womack)



Smooth parallel lines without subgingival ledges is the goal. (Womack)



Monitor with floss to ensure contacts are not binding.



Thickness gauge to verify the amount removed in .1 mm increments. (Womack)



Using diamond strips to round out line angles and create natural-looking dental anatomy. (Womack)

ROOT CAUSES

SOLUTIONS

REFERENCES

Not enough time for movement to be expressed

Extend wear time of Aligner stage; ensure contacts are not binding on teeth that are trying to rotate

Use Invisalign Detail Pliers to assist with minor movements

During Case Refinement ask for Overcorrection (see Align's Overcorrection policy, p. 12)

Prevention Note 2.0

Lack of overjet; teeth have no place to move without interference from the opposing arch

Move teeth from opposing arch out of the way

IPR Guides (Tips & Techniques on Online CEC; IPR Video; IPR in Clinical Update, Fall 2007)

Prevention Note 2.1

Not enough space for teeth to move due to lack of IPR

Complete the amount of IPR prescribed; extend Aligner wear with current Aligner (maybe backtrack 1-2 Aligners); continue treatment (see fig. A,B)

IPR Guides (Tips & Techniques on Online CEC; IPR Video; IPR in Clinical Update, Fall 2007)

Prevention Note 2.0

Not enough space for teeth to move due to tight contacts

Monitor contacts with unwaxed floss during treatment whether IPR prescribed or not—if contacts are tight, lightly loosen contacts with a fine diamond strip; verify treatment progress with corresponding ClinCheck stage (see fig. C,D,E)

Use Invisalign Detail or Eraser Pliers to assist with minor movements

Prevention Note 2.0

IPR Guides (Tips & Techniques on Online CEC); IPR Video; IPR in Clinical Update, Fall 2007

IPR Guides (Tips & Techniques on Online CEC); IPR Video; IPR in Clinical Update, Fall 2007

PREVENTION NOTES:

2.0 Always monitor contacts with unwaxed floss during treatment whether IPR was prescribed or not. If contacts are tight, loosen contacts with a fine diamond strip; verify treatment progress with corresponding ClinCheck stage; if anticipating >3 mm of IPR then consider doing IPR prior to PVS Impressions (esp. if IPR is in the posterior area); check repro-imation form during treatment and keep track of amount of IPR during treatment.

2.1 In Treatment Plan and ClinCheck review, pro-cline uppers; consider IPR on lowers to make space for retraction of anteriors.

2.2 Consider adding attachments during ClinCheck to assist with rotations [See Attachment Protocol on Online CEC to see options you may request, including size, shape, location of attachment]. NOTE: If you change/add an attachment during treatment, you should section the attachment template into a tooth-specific template, or use the current Aligner as a template. If you use the current Aligner as a template, note that the Aligners will be 1 stage off in relation to the attachments.

Section continued on following page...

2 Handling tooth-specific movements

Rotations of anterior teeth not occurring

PAGE 2 OF 2

ROOT CAUSES	SOLUTIONS		
If the tooth did not extrude, the Aligner may have failed to "grab" the tooth, leaving less surface contact area to rotate the tooth (common with upper lateral incisors)	Rotate teeth as a separate step from extrusion		
Attachments are not engaged	Ensure there are no interproximal space constraints and reference the Attachments section, pp. 31-32		
Prevention Note 2.2 see page 16			
The surface contact of the Aligner against the tooth is small (i.e., peg lateral)	Extend wear time of Aligner stage	Add an attachment during Case Refinement to enhance the undercut	During Case Refinement ask for Overcorrection (Be specific about tooth and magnitude of Overcorrection: see Align's Overcorrection policy at right)

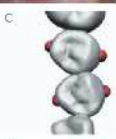
Section continued from previous page.

Align Technology, Inc. Note on Overcorrection:
Align recommends overcorrection for all case refinement orders at or near the end of treatment. Align does not recommend building overcorrection into Prescription & Diagnosis Forms at the start of treatment. At the beginning of treatment, it's nearly impossible to predict the direction and magnitude of overcorrection that may be required at the end of treatment. In fact, a clinical study indicated that the incidence of Refinement does not decrease with the incorporation of overcorrection at the beginning of treatment. If anything, overcorrection may delay the onset of treatment because of confusion from the appearance of ClinCheck, and may also extend overall treatment time because of its unpredictable outcome. Overcorrection makes more sense near the end of treatment when the specific movements needed are clearly identified. The clinician can then communicate through case refinement which teeth to overcorrect, how much, and in which direction. With the Invisalign Detail Pliers, minor movements may even be corrected without resorting to case refinement.

Requests for overcorrection at the outset of treatment will still be honored if the instructions are specific. The initial prescription form must specify which teeth need overcorrection, what magnitude (degrees or mm), and in which direction. This should ensure greater predictability with treatment outcome, improve the overall appearance of ClinCheck set-ups, and avoid delays in order processing. ClinCheck versions 1.7 and above have a "View Overcorrection" checkbox which enables clinicians to view the overcorrection stages so that the last stage shows the optimal set-up, rather than the overcorrected position.

2 Handling tooth-specific movements

Rotations of posterior teeth (especially premolars/bicuspids) not occurring PAGE 1 OF 2

	ROOT CAUSES	SOLUTIONS	REFERENCES
 <p>Before rotation</p>	<p>Not enough time for movement to be expressed due to variation in bone biology or tooth morphology</p> <p>Prevention Note 2.3</p>	<p>Extend wear time of Aligner stage; and ensure contacts are not binding on teeth that are to rotate</p>	<p>IPR Guides (Tips & Techniques on Online CEC); IPR Video; IPR in Clinical Update, Fall 2001</p>
 <p>After rotation</p>	<p>Not enough space due to inadequate IPR</p> <p>Prevention Note 2.3</p>	<p>Do the amount of IPR prescribed; extend Aligner wear with current Aligner (maybe backtrack 1-2 aligners); continue treatment <i>see fig. 4.8</i></p>	<p>IPR Guides (Tips & Techniques on Online CEC); IPR Video; IPR in Clinical Update, Fall 2001</p>
 <p>Prevention solution of buccal-lingual attachments</p>	<p>Not enough space due to tight contacts</p> <p>Prevention Note 2.3</p>	<p>Monitor contacts with unwaxed floss during treatment whether IPR prescribed or not—if contacts are tight, lightly loosen contacts with a fine diamond strip; verify treatment progress with corresponding ClinCheck stage</p>	<p>IPR Guides (Tips & Techniques on Online CEC); IPR Video; IPR in Clinical Update, Fall 2001</p>
 <p>Using sectional to correct rotation first, before sending PVS impressions</p>	<p>Inadequate undercuts for the Aligner to grab tooth properly, even with attachments</p> <p>Prevention Note 2.4</p>	<p>Auxiliary Treatment: Button interarch elastic—and make sure there is no contact binding <i>see p. 24, fig. A.2.D.2</i></p>	<p>Brackets/sectional wires <i>see fig. D</i></p>

