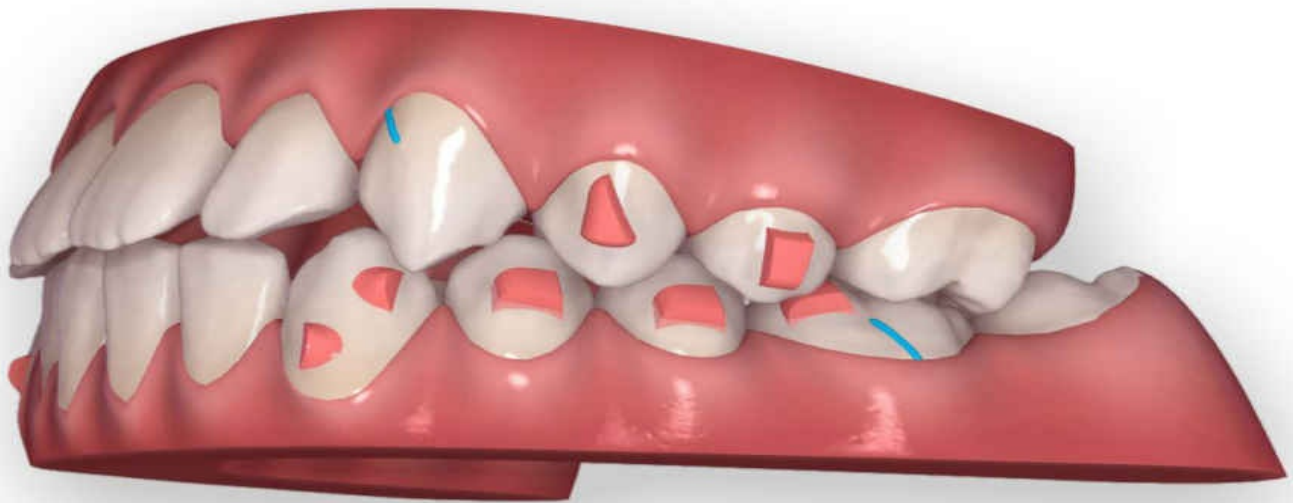


The Insider's Guide to **Invisalign®** **Treatment**

A step-by-step guide to assist you with
your ClinCheck® treatment plans



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A step-by-step guide to assist you with
your ClinCheck® treatment plans

BY BARRY J. GLASER DMD

www.AlignerInsider.com

Dr. Barry Glaser is a paid consultant of Align Technology, Inc., however, the views presented herein represent his personal opinions in his capacity as healthcare professional and do not necessarily reflect the opinions, thoughts, or views of Align Technology, Inc. Dr. Glaser was not compensated by Align Technology, Inc. in connection with this book.

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Dedication

To Tracy, Scott and Jake,
La familia es todo

BOOK TESTIMONIALS

“Dr. Glaser, like myself, recognized long ago that his students needed to have an organized way to talk to the teeth with plastic force systems just as we do with wire and braces. *The Insider’s Guide to Invisalign Treatment* will set the doctor on the right track to do just that.

This book is well organized to help the doctor learn the important principles in each case type in an easy-to-read, systematic format. Each chapter addresses another aspect of correcting malocclusion with Invisalign clear aligners, and guides the reader through a common-sense approach to virtual treatment planning using the ClinCheck® software. His concept of viewing a ClinCheck treatment plan as force systems, not teeth compliments my own educational principle of think like plastic and feel like a tooth.

The Insider’s Guide to Invisalign Treatment is a must-read for all doctors looking to up their Invisalign game. I highly recommend you study this book and keep it next to the computer where you work up your ClinCheck treatment plans. I am confident that if you follow Dr. Glaser’s methods, you will be delighted with the results!”

– Willy Dayan, DDS, Dip. Ortho, Toronto, ON, Canada

“The current landscape of orthodontic literature regarding Invisalign therapy is replete with text books showing before and after cases following a review of some distinct advantages aligners have over fixed appliances in regards to orthodontic tooth movement. The unmet didactic need for the private practitioner is a true ‘how to’ textbook when it comes to treatment planning using the ClinCheck software. Dr. Barry Glaser’s contribution to the orthodontic literature is the first of its kind towards this endeavor and readily services a doctor’s unmet need when treatment planning in the privacy of their offices.

“Whether a novice or more experienced, Dr. Glaser’s logical, methodical, and step-by-step approach is exactly what is needed to streamline the Invisalign

treatment planning process so it will become as second nature as it is for fixed appliances.

This body of work will prove to be a timeless addition to your library to be happily referenced often while submitting your cases. I have removed a text book on fixed appliances to make room for it on my book shelf!”

– Jonathan L. Nicozisis, DMD, MS, Princeton, NJ

“Dr. Glaser has and continues to be a guiding voice in the Invisalign orthodontic community. His commitment to mastering the art and science of moving teeth with plastic is commendable. This book is a testimony to his passion to all things Invisalign. Its content is a wonderful resource for us all. Thank you, Barry, for taking the time and energy to compile your ideas, insight, and experience into this volume. This book is certainly a valuable addition to the wealth of orthodontic knowledge.”