PREVENTION NOTES:

2.3 Monitor contacts with unwaxed floss during treatment whether IPR prescribed or not—if contacts are tight, lightly loosen contacts with a fine diamond strip; verify treatment progress with corresponding ClinCheck stage; if anticipating > 3 mm of IPR then consider doing IPR prior to PVS Impressions (especially if IPR is in the posterior area); check reproximity form during treatment and keep records of amount of IPR during treatment.

2.4 Rotate tooth prior to beginning treatment with other appliances, such as sectionals. When reviewing ClinCheck, make sure that the tooth has room to rotate, either through space or planned IPR (space on each side of tooth). Consider adding buccal and lingual attachments or other attachments during ClinCheck to aid with rotations, but be careful about over-retentive Aligners if there are too many buccal/lingual attachments (See Attachment Protocol on Online CEC). (*see fig. C*)

2.5 Consider adding attachments during ClinCheck to assist with rotations (See Attachment Protocol on Online CEC to see options you may request, including size, shape, location of attachment). NOTE: If you change/add an attachment during treatment, you should section the attachment template into a tooth-specific template, or use the current Aligner as a template. If you use the current Aligner as a template, note that the Aligners will be 1 stage off in relation to the attachments.

Rotation (Tips & Techniques on CEC)

Section continued on following page...

2 Handling tooth-specific movements

Rotations of posterior teeth (especially premolars/bicuspid) not occurring **PAGE 2 OF 2**

ROOT CAUSES	SOLUTIONS	REFERENCES	
Attachments are not engaged	Ensure there are no interproximal space constraints and reference the Attachments section (pp. 31-32) of this Guide	Attachment Protocol (Tips & Techniques to be on Online CEC)	
The surface contact of the Aligner against the tooth is small (i.e., peg lateral)	Extend wear time of Aligner stage	Add an attachment during Case Refinement to enhance the undercut	During Case Refinement ask for Overcorrection (Be specific about tooth and magnitude of Overcorrection: see Align's Overcorrection policy, p. 12)
Prevention Note 2.5 see page 18			

Section continued from previous page.

2 Handling tooth-specific movements

Residual crowding



Example before



Adjustment (Canine adjustment to Aligner was added after photo was taken.)



Example After



Overcorrection Aligners, indicated with a "+"

ROOT CAUSES

Aligner lag, or not enough time for movement to be expressed due to variation in bone biology or tooth morphology

SOLUTIONS

Extend wear time of Aligners or backtrack an Aligner before moving forward. Ensure contacts are not binding on teeth that are to rotate

REFERENCES

Detail Pliers (Tips & Techniques on Online CEC)

Lack of overjet: Lower crowding cannot be resolved because lower teeth are contacting upper teeth (interarch interference)

Move interference out of the way with Case Refinement Aligners

Inadequate IPR during treatment

Complete the amount of IPR prescribed and extend wear time of Aligner or backtrack an Aligner

IF AT END OF TREATMENT, during Case Refinement ask for Overcorrection see tip 2.

Use Detail Pliers to apply pressure points for additional force

Detail Pliers (Tips & Techniques on Online CEC)

Prevention Note 2.6

Contact binding (interproximal interference)

Ensure no contact binding with floss and finishing diamond strips. Extend wear time of Aligners

Use Detail Pliers to apply pressure points for additional force

IPR Guides (Tips & Techniques on Online CEC; IPR Video; IPR in Clinical Update, Fall 2001; Detail Pliers (Tips & Techniques on Online CEC)

Prevention Note 2.7

PREVENTION NOTES:

2.6 Closely track amount of IPR and monitor teeth.

2.7 Consider Pre-FVS IPR (make sure to retain teeth between taking FVS impressions and initial Aligner delivery).

2 Handling tooth-specific movements

Residual spaces at the end of treatment

PAGE 1 OF 2



Residual spacing



Spaces closed



In this case, space closure was over-corrected (virtual c-chain).



Residual spacing



Residual spacing

ROOT CAUSES

SOLUTIONS

REFERENCES

Aligner lag, or not enough time for movement to be expressed due to variation in bone biology or tooth morphology

Extend wear time of Aligners.

Case Refinement (build in overcorrection—virtual C-Chain) Be specific about tooth and magnitude of Overcorrection. (See Align's Overcorrection policy, p. 12.)
see pg. A, B, C

Detail Pliers to retract no more than 0.5 mm per tooth

Hawley retainer (relieve lingual acrylic)

Positioner

IPR Guides (Tips & Techniques on Online CEC), IPR Video, IPR in Clinical Update, Fall 2001

Prevention Note 2.8

Excessive IPR

Case Refinement (build in overcorrection—virtual C-Chain) Be specific about tooth and magnitude of Overcorrection. (See Align's Overcorrection policy, p. 12.)
see pg. A, B, C

Detail Pliers to retract no more than 0.5 mm per tooth

Hawley retainer (relieve lingual acrylic)

Positioner

Detail Pliers (Tips & Techniques on Online CEC)

No space to retract the teeth due to lack of overjet/
Tooth size discrepancy

Leave space for restoration

IPR opposite arch to close the spaces with Case Refinement

Order Refinement Aligners to overcorrect intrusion to allow overjet for retraction

PREVENTION NOTES:

2.8 Using highest detail setting in ClinCheck, review setup for spaces

Section continued on following page...

2 Handling tooth-specific movements

Residual spaces at the end of treatment

PAGE 2 OF 2



Smooth parallel lines without subgingival ledges is the goal. (Wornack)

ROOT CAUSES	SOLUTIONS
No space to retract teeth due to deepbite	Intrude upper or lower incisors to openbite then close spaces (Mid-Course Correction)
Subgingival IPR ledge makes contacts appear open.	Remove ledge with IPR, close space with any of the above solutions listed under "Aligner lag" (p. 16) <small>see fig. A</small>
Space may have been present in ClinCheck	Close space with any of the solutions listed in the "Aligner lag" row of the previous page
Prevention Note 2.8 <small>see page 27</small>	

Section continued from previous page.

2 Handling tooth-specific movements

Anterior teeth not level



Initial photo: Class I, mild upper, moderate lower crowding, deep bite, dark teeth.



After 3+ upper, 20 lower Aligners: Mild rotations/in-out discrepancies in lower anterior are still needed, but most noticeable is the 2 mm discrepancy in central incisor crown length, as well as the incisal edge irregularity. The teeth are lighter from tooth whitening during Invisalign treatment.



After esthetic adjustments were made: Right central and left lateral edges were shortened for improved symmetry. Refinement impressions were taken after the esthetic adjustments were made. The patient is finishing 5 upper and lower refinement Aligners. #5 will be shortened even more or #9 incisal edge built up, depending on the refinement outcome. The patient can also benefit from slight gingival recontouring around #9.

ROOT CAUSES

Extrusion not occurring:
See sections on Extrusions (p. 24) and Intrusions (p. 33)

Prevention Note 2.9

SOLUTIONS

Aesthetic leveling based on clinician's judgement (build up a tooth or aesthetically level it)
see fig. A, B, C

Case Refinement or Mid-Course Correction to request levelling

Tooth crowns are different lengths

Prevention Note 2.9

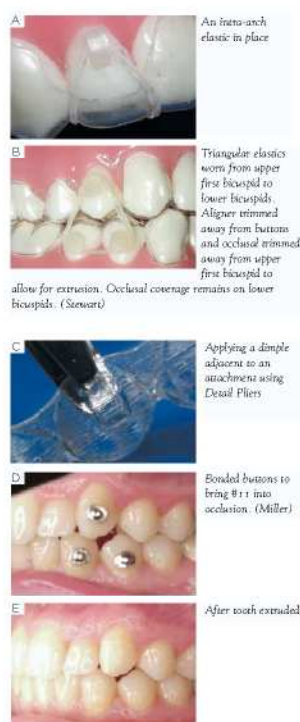
Reshape or build up to even teeth
see fig. C

PREVENTION NOTES:

2.9 Where possible intrude teeth rather than extrude teeth when leveling (extrusion is a less predictable movement).

2 Handling tooth-specific movements

Incomplete extrusions



ROOT CAUSES

SOLUTIONS

REFERENCES

Absolute extrusion was programmed (less predictable than relative extrusion).

Prevention Note 2.10

Auxiliary Treatment: Button—interarch or intra-arch elastic—and make sure there is no contact binding *see fig. A,B,D,E*

Sectionals (brackets and wires)

Extrusions (Tips & Techniques on Online CEC); Buttons; Button Kit

Insufficient undercut for Aligner to grab tooth

Prevention Note 2.10

Auxiliary Treatment: Button—interarch or intra-arch elastic—and make sure there is no contact binding *see fig. A,B,D,E*

Sectionals (brackets and wires)

Extrusions (Tips & Techniques on Online CEC); Buttons; Button Kit

Attachments not engaging, or attachment ineffective

Prevention Note 2.11

Remove attachments and use Auxiliary Treatment: Button—interarch or intra-arch elastic—make sure there is no contact binding *see fig. A,B,D,E*

Consider using Detail Pliers to assist with extrusion by placing dimples directly gingival to the attachment. *see fig. C*

Ensure there are no interproximal space constraints and reference the Attachments section, pp. 31-32.

Extrusions (Tips & Techniques on Online CEC); Buttons; Button Kit; Pliers (Tips & Techniques on Online CEC)

Insufficient coverage area of the isolated tooth (short Aligner around tooth)

Auxiliary Treatment: Button—interarch or intra-arch elastic—and make sure there is no contact binding *see fig. A,B,D,E*

Sectionals (brackets and wires)

Extrusions (Tips & Techniques on Online CEC); Buttons; Button Kit

Lack of space (interproximal interference)

Always monitor contacts with unwaxed floss during treatment. If IPR is prescribed, check reproximation form and track amount of IPR done. If IPR is not prescribed, continue to check if contacts are tight, loosen contacts with a fine diamond strip; extend Aligner wear with current Aligner (maybe backtrack 1-2 aligners); verify treatment progress with corresponding ClinCheck stage

Auxiliary Treatment: Button—interarch or intra-arch elastic—and make sure there is no contact binding *see fig. A,B,D,E*

PREVENTION NOTES:

2.10 Program more predictable movements in ClinCheck (intrusion and relative extrusion); if doing less predictable movements, program them at the end of treatment (i.e., absolute extrusion); attachments are placed for 2-3 anterior intrusions but not automatically placed for extrusion of posterior teeth—request if desired (see Attachment Protocol on Online CEC).

2.11 Attachments for anterior extrusions are automatically placed for extrusions >1 mm. Posterior extrusion >1 mm must be requested by doctor.

IPR Guides (Tips & Techniques on Online CEC); IPR Video, IPR in Clinical Update, Fall 2001

2 Handling tooth-specific movements

Posterior openbite occurring near end of treatment

REFERENCES

ROOT CAUSES

SOLUTIONS

Extrusion (see *Tips & Techniques* on Online CEC)

PREVENTION NOTES:

2.12 Expansion via buccal segment uprighting is more likely to be successful than bodily expansion of the entire segment

Clinical photograph showing a close-up of the anterior teeth (incisors) with a noticeable overbite and potential interference during occlusion.

CASE ONE:

Anterior interference can lead to...

Anterior interference/
insufficient leveling
see fig. A, B

Case Refinement
to relieve anterior
interference by
additional leveling
(intrusion of upper
and/or lower
incisors)

Case Refinement to
relieve anterior
interference by mov-
ing uppers forward,
lowers back. IPR
may be needed.

Anterior occlusal
equilibration

Clinical photograph showing the posterior teeth (premolars and molars) with a significant open bite, where the upper and lower teeth do not meet.