– Bart Iwasiuk, DDS, Burlington, ON, Canada

“If you have been sitting on the fence, thinking about offering Invisalign to your patients, or gaining the confidence to tackle more challenging cases, then this informative and instructive book from Dr. Glaser will get you started on the right path. Dr. Glaser brings his personal and extensive experience as an Elite Provider of Invisalign and provides specific detailed strategies to help you set up your cases with predictable and profitable results.”

– Donna Galante, DMD, Sacramento, CA

“I have had the pleasure of speaking alongside Dr. Barry Glaser, in addition to listening to his lectures and insight on multiple occasions. His knowledge is invaluable, and important for anyone wanting to treat their Invisalign patients with excellent results.”

– Mazyar Moshiri DMD, MS, FICD, Saint Louis, MO

ACKNOWLEDGMENTS

First, I would not be the person I am today without the brilliant guidance and inspiration of the late Dr. Anthony A. Gianelly. I will be forever grateful to Dr. Gianelly for accepting me into Boston University's orthodontic program back in 1990, an event that changed the arc of my professional life in so many ways. Dr. G, I hope I have made you proud.

To the many Invisalign educators who have inspired me along the way, I would not be where I am today without you. I would be remiss without making special mention of the giants whose shoulders I have stood upon: Willy Dayan, Gary Brigham, Bill Kottemann, Johnathan Nicozisis, Donna Galante, Sandra Tai, Maz Moshiri. Your teachings and friendship are a constant source of inspiration.

Thank you to my amazing staff for not only assisting me in caring for our patients and gathering all the records for this book, but also enduring the countless schedule changes that allow me to go on my teaching expeditions around the world. You guys are the best!

Michelle Gamble, this book would not be possible without your editing and guidance every step of the way. Who knew I could write a book? And thank you to Erin Pace-Molina for all the internal layout as well as the fantastic cover graphics.

Thank you to my patients who appear in this textbook for so graciously allowing me to share their success stories with the world. May your gifts be a source of inspiration for doctors to create healthy, beautiful smiles with clear aligners for millions of patients around the world.

To my parents, thank you for raising me the right way and for always being there for me. You always tell me how proud you are of your son the orthodontist, but this is my opportunity to let you know how proud I am of you! I love you both.

Last but not least, this book is dedicated to my wife Tracy and sons Scott and Jake. There is nothing more important to me in the world than you.

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Preface

When I set out to write this book, my objective was to develop a user-friendly, systematic guide to virtual treatment planning with Invisalign[®] treatment. Throughout my travels lecturing to doctors about treating patients orthodontically with Invisalign clear aligners, as well as consulting with doctors on my educational website AlignerInsider.com, a common theme I hear is that many doctors don't "get" Invisalign treatment planning. For example, they don't understand how to interpret what they see on a ClinCheck[®] treatment plan, nor do they understand how to effectively communicate their treatment goals to their technician.

Based on these observations, I developed a 10-step method to Invisalign treatment planning and ClinCheck design I call the "ClinCheck list". The ClinCheck list is a systematic approach to Invisalign treatment planning, providing the doctor with a step-by-step method to guide them through a rational, common sense thought process to achieve consistently excellent results with Invisalign.

Whether you are a first-time user or an experienced provider, the principles revealed in this book will help you look at ClinCheck plans in an entirely new way — as "force systems, not teeth". By retraining your eyes and mind to view your ClinCheck setups as the *forces exerted upon the teeth by the aligners* rather than a depiction of the teeth themselves, you will better understand how to set up your cases to achieve more predictable results, more efficiently, with fewer refinements.

You may be asking yourself, "Why can't I just submit my case, push the "Accept" button on my ClinCheck plan, and have everything track perfectly on every patient?" The short answer is "Because that's not how orthodontics works." Orthodontics, whether performed with fixed appliances or Invisalign, is both art as well as science. The engineers at Align Technology, Inc., the makers

of Invisalign, are continuously innovating their products to achieve more predictable results. SmartForce[®] features, SmartStage[™] technology, and SmartTrack[®] aligner material continue to evolve as the science of Invisalign advances from year to year. Nevertheless, just like with “straightwire” pre-adjusted fixed appliances, despite the presence of a prescription in each bracket for tip, torque and in-out position, we can’t simply “throw in a wire” and have the case treat itself. Wires still need to be bent, auxiliaries used, and adjustments made to accommodate individual variation from one patient to the next. Tooth anatomy, root morphology, bone density and genetic differences between patients means that there will always be the need for an orthodontist treating his or her patient.

It’s the same with Invisalign. While advances in aligner technology will continue to improve treatment outcomes, there will always be the need for the orthodontist to monitor, adjust and adapt to the patient’s individual needs. That’s what this book is all about.