...posterior openbite

Transient posterior
interference/intrusion

Cut out premolar/molar region of Aligners;
allows for settling in posterior (Watch for
rotation relapse of posterior teeth if they
are not covered) *see fig. C, D*

Deliver non-occlusal
coverage retainers
(i.e. Hawley Retainers/
circumferential
retainer/wrap-
around retainer)

Do nothing—may
naturally settle after
treatment

Auxiliary Treatment:
Buttons - extrusion
(interarch) - to
extrude and close
the posterior open-
bite

Clinical photograph showing the upper dental arch with a noticeable bowing or protrusion of the incisors.

CASE TWO:

Aligners trimmed
distal to second
premolar to allow
passive eruption
(settling).

Bowing of arch due to
insufficient IPR (Unwanted
intrusion)

(See "Unintended
Intrusion" section,
p. 24)

Clinical photograph showing the lower dental arch with a sealed occlusion, where the teeth are in contact but there is no space for expansion.

Sealed occlusion
(Boyd)

Posterior buccal tipping
instead of bodily expansion

Provide buccal root
torque via fixed
appliances

Prevention Note 2.12

PREVENTION NOTES:

2.12 Expansion via buccal segment uprighting is more likely to be successful than bodily expansion of the entire segment

2 Handling tooth-specific movements

Black triangles appear



Black triangle

ROOT CAUSES

Due to shape of teeth, position of teeth, or lack of papilla once teeth are aligned

Prevention Note 2.13

Unwanted tip between two teeth causing contact point to be occlusal

SOLUTIONS

Perform IPR and move contact point gingivally and then close the space with Case Refinement or Detail Pliers

Consider additional IPR to move contact gingivally

Upright the teeth with sectionals/ fixed appliances or Case Refinement with attachments

Restorative dentistry

PREVENTION NOTES:

2.13 Review ClinCheck carefully for black triangles, although note that ClinCheck is not always 100% indicative of eventual treatment outcomes and simulated gingiva in ClinCheck may not always accurately represent the patient's gingiva. Review patient's initial condition to assess for potential black triangles at the end of treatment.

2 Handling tooth-specific movements

Incomplete tip at end of treatment



Sectional fixed appliances may be used to correct severe rotations, extrusions and tips not easily achieved by Aligners alone. This can be done discretely prior to taking initial PVS impressions, or after Aligner treatment is complete.

ROOT CAUSES

Aligners switched too fast to allow for root translation

Prevention Note 2.14

SOLUTIONS

Extend wear time of each Aligner before advancing to the next stage

Insufficient undercut area for Aligner to grab the tooth

Prevention Note 2.14

Sectional brackets and wires *see Fig. A*

Add attachments in Case Refinement as close to center of rotation of tooth as possible to upright the teeth

Use Detail Pliers near mesial/distal line angles to enhance desired pressure

REFERENCES

Attachment Protocol (Tips & Techniques on Online CEC)

PREVENTION NOTES:

2.14 Request rectangular Attachments. Extend wear time. Ensure amount of tip you want is expressed in ClinCheck.

2 Handling tooth-specific movements

Incomplete torque



Typical lower incisor extraction case; rectangular attachment



Sectional fixed appliances may be used to correct severe rotations, extrusions and tips not easily achieved by Aligners alone. This can be done discretely prior to taking initial PVS impressions, or after Aligner treatment is complete.

ROOT CAUSES

Insufficient undercut area for Aligner to grab the tooth

Prevention Note 2.15

SOLUTIONS

Add attachments in Case Refinement

Extend wear time of Aligner

Overcorrect root torque at Case Refinement

Skeletal component of expansion

Prevention Note 2.16

REFERENCES

Attachment Protocol (Tips & Techniques on Online CEC)

PREVENTION NOTES:

2.15 Request attachments in ClinCheck for additional undercut.

2.16 Expansion via buccal segment uprighting is more likely to be successful than bodily expansion of the entire segment

2 Handling tooth-specific movements

Unintended intrusion is occurring of tooth that I'm trying to extrude/rotate/expand



Unexpected intrusion

ROOT CAUSES

Inadequate IPR, causing Aligner to squeeze tooth apically

SOLUTIONS

Monitor contact; if tight, lightly loosen contact with fine diamond strip; use auxiliary treatment to get tooth back on track

Buttons/elastics

Sectional fixed appliances

REFERENCES

IPR Guides (Tips & Techniques on Online CECI); IPR Video; IPR in Clinical Update, Fall 2001

PREVENTION NOTES:

2.18 Make sure sufficient interproximal space is present during rotations and extrusions; Stage less predictable movements towards the end of treatment.

2 Handling tooth-specific movements

Unwanted tipping/dumping during large span space closure of extraction spaces

ROOT CAUSES	SOLUTIONS					
Space too large (e.g., bicuspid extraction)—less predictable movement of Aligners	Extend wear time of Aligner to allow tooth movements to fully express	Consider combining with restorative dentistry and not trying to close all spaces orthodontically	Mid-Course Correction if off-track. Submit new PVS impression to Align.	Consider other appliances: Sectionals, Power arms	Consider virtual gable bend programmed in ClinCheck.	Combination Treatment: Aligners plus sectionals or fixed appliances
Prevention Note 2.19						

PREVENTION NOTES:

2.19 Choose extraction cases where the roots are positioned in your favor; request rectangular attachments on teeth adjacent to the extraction site and plan to extend the wear time of the Aligners per stage; combination treatment—use Aligners until unwanted crown dumping/tipping occurs then switch to sectionals or fixed appliances. Place vertical rectangular attachments to help prevent unwanted tipping.

2 Handling tooth-specific movements

Distalization/Mesialization not occurring



Notice orientation of buttons in direction of elastic pull



Clear buttons bonded onto the Aligner for Class II correction (Boyd)



Elastics attached to button (Boyd)

ROOT CAUSES

Aligners can be less predictable distalizing teeth depending on bone biology and tooth morphology (>2 mm less predictable)

Prevention Note 2.20

SOLUTIONS

Backup anchorage with elastics. NOTE: Aligner may become less retentive with prolonged elastic wear, so add pressure points with Detail Pliers for retention.

REFERENCES

Interarch Guide (Tips & Techniques on Online CEC)

Aligners can be less predictable mesializing teeth (>1 mm). Due to natural distal root tip of teeth, bringing posterior teeth forward a large distance can cause tipping.

Prevention Note 2.20

Backup anchorage with elastics. NOTE: Aligner may become less retentive with prolonged elastic wear, so add pressure points with Detail Pliers for retention.

Fixed appliances

Interarch Guide (Tips & Techniques on Online CEC)

PREVENTION NOTES:

2.20 If you anticipate using elastics during treatment, the Aligner may become less retentive so add attachments for retention in your ClinCheck; do distalization/mesialization before Invisalign treatment with a fixed or removable distalization appliance; hold with retention prior to Aligners arriving.

2 Handling tooth-specific movements

Expansion not occurring

ROOT CAUSES

Excessive expansion by bodily movements rather than buccal uprighting

Prevention Notes 2.21 and 2.22

SOLUTIONS

Mid-Course Correction; Fixed Appliances

REFERENCES

In & Out (Tips & Techniques on Online CEC)

Excessive skeletal component to the expansion for a dental movement appliance

Prevention Note 2.23

Consider treating in combination with Aligners and fixed appliances/surgery

PREVENTION NOTES:

2.21 In Treatment Planning/ClinCheck, expansion via buccal uprighting is more predictable than bodily movement.

2.22 Consider expanding posterior segment (4-7) as one unit first vs. individual teeth.

2.23 Consider combination pre-treatment with expanders (see Online CEC article *Hickory WB. Combination Treatment to Meet Market Demands: Pre-Invisalign Combination Treatment, Part 1: Intrusion. Praxis, excellence in orthodontic management. June/July 2002; 11-13*) or surgical expansion. Consider modifying treatment goals if skeletal component to expansion and the patient is unwilling to correct through surgery.

2 Handling tooth-specific movements

Intrusion not occurring



Align will automatically place attachments for anterior intrusions greater than ~0.50 mm.

ROOT CAUSES

Attachments may have come off or may have become worn down

Prevention Note 2.24

Lack of anchorage on adjacent teeth with Aligners not grabbing attachments

Prevention Note 2.25

Inadequate interproximal space for intrusion

SOLUTIONS

Rebond attachment using sectioned template or current Aligner. (see Attachments section, pp. 31-32.)

Mid-Course Correction (remove any old attachments prior to new PVS impressions)

Always monitor contacts with unwaxed floss during treatment. If IPR is prescribed, check reproximation form and track amount of IPR done. If IPR is not prescribed, continue to check if contacts are tight, loosen contacts with a fine diamond strip; extend Aligner wear with current Aligner (maybe backtrack 1-2 aligners); verify treatment progress with corresponding ClinCheck stage

REFERENCES

Guide to Placing Attachments (Tips & Techniques on Online CEC)

IPR Guides (Tips & Techniques on Online CEC), IPR Video; IPR in Clinical Update, Fall 2007

PREVENTION NOTES:

2.24 When reviewing ClinCheck, check intrusive movement—is it isolated or in combination with tipping or torquing movement. Try to isolate intrusion. Separate movements in ClinCheck. If a lot of intrusion is being done, consider intruding 2-3 first, then intruding the cuspids rather than all at once. Place attachment adjacent to the tooth needing to be intruded in ClinCheck.

2.25 Intrusion of upright teeth is more biomechanically advantageous than intrusion of flared teeth.

2 Handling tooth-specific movements

Extraction site space not closing

ROOT CAUSES	SOLUTIONS	REFERENCES
Pontic material preventing adjacent teeth from moving	Make sure to leave space mesial/distal on each side on pontic (suggested rule of thumb: toothpick size space on each side)	Align Pontic Kit; Guide to Extractions (on Online CEC)

2 Handling tooth-specific movements

Anterior or lateral openbite (rare) occurring

ROOT CAUSES

Terminal molar (i.e., 2nd or 3rd molar) superupraption due to non-occlusal coverage of terminal molar (doctor would have to cut Aligner at terminal molar with no coverage on that tooth for this to occur or missed capturing the molar in the initial PVS impression)

Prevention Note 2.26

SOLUTIONS

Occlusal equilibration

Fixed appliances to extrude teeth or intrude terminal molar

REFERENCES

IPR Guides (Tips & Techniques on Online CEC); IPR Video; IPR in Clinical Update, Fall 2001

PREVENTION NOTES:

2.26 If trimming Aligners at terminal molar, ensure at least mesial half of tooth is covered to prevent supereruption.

2.27 Make sure terminal molar (2nd or 3rd molar) are included in the impression. Decide what will be done with third molars before ClinCheck (i.e., virtually extract 3rd molars or include in Aligner coverage).

3 Ensuring Attachments fit and stay bonded

Attachments are not fitting into the Aligner attachment space



Properly seated attachments.



Verify attachment seating by marking it with a pencil.



If the pencil mark and the Aligner do not line up, then the tooth movement is lagging behind.



Before using Eraser Pliers to erase attachment pocket.



After using Eraser Pliers to erase attachment pocket.

ROOT CAUSES

Tooth movement not occurring due to bone biology, Aligner lag, or excessive speed of movements

SOLUTIONS

Back up an Aligner to try to reengage attachment into pocket. If they don't reengage, see the solutions to the right...

Remove attachment and use sectioned attachment template to rebond attachments; or use current Aligner as an attachment template, but be aware that you will be one stage off

Remove attachment and continue treatment without attachments if possible. If attachment pocket in Aligner affects patient aesthetics, erase it with the Eraser pliers (NOTE: this may distort the Aligner) *see Fig. D, E*

If attachments are necessary to achieve original treatment goals, then use Mid-Course Correction for new Aligners

Gingiva is simulated in gingiva—if Aligner is trimmed short then attachment will not be fully covered and therefore not fully engaged

(See Short Aligners section, p. 9)

Prevention Note 3.0

REFERENCES

Guide to Placing attachments (Tips & Techniques on Online CEC)

PREVENTION NOTES:

3.0 Make sure attachment is fully covered by Aligner—during ClinCheck modification, request attachment is placed at least 2 mm away from the gingival ledge of the Aligner.

3.1 Educate the patient to mark the attachment with a pencil or wax pencil and to check to make sure the attachments are engaged. (See Fig. B, C)

3 Ensuring Attachments fit and stay bonded

Attachments come debonded



A Section attachment template and reuse it on current tooth to bond attachment.