It is important to note that the information contained in this book is based on how I approach Invisalign treatment in my own practice. The views and opinions expressed in this book are mine, and are not necessarily those of Align Technology, Inc. Just like with fixed appliances, there are many different philosophies and treatment approaches with Invisalign. In this book you will learn about my unique way of approaching Invisalign treatment. This speaks more to the art of orthodontics — there is more than one way to arrive at an excellent final result. To me, this is one of the joys of orthodontics — each patient presents with new challenges to solve, and the ability to think my way creatively through a case helps keep my practice fresh and exciting. After more than two decades in practice I still enjoy coming to the office every day.

I hope you find the information in this book beneficial to both you and your patients, and I wish you the same excitement and enthusiasm in your practice as I feel for mine.

—Barry J. Glaser, DMD

A Guide On How To Read This Book

When I began this project, my initial temptation was to simply present patients treated with Invisalign and go through a step-by-step explanation of how I treatment planned the case from beginning to end using the ClinCheck list. I quickly realized that this made for an overwhelming and somewhat disjointed amount of information for the reader to digest. Instead, I decided to break the body of the book into discreet sections, each dealing with a different clinical aspect of orthodontic treatment using Invisalign.

Each chapter of this book deals with a specific section of the ClinCheck list. As a result, you will see many of the same cases presented multiple times throughout the chapters along with an in-depth description of a specific element of ClinCheck treatment planning. For example, the same patient with a CL II div. 1 malocclusion and deep overbite may be presented in both the chapter on sagittal correction as well the chapter on vertical problems. Therefore, you have several ways you can read this book.

If you are relatively new to Invisalign, reading through each chapter in order would make the most sense. In each chapter, another element of ClinCheck treatment planning will be presented along with representative case studies to reinforce the educational concepts.

Here is my recommended approach for new Invisalign users reading this book:

1. Learn the basics in Chapters 1 and 2 then proceed through the remaining chapters in order. Start off with the most common orthodontic problems, *crowding* (chapter 3) and *spacing* (chapter 4).
2. Progress through more complex problems (*vertical, sagittal and transverse*) in chapters 5, 6 and 7.
3. Learn the nuances of *attachments, IPR and staging* in chapters 8 and 9.
4. Discover the importance of *over treatment and over correction* in chapter

10, then finish up with troubleshooting in chapter 11.

Here is my recommended approach for orthodontists more experienced with Invisalign, but may be having a specific challenge. For example correcting deep bites:

1. Start off by reviewing the basics presented in Chapters 1 and 2.
2. Then jump directly to Chapter 5, which deals with correcting problems in the vertical dimension.
3. From there, proceed to Chapter 8 to learn more about how attachments help to achieve deep bite correction, Chapter 10 which explores the concepts of over treatment, then Chapter 11 for some helpful tips on troubleshooting.

Finally, here is my approach for those doctors with extensive experience with Invisalign:

1. Start off with a quick read of chapters 1 and 2 to familiarize yourself with the ClinCheck list, then jump to whatever chapter you see fit.
2. Haven't treated many CL II teens? Off to chapter 6 you go to take a dive into the deep end of the CL II correction pool!
3. Have some troubleshooting questions? Turn to chapter 11. And so on.

In any event, I strongly suggest you keep this book handy at the computer where you work up your ClinCheck treatment plans. You can also download a free copy of the ClinCheck list from my educational website, AlignerInsider.com. Use the ClinCheck list as a guide on every case, and I am confident that you will quickly see your Invisalign cases track better, require fewer refinements, and finish with consistently excellent results.

—BJG

INTRODUCTION

Invisalign Offers a New Way to Grow Your Practice

Invisalign clear aligner technology is growing in the number of patients treated annually. The statistics regarding patient adoption rates worldwide now show according to the *Align Technology Annual Report* that over 4 million patients have used Invisalign technology to straighten their teeth. Orthodontists should wisely consider this growing marketplace as an area to expand their practices to take advantage of the immense opportunities, especially as the market becomes ever more competitive.

Not only does clear-aligner technology, led by the innovative company Align Technology, Inc., enable straightening of teeth in routine Class I cases, but recent advances in techniques and technology now offers correction of more severe malocclusions. Just 10 years ago, the thought of predictably correcting moderate to severe malocclusions with clear aligners would have seemed far-fetched. The latest innovations are creating new market opportunities for orthodontists to not only expand adult teeth straightening, but also teenage cases.

In years past, the adult orthodontic market was limited. Many adults who had severe malocclusions weren't offered much more than traditional metal or ceramic or lingual braces. This prevented many adults who didn't want the stigma of braces from getting their teeth straightened. Today, the evolving technological innovations coming out of Align Technology, which is the leader in clear-aligner products, enables a large segment of the adult population to use highly esthetic clear aligners to straighten their teeth. The clear aligners enable adults to avoid the perceived embarrassment of braces and easily persuade them to straighten their teeth even as senior citizens.