B Sectioning Aligner template to apply attachments or subsequent appointments

ROOT CAUSES

SOLUTIONS

REFERENCES

Contaminated bond surfaces

Replace under better isolation

Prevention Note 3.2

Attachment broken from use

Section attachment template and reuse it on current tooth to bond attachment see fig. A, B

Use previous Aligner, if present, or current Aligner as an attachment template

Prevention Note 3.3

Attachments worn down from wear

Remove and replace attachment with higher-fill composite

Prevention Note 3.3

Occlusal interference, causing patient to shear off attachment

Adjust attachment with trimming bur to relieve

Prevention Note 3.4

Attachments don't bond well to restorations

Guide to Placing Attachments (Tips & Techniques on Online CEC)

PREVENTION NOTES:

3.2 Bonding to porcelain or gold may be difficult. Check ClinCheck to see if teeth with crowns or veneers have attachments and plan accordingly. Treatment goals may require alteration if attachments are not bonded to crowns.

3.3 Don't smooth off edges of rectangular attachments.

3.4 Attachment repositioning can be requested during ClinCheck modification.

Align Technology, Inc. Note on Attachments:

Not all types of attachments are placed automatically by default (please reference the Attachment Protocol document) because we are still researching the data that will help determine if and when certain attachments are indispensable for certain movements to occur, or to prevent unwanted results from developing. Until further data is available, aside from the current default attachments, the decision whether attachments are necessary, what type and where to put them, is up to the treating clinician. Align will make suggestions if it is requested from us, but please be aware that further clinical data is still required on this issue. Align and several universities are currently researching this area of the treatment. (See Attachment Protocol on Online CEC)

4 Addressing patient concerns

Patient has negative reaction to Aligner (rare)

ROOT CAUSES

Sensitivity to Aligner material

Prevention Note 4.0

SOLUTIONS

Call Align Customer Support to report problem.

PREVENTION NOTES:

4.0 Check if patient has history of allergy to plastics. Rule out latex allergy, especially when delivering Aligners using latex gloves.

4 Addressing patient concerns

TMD symptoms occurring (jaw hurts or locks—rare)

ROOT CAUSES	SOLUTIONS
Material thickness; jaw clenching while sleeping Prevention Note 4.1	Trim occlusal/distal-most portion of Aligner Don't wear Aligners while asleep; extend wear time to 3 weeks to compensate for lost time
Anterior tooth interference Prevention Note 4.0	(See Posterior Openbite section, p. 20)
Supereruption of terminal molar Prevention Note 4.0	(See Anterior or Lateral Openbite section, p. 30)
Underlying/masked symptoms manifesting as a result of splint effect from Aligners	Stop treatment. Re-diagnose or treat one arch at a time. Discontinue elastic use, if any

PREVENTION NOTES:

4.1 Diagnose for underlying TMD symptoms or history of TMJ problems prior to starting treatment. If in doubt, consider making a vacuum retainer as a starter appliance before committing to Invisalign treatment.

5 Handling lost or broken Aligners

Lost or broken Aligner

ROOT CAUSES

If <7 days into current stage

If >7 days into current stage

Prevention Note 5.0

SOLUTIONS

Try moving to next Aligner stage; Retain with Previous Stage; Reorder lost stage (if broken, a warranty Aligner will be available at no charge if broken Aligner is returned to Align).

Try to move to next stage.

PREVENTION NOTES:

5.0 Have patients keep previous (old) Aligners for retention and backtracking.

6 Maintaining Aligner aesthetics

Staining or discoloration



A The pink discoloration reflects plaque and stain buildup. This patient cleaned his Aligners daily for a week using denture tablets.



B Same patient, different week, using a toothbrush.



C Same patient, different week, using the Invisalign Cleaning System.

ROOT CAUSES

Patient drinking tea, coffee, soda, wine, smoking with Aligners on.

Prevention Note 6.0

SOLUTIONS

Instruct Patient to remove Aligners when drinking/smoking/eating. Instruct Patient on cleaning: use the Invisalign Cleaning System.

REFERENCES

Instructions for Use in Patient Starter Kit; Cleaning Kit

PREVENTION NOTES:

6.0 Have Staff instruct patient at outset of treatment on cleaning care and use of the Invisalign Cleaning System and crystals.

6 Maintaining Aligner aesthetics

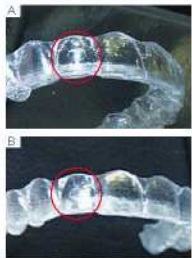
Holes or bubbles

ROOT CAUSES	SOLUTIONS
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Potential issue in manufacturing, packaging, or damage during shipment (rare)	Call Align Customer Support for warranty replacement Aligner(s)
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6 Maintaining Aligner aesthetics

Attachments on anterior teeth are not aesthetic



Before using Eraser Pliers to erase attachment pocket

After using Eraser Pliers to erase attachment pocket

ROOT CAUSES

Attachments on anterior teeth

Prevention Note 6.1

SOLUTIONS

Remove attachments and do a Mid-Course Correction for new Aligners without attachment spaces (fee involved)

Use Eraser Pliers to "erase" attachments until needed; may distort Aligner (see fig. A, B)

References

Attachments Protocol, Guide to Placing Attachments (Tips & Techniques on Online CEC)

PREVENTION NOTES:

6.1 Save requests for less aesthetic attachments until Case Refinement or consider placing attachment on the lingual surface.

7 Retainer questions

Frequently asked questions and answers

QUESTIONS

ANSWERS

REFERENCES

Is the last Aligner a retainer?

No. The Aligner material is not durable for long-term retention. Invisalign retainers are made from more durable material.

Retainer Information sheet on Online CEC

Can I order an Invisalign Retainer?

If you are satisfied with the final position of the teeth, match the teeth to stage of ClinCheck (initial or case refinement ClinCheck) and order retainer from Align for that particular stage. Use the Retainer Order form.

Note 7.0

Do I have to use an Invisalign Retainer?

No. You can use any retainer—fixed or removable. Retention is left up to the doctor and patient preferences.

Note 7.1

NOTES:

7.0 Align does not accept study models or additional impressions to make retainers (Retainers only created from initial or case refinement ClinCheck).

7.1 Retention should be planned and discussed with the patient prior to the beginning of treatment.

Glossary

This glossary is intended to be used as a tool for the dental professional as they learn about the Invisalign® treatment modality. It is not designed to be an all-inclusive orthodontic glossary, but to serve as reference to commonly used Invisalign terms.

Terms denoted with a (*) refer to either an Invisalign specific term, or a definition that differs slightly from the accepted orthodontic definition.

Absolute Extrusion True vertical movement along the long axis of the tooth.

Anchorage Resistance to displacement. The Invisalign system allows for intra-arch anchorage by isolating selected teeth to be moved.

Angle's Classification A classification system based on the relationship of the permanent maxillary first molars and Occlusion cuspids to the lower permanent teeth.

Angulation Mesial-distal movement of a tooth around the center of rotation.

Ankylosis Abnormal immobility, union or fusion. May occur between two bones at their articulation (i.e., TMJ) or between teeth and the alveolar bone. Dental ankylosis prevents both eruption and orthodontic movement.

Anterior open bite No vertical overlap exists between maxillary and mandibular anterior teeth.

A-P Discrepancy Anterior Posterior Discrepancy. Also known as Sagittal Discrepancy. An evaluation of the anterior-posterior position of the jaws, and / or teeth made from a profile view.

Arch length deficiency Difference between the available and required space within an arch to align the teeth.

Attachments* Composite forms bonded onto facial or lingual surfaces of teeth using a forming template to help achieve certain types of tooth movement with the Invisalign System.

Bilateral Denoting both sides.

Biomechanics Application of physical principals such as force, resistance as it relates to biological systems.

***Bite O (Bite Zero)** The stage at which the models are virtually articulated in. Extensive measurements are taken of plaster casts to insure the occlusion as you see depicted in the ClinCheck file on the computer, match the patients actual centric occlusion.

Bodily Translation The movement of a tooth where the crown and root of the tooth move the same distance in the same direction at the same time.

Bolton Analysis A method to evaluate tooth-size discrepancies (mesio-distal crown width) between the upper and lower arches.

***Case Refinement** The term used by Align Technology to describe when additional Aligners-beyond the last stage are required to get the patient closer to the desired treatment goal as established at the start of treatment. Case refinement forms are required.

Center of Rotation The point about which a tooth rotates.

Centric Relation (CR) The definition used by Align Technology: CR is the position of the teeth when the mandibular condyles are against the temporomandibular disc in the anterior and superior most portion of the glenoid fossa.

Centric The definition used by Align Technology: CO is the position of the teeth

when the teeth are in Occlusion (CO) their maximum intercuspal position, i.e. the best fit of the teeth.

Cephalometrics The scientific measurement of the bones of the cranium and face, utilizing a fixed reproducible position for lateral radiographic exposure of the skull and facial bones. Used for the evaluation of facial growth and development, including soft tissue profile.

Class I The mesiobuccal cusp of the upper first molar lies in the buccal groove of the lower first molar. The upper canine lies distal to the lower canine.

Class II The mesiobuccal cusp of the upper first molar lies mesial to the buccal groove of the lower first molar. The upper canine lies mesial to the lower canine.

Class II Division 1 Class II with increased overjet.

Class II Division 2 Class II with retroclined upper central incisors.

Class III The mesiobuccal cusp of the upper first molar lies distal to the buccal groove of the lower first molar. The upper canine lies distal to the contact point between the lower canine and first premolar.

***ClinCheck®** A computerized movie depicting the patient's teeth from beginning to final position is sent to you via the Internet and is easily viewed using Align Technology's exclusive ClinCheck software. This program allows you to visually review the projected movement as well as the final set up in three dimensions. Depending on the treatment option you select, ClinCheck may also give you the opportunity to request modifications in the treatment plan until you are satisfied with the movement staging and final outcome.

Couple Two parallel forces of equal magnitude acting in opposite directions and separated by a distance. Couples result in pure rotational movement about the center of resistance regardless of where the couple is applied on the object.

CR/CO Discrepancy When the CR bite position and the CO bite position are not coincident.

CR/CO Shift A deflection of the mandible in an anterior, posterior and / or lateral direction to centric occlusion, as a result of a premature contact occurring when the mandible is in centric relation.

Crossbite An abnormal relationship of one or more teeth to one or more teeth of the opposing arch, in the buccolingual or labiolingual direction. May be Anterior, Buccal, Lingual, Palatal, Posterior, Functional.

Buccal Crossbite A crossbite due to buccal displacement of the affected tooth or group of teeth from their ideal position relative to their antagonists.

Lingual Crossbite A crossbite mainly due to lingual displacement of the affected mandibular tooth or group of teeth from their ideal position relative to their antagonists.

Curve of Spee Curvature of the mandibular occlusal plane, from the buccal view. Ideally it should be flat to slightly concave.

Deep Bite Excessive overbite.

Distalization The movement of teeth in the distal direction.

Edge to edge occlusion An occlusion in which the anterior or posterior teeth of both jaws meet along their incisal or buccal cuspal edges. Often associated with a Class III occlusal relationship.

Glossary (cont'd)

Expansion Widening of the dental arches.

Extrusion A translational type of tooth movement parallel to the long axis of the tooth in the direction of the occlusal plane.

Finishing *see case refinement*

Force The actions of one body against another - push or pull, it has both magnitude and direction.

Headfilm A common term for cephalometric radiograph. In orthodontics lateral and frontal head films are common.

Inclination The buccal lingual movement of a tooth around the center of rotation.

***Interproximal Interference** Excessive "virtual" interproximal contacts between adjacent teeth. Clinically can result in stalled or lack of movement of teeth. May require additional interproximal reproximation.

Intrusion A translational type of tooth movement parallel to the long axis of the tooth in an apical direction.

IPR (Interproximal reduction)

Interproximal reduction of enamel. Also known as reproximation, slenderizing, stripping, Air-Rotor Stripping (ARS), or recontouring. Lateral Relating to the one side or the other.

Limited Treatment Orthodontic treatment with a limited treatment objective, not involving the entire dentition. Typically addressing the patient's chief concerns or objectives.

Malocclusion Any deviation from the normal or ideal occlusion.