Invisalign also offers orthodontists the opportunity to increase their teen product offerings. Not only can clear aligners now correct most malocclusions,

but also Align Technology addressed parental concerns about lost aligners and teenagers not being responsible enough with their aligners. Without these new programs, orthodontists were finding it challenging to grow the use of Invisalign among the teenage market segment. In doing patient evaluations and providing recommendations, orthodontists were coming up against parental concerns about extra costs due to teenagers losing aligners or not properly wearing their aligners. Parents were attracted to fixed braces vs. clear-aligners because of these concerns. As a result, clear-aligners weren't as broadly adopted by teens.

So Align Technology implemented its Invisalign Teen program to responsibly address parental concerns. Now orthodontists have in their arsenals a great marketing tool to encourage parents to use clear-aligners instead of fixed braces for their teenagers. The program features and benefits make the orthodontist's sales job easy.

Invisalign Teen addresses issues such as misplaced or lost aligners by offering free aligner replacements (up to a certain number). Additionally, Invisalign Teen uses compliance indicators — color-changing markers to indicate for parents whether or not their teen is properly wearing their aligners. These offers have alleviated parents' concerns, and as a result the Invisalign Teen program is rapidly growing in adoption rates.

Your orthodontic practices can greatly benefit from expansion into the Invisalign marketplace. Opening the door for more opportunities to serve the adult and teen market make it a terrific way to grow your practice.

To do this, you will need education about the latest Invisalign treatment techniques. This knowledge will help you understand Invisalign's potential value through the technology's capabilities. It may even inspire you to broaden your orthodontic patient solutions using my prescribed principles, practices and methodologies to achieving winning results.

As the author of this book, my intention is to help orthodontists see Invisalign not just as a device to correct malocclusion, but to understand the science behind the technology. For those of you unfamiliar with Invisalign technology,

ClinCheck is the software application created by Align Technology designed specifically for doctors who register to work with the program. ClinCheck provides a 3D virtual representation of a treatment plan derived from the doctor's orthodontic prescription. Each doctor is able to send information back and forth with Align as changes are made to the treatment plan, and then aligners are manufactured to the plan and sent to the doctor for the patient's treatment.

In this book, I will be showing you how to use the ClinCheck software to become a sort of "orthodontic software engineer". I will help you understand how to use the software tool to integrate the digital capabilities with the physical practice of moving and adjusting teeth. I will also uncover the scientific principles and techniques behind the technology that enable practical patient application.

As we step through this process of using ClinCheck software, you will see how modern orthodontic techniques are applying the science of innovation and technological evolution to inspire new ideas in orthodontic practice. This book outlines those principles and science behind clear-aligner treatment to motivate new ways of practical application to achieve beautiful smiles and healthy occlusions even in some of the most challenging cases.

As I begin this introduction into the new innovations and practical applications of Invisalign technology, I will identify specific opportunities to apply ClinCheck software to engineer the teeth into place. Yes, I said engineer. You will use ClinCheck to become a new breed of orthodontic software engineer to figure out how to move teeth using my principles described in the upcoming chapters. I am going to outline and explain how I use ClinCheck software to essentially "over-engineer" the teeth (I'll explain what I mean by "over-engineer" in the following chapters) to correct almost all problems.

As an orthodontist myself I understand the unique challenges we all face to remain competitive in this changing industry. I've learned a lot about Invisalign technology, and I'm going to share my insights and hands-on experience to help you understand and apply my principles and knowledge to your own patients. Maybe using my techniques, you will even recognize new ways to apply them

yourself. When you learn my tried-and-true techniques how to “over-engineer” and manipulate the teeth using ClinCheck you will ultimately benefit both your patients and practice. So let’s get started.

— Dr. Barry Glaser

CHAPTER 1

Principles of Invisalign® Treatment Planning

Before I became a Certified Invisalign Provider in 2006, I saw clear-aligner technology as just another in a long line of frustrating, underperforming removable appliances. In my pre-Invisalign days, adult patients would frequently present for consultation with lower incisor crowding asking for “just a retainer.” Psychologically, adult patients would often underestimate the magnitude of their orthodontic problem, from both a clinical as well as financial perspective. In their minds, “just a retainer” would be an inexpensive, easy way to straighten their teeth. In my earliest days of practice, I would welcome these patients, only to find that these “simple” six-month lower incisor alignment cases weren’t progressing well and were falling way past the estimated completion date. Ensuing discussions with these patients revealed that despite clear instructions, the retainers were not being worn full-time as directed. “I can’t wear this thing to work!” was heard in my office more times than I care to admit. The patients weren’t compliant, the devices weren’t producing straight teeth, and of course it was all my fault. No matter what I tried (spring aligners and other removable appliances) I simply couldn’t get teeth straightened on a consistent basis without using traditional braces. As a result of these frustrating experiences, I quickly gave up on removable appliances as an option to straighten teeth. Needless to say, I was losing this adult cohort of patients to treatment year after year and was missing the opportunity to capitalize on the growing adult segment of the orthodontic population.

In 1999, Invisalign arrived on the scene. My initial impression was that clear aligner therapy was going to be another in a long line of failed removable appliances. I was skeptical of the ability of clear aligners to achieve the control I had with fixed appliances, and I was bruised and battered from the practice management nightmares I had with my previous “just-a-retainer” patients.

I became Invisalign certified in 2006 as a self-proclaimed skeptic. Initially, I viewed clear-aligner therapy as a minor tooth moving appliance at best, and I was quite skeptical of both its efficacy as well as patient compliance. I began treating adult mild crowding and spacing cases — those that I recognized as removable appliance cases. Surprisingly, I found my earliest test cases to turn out quite nicely. In addition, patients (only adults at this point) seemed to wear the aligners the required 22 hours per day with little complaint, and in fact, high levels of satisfaction. Before long, patients began to seek me out for Invisalign treatment.

As time went on I started to see gradual changes in the clear-aligner technology, ideas behind it, techniques to apply it, and practical application of it. As an orthodontist I slowly tried out these practices on patients; however, it wasn't until 2010 that I became more educated on the emerging applications of this technology. It was then that I attended the Invisalign Summit for the first time and learned about the revolutionary Invisalign G3 technology.

At the Summit I started to realize the innovators at Align Technology were working out actual scientific methods on how to get the aligners to work more predictably. It was also interesting to discover that they were now talking about the techniques in terms of science — a word I had never heard applied to clear-aligner therapy before. At that moment I resolved to learn all I could about treating malocclusions with Invisalign, and resolved to fully integrate Invisalign into my practice.

One of my earliest success stories came with using Invisalign on a patient with a Class I malocclusion, complicated by severe upper and lower crowding. Quite frankly, I didn't think I could complete the case with aligners alone, and I counselled the patient that I would have to finish his case in braces. In this case (image 1-1, 1-2), I was able to use Invisalign to correct the problem without extractions in 25 months of treatment. This case was one of my earliest successes, and I still view this patient as an “index case” — meaning if I could successfully control his severe crowding with Invisalign, there were a multitude of mild to moderate cases I should be able to control as well. It was

cases like this one that began to help me understand much of what we're going to review in this book.

As we delve into this discussion, one of my main goals of this book is to get orthodontists to begin to look at ClinCheck as “force systems, not teeth.” As you examine ClinCheck, begin to adjust your thinking regarding biomechanics in the process of straightening teeth. ClinCheck works from the basic concept that defines a new paradigm of virtual treatment planning that recognizes ClinCheck as not a visual prediction of the final occlusion, but rather a graphic representation of force systems produced by the aligners acting on teeth. As this chapter reviews the principles and provides explanations, the information will describe, define and illustrate what is meant about these force systems and the earlier mentioned “over-engineering” principle.



IMAGE I-1



INVISALIGN FUNDAMENTAL PRINCIPLES

So let's start with the actual principles and then slowly describe and define what I mean by them. The basic fundamental principles of using Invisalign are as follows:

- NO. 1: ALIGNERS ONLY WORK BY PUSHING TEETH; THEY DON'T PULL
- NO. 2: MULTIPLE MOVEMENTS AT THE SAME TIME
- NO. 3: ANCHORAGE IS REQUIRED FOR EFFICIENT MOVEMENT
- NO. 4: OVER-ENGINEERING CLINCHECK IS A MUST
- NO. 5: TEETH NEED SPACE TO MOVE

Now let's break down the principles and walk through the concepts.

PRINCIPLE NO. 1: ALIGNERS ONLY WORK BY PUSHING TEETH; THEY DON'T PULL

What does that mean? Isn't the idea behind orthodontics that we're pulling teeth in different directions? In the case of clear-aligner treatment and what you're trying to do requires an understanding about one key thing:

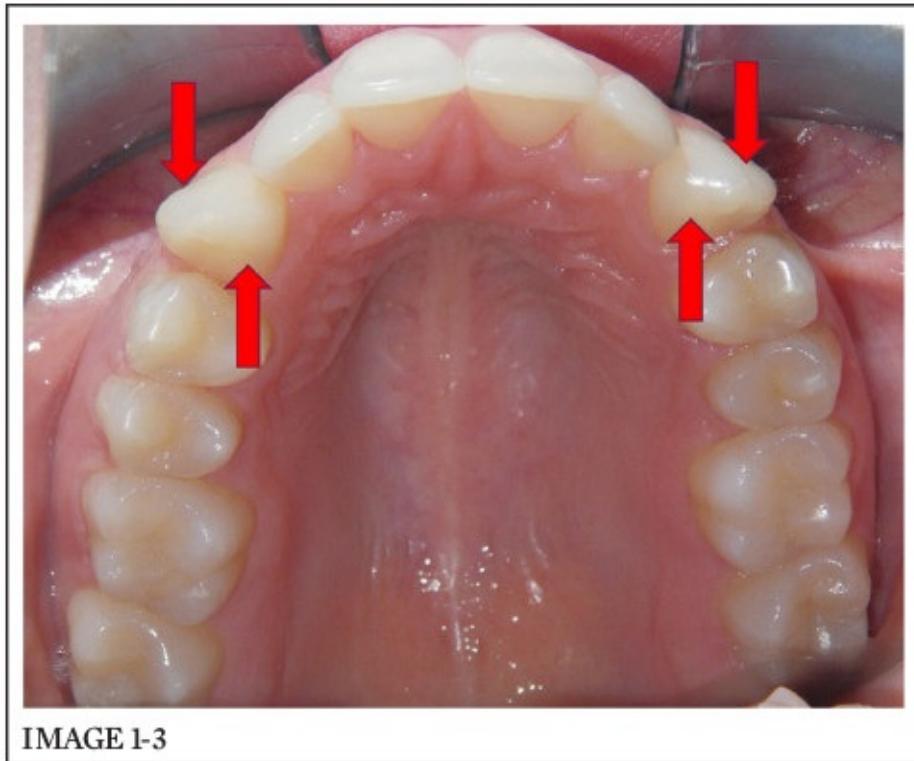
Aligners Push

It's very important to recognize the push surfaces on either the teeth themselves or on the attachments placed on teeth to get the desired movement. We need the interaction of an aligner surface with the tooth or active surface of an attachment to achieve movement. Pulling won't work — an aligner surface that is pulling will simply disengage from the tooth. So remember, we're pushing NOT pulling. It's one of the main reasons that extrusion of maxillary lateral incisors is so challenging — there is essentially nowhere for the aligner to “grab” on either the labial or palatal surface. We will look at this problem in depth in the chapter on vertical control of teeth and I will offer solutions to improve maxillary lateral incisor tracking, but the fundamental concept is this: If you can develop an appropriate push surface on a tooth, the chances of the tooth moving in the desired direction increase greatly.

So think ***PUSH***, and you are on your way to looking at ClinCheck in an entirely new way.

CASE STUDY NO. 1 — PUSH SURFACE

This was a teen patient treated in one year with no refinements. The teeth tracked very well because of the large push surfaces. Look at image 1-3 and notice the upper canines. See the broad, flat labial and palatal surfaces? The aligners were able to produce a set of opposing push forces on each tooth, and the upper canines tracked well (image 1-4)



PRINCIPLE NO. 2: MULTIPLE MOVEMENTS AT THE SAME

TIME

The second principle, multiple movements at the same time, speaks to one of the benefits of the Invisalign system — its efficiency. In the sample ClinCheck (see sequence of photos, images 1-5 through 1-7), you can observe that you can simultaneously torque teeth, rotate and align them. Let's take a look at Erin.





CASE STUDY NO. 2 — ERIN

Let's take an example of what we mean by multiple movements at the same time. In this case study we have a patient named Erin. She presented with a Class I malocclusion, which you can observe in image 1-8, a deep overbite and

cross-bite of the upper-right canine. Erin's case illustrates multiple movements being done at the same time. As you can see in the sequence of ClinCheck photos the work being done is to simultaneously intrude the upper-right and the upper-left central incisors while at the same time correcting her cross-bite.

The ClinCheck plan actually shows what is happening with this process. Observe intrusion of the two upper-front teeth to level the smile arc. This procedure is done at the same time that the upper-right canine is being moved buccally out of cross-bite.

The key takeaway: ***The orthodontist does this all at the same time — and that is what I mean by the efficiency of the process.***

Here is the final picture at the end of Erin's treatment (image 1-9). She has a normal occlusion, and we have achieved a good final result.





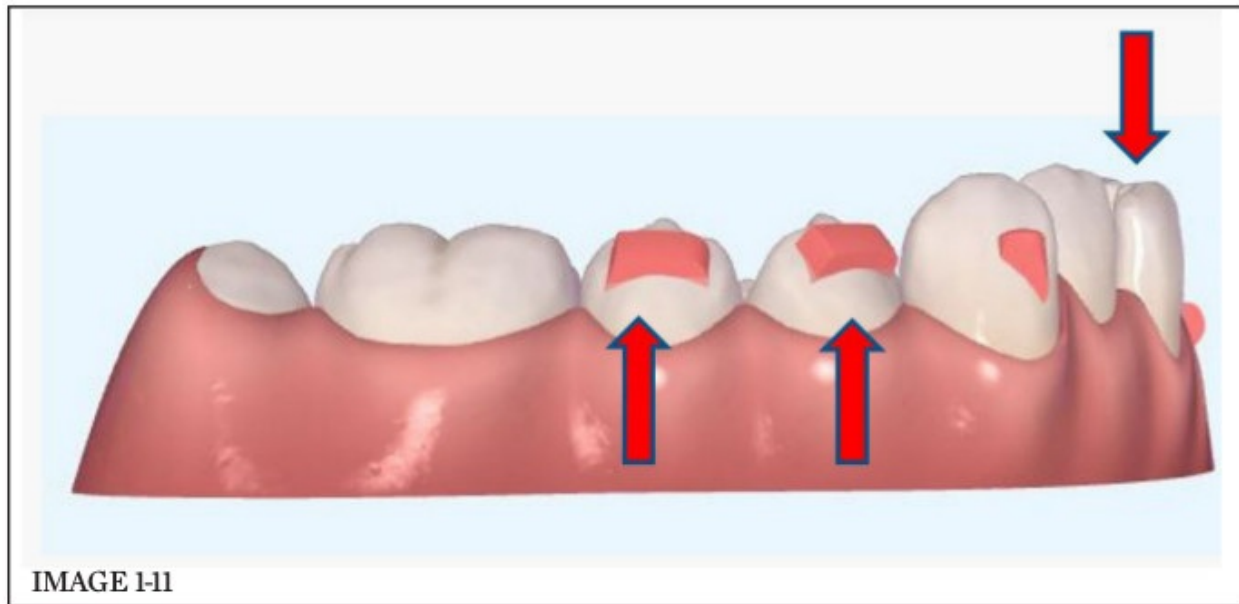
PRINCIPLE NO 3: ANCHORAGE IS REQUIRED FOR EFFICIENT MOVEMENT

The term “anchorage” is used all of the time with conventional fixed appliances.

I use the term a little differently for the Invisalign system. When I refer to anchorage, a good example of that would be Haley’s case (image 1-10). Haley presents with a significantly deep overbite. In her case, the goal is to correct the deep overbite with a combination of 30-percent intrusion of the upper incisors and 70 percent of lower incisors.



Now review the ClinCheck (image 1-11), and a problem presents itself. Start by going back to Principle NO. 1: Aligners only work by *push teeth- ing*; *they don't pull*. The aligner plastic only works by pushing against the teeth.



Let's focus in the lower arch. In Haley's case we want to intrude the lower incisors. Newton's third law states that for every action there is an equal and opposite reaction. So in a case like Haley's, the "action" force is the aligner pushing on the lower incisors to intrude, while the reaction force tends to want to lift the aligner off the posterior teeth. If the aligners lift off the posterior teeth you're going to lose the desired push force on the lower incisors. As a result of this lift off, there will be less force to intrude the teeth. The bite will then remain deep, which is a common clinical problem where posterior aligner anchorage is not properly set up in the ClinCheck plan.

In a case like Haley's we apply our Principle NO. 3 and set up anchorage. Look at image 1-11 and notice the attachments on the lower first and second premolars. They are occlusally beveled rectangular attachments, 4mm in length. The retentive surface of these attachments is at the gingival aspects. The goal is when Haley snaps the aligner on it's going to be retentive in the buccal segments. These attachments are going to prevent the dislodgment of the aligner posteriorly. Imagine the aligner is like a lever arm, and the lowers incisors are going to feel the force of the intrusion. The results: more predictable bite opening. As you can see from Haley's final results (image 1-12), her deep overbite was successfully resolved.



IMAGE 1-12

The principle of attachment design and the use of attachments is the area of ClinCheck treatment planning this book will revisit over and over again.

PRINCIPLE NO. 4: OVER-ENGINEERING CLINCHECK PLAN IS A MUST

Key Point #1: Aligners vs. Braces: Not as different as you think.

What does the term “over-engineering” mean as applied to our ClinCheck process? Let’s make a parallel between braces and Invisalign — in a lot of ways they are not as different as you would think. These days, most orthodontists use a “pre-adjusted system” meaning there is a prescription toward first-, second- and third-order movements built into the brackets themselves.

In a Roth Prescription, for example, in the maxillary central incisors there is +12 degrees of palatal root torque built into the bracket. The Damon System

happens to have +15 degrees. MBT +17 degrees. Do we want full expression of all this palatal root torque? Not always. So why do these prescriptions exist?

We need to over-build our prescriptions in our brackets for a variety of reasons, but for this discussion let's focus on the play between the wire and the slot. For every .001" play between the arch wire and slot there is a loss of approximately 4 degrees of torque. That means a .021" x .025" arch wire in an .022" slot in a Roth prescription will express at most 8 degrees. Think of this as a "loss factor".

Modern pre-adjusted straight wire appliances have become very sophisticated. The orthodontist has a variety of prescriptions to choose from, in addition to multiple wire configurations and metallurgy. These advances have been beneficial to both orthodontist and patient. Despite these advances, however, we don't simply "throw in a wire" and have the cases treat themselves. Each patient is unique, and as a result wires still need to be bent, auxiliaries employed, brackets repositioned, and adjustments made. Biological differences from one patient to the next means that the doctor is still in the driver's seat, managing tooth movement from beginning to end.

It's the same with ClinCheck treatment planning. In reality, there is a tremendous amount of science and engineering built into every ClinCheck treatment plan. The engineers at Align technology have sophisticated algorithms designed to place optimal force systems along the arch to achieve desired tooth movements. In addition, advances in Smart Force™ features and aligner materials (Smart Track™) have revolutionized clear-aligner treatment to the point where, for me, Invisalign is the appliance of choice in most situations. I make the parallel between ClinCheck and straight-wire appliances only to illustrate a point: that in my experience, in certain clinical situations, Invisalign, just like straight-wire appliances, requires adjustment to compensate for individual differences from one patient to another. This is what I mean when I use the term "over-engineering". We will spend a considerable amount of time in this book looking at four areas requiring over-engineering — *deep/open bite, tip, torque and expansion*.

Key Point #2: When you look at ClinCheck plan you are not looking at teeth. You are looking at force systems acting on the teeth.

CASE STUDY NO. 3 — KYLE

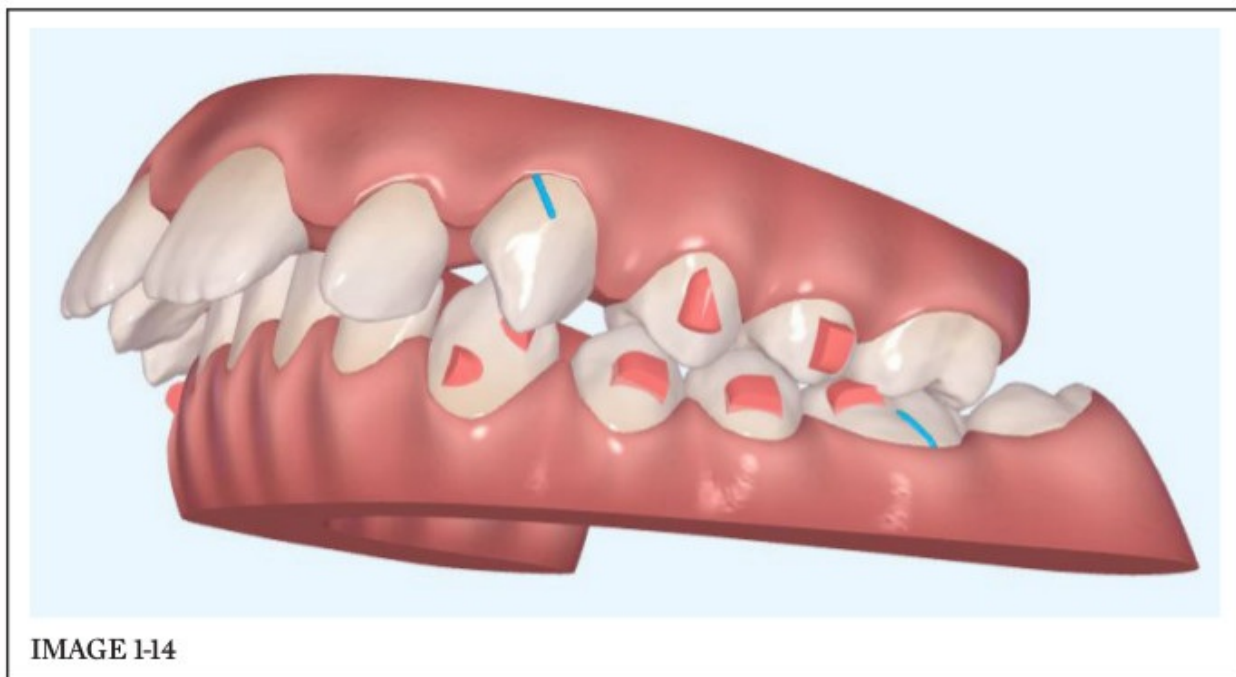
Let's look at Kyle's case (image 1-13). Imagine he is being treated with fixed appliances. We endeavor to correct his deep over-bite by leveling the lower Curve of Spee. To accomplish that goal, it would be quite normal to place a reverse curve-arch wire in the lower arch. I'll call this reverse-curved arch wire over-engineered, meaning we've placed something additional into the wire that doesn't exist in the bracket prescription.



If we think about the shape of the reverse curve arch wire, we don't want the lower arch ultimately to have this curve; but as orthodontists we have learned that if we place a reverse curved-arch wire into the lower arch it's going to place

a *force system* that will flatten the arch. So a curve produces a leveled arch — and thus, it's the same with a ClinCheck plan.

Let's go back to Kyle's case where the patient presents with a deep over- bite (image 1-14). We know we need to level the Curve of Spee. Just like in the use of the reverse curved arch wire, we need to over-engineer our ClinCheck plan. The reverse curve built into this ClinCheck plan (image 1-15) to achieve the appropriate bite opening. I am not expecting the final result to look like this image. A ClinCheck plan is not a predictor of the final result of occlusion. It