***Mid-Course Correction** The resubmission of a case when the clinical results have deviated from the approved course of treatment

to the point that the teeth no longer fully adapt to the Aligner. A mid-course correction is also required if the patient undergoes significant dental work such that the Aligners no longer fit. New PVS impressions and instructions regarding treatment are required. The patient should be instructed to wear the latest, best fitting Aligner to hold progress until the new Aligners arrive.

Moment A force that does not pass through the center of resistance will not produce solely linear movement and will result in some rotational movement. This rotational movement is called a moment of the force.

***Occlusal Interference** Excessive "virtual" contacts between upper and lower teeth. Often referred to clinically as premature or excessive contacts. May require occlusal equilibration.

Open Bite Form of malocclusion that may be inherited, developmental, or acquired.

Overbite Vertical overlap. The distance between the upper and lower incisal edges when the patient is in maximum intercuspation.

Overcorrection Tooth movement beyond the ideal, final position to compensate for potential dental relapse.

Overjet The horizontal distance between upper and lower incisal edges along the occlusal plane.

Palmer Notation Numbering System

The standard numbering system used by Orthodontists in the United States. The mouth is divided into four quadrants. Numbers 1 through 8 identify each tooth within the quadrant, with 1 designating centrals moving distally with third molars being "8's". When charting, the numbers sit inside an L-shaped symbol to identify the quadrant

they belong to - as you look into the patient's mouth. Primary teeth (20) follow the same format but are represented with letters "A" through "E" in each quadrant.

Posterior Open Bite No vertical contact is exhibited between maxillary and mandibular posterior teeth.

Proclination Inclination of the crown forward.

Protraction Anterior (mesial) movement of teeth, usually referring to bodily movement.

Protrusion The state of being anteriorly positioned.

PVS (aka VPS) Polyvinylsiloxane impression material.

Relapse A partial or full return of malocclusion following orthodontic treatment.

Relative Extrusion Used to describe the appearance of vertical correction by crown inclination (torque)

Reproximation *see* IPR

Retention Holding of corrected occlusion after orthodontic treatment.

Retraction Posterior (lingual) or distal movement, usually referring to the bodily movement.

Retroclination Lingual inclination or tipping of crown backward.

Rotation Spinning a tooth around the vertical axis.

Tipping *see* Angulation

TREAT* Refers to the software used at Align Technology uses internally to do "virtual" set-ups of cases.

TMJ Temporomandibular Joint

Tooth-Size Discrepancy *see* Bolton Analysis

Torque *see* Inclination Usually refers to root movement more than crown movement.

Translation *see* Bodily Translation

Transverse Discrepancy *see* Crossbite

Universal Numbering System Permanent teeth are numbered 1 to 32, starting with the upper right third molar, working around to the upper left third molar, then dropping down to the lower left third molar and working around to the lower right third molar. The 20 primary teeth are lettered, using capital letters A through T, following the same methodology as for the permanent teeth, starting with the upper right second primary molar and ending with the lower right second molar

***VIP** Stands for "Virtual Invisalign Practice." This is the name of the program that allows doctors to manage their Invisalign practices online. Within VIP you can: view all aspects of your patient's cases, including ClinCheck; order marketing materials; start a new patient using online treatment planning forms; review Invisalign "how-to" tutorials; and more.

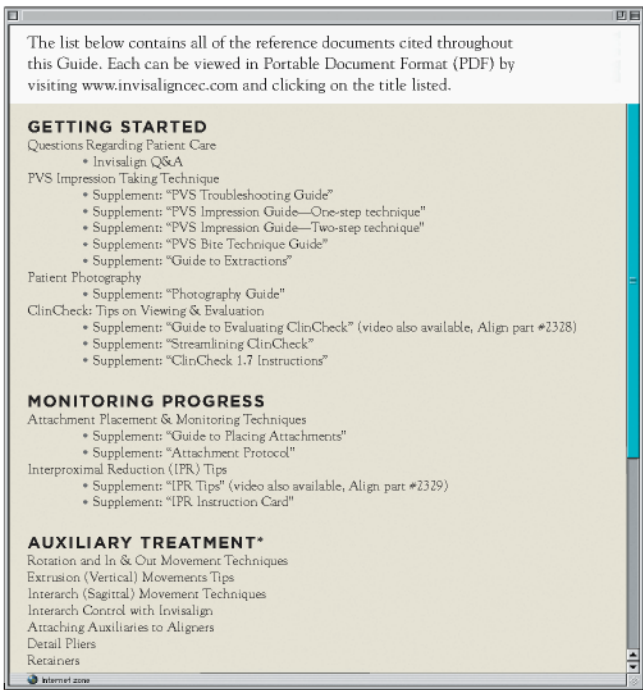
References

Tips from Your Colleagues on Getting the Results You Want with Invisalign®

Align has compiled a range of creative tips from your peers on a variety of clinical topics. These tips may not have been tested in clinical trials, but rather are personal techniques from Invisalign-experienced colleagues. Some tips have been used on many cases and some on only a few. It is at your discretion to use them where appropriate to best to get the results you want with Invisalign.

To see full downloadable and printable copies of the in-depth Tips & Techniques guides referenced in this document, please go to the Invisalign Clinical Education Center at: www.invisaligncec.com

Acrobat Reader is required to view these documents. (Software available as a free download from Adobe.com)



*Auxiliary treatment does not necessarily mean braces, but rather buttons, elastics or other simple and often inexpensive techniques in combination with Aligners. It can also be the use of fixed appliances on one arch or the use of traditional fixed appliances where appropriate for surgery patients.

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Credits

Align Technology, Inc. would like to thank the following clinicians who contributed to and reviewed this Guide.

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Dr. Doug Brandt

Dr. Robert Brewka

Dr. David Chenin

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Dr. Mitra Derakhshan

Dr. Ken Fischer

Dr. Eric Kuo

Dr. Mark Perelmutter

Dr. Thom Rosenbarger

Dr. Lou Shuman

Dr. Michael Steinberg

Dr. Rene Sterental

Dr. Rob van den Berg

Dr. Damon Wilkerson

Dr. Randol Womack

We hope you find this Guide useful. Please do not hesitate to contact us with additional Tips & Techniques (tips may be submitted through the Online Clinical Education Center at www.invisaligncec.com) that will continue to expand the body of clinical knowledge around Invisalign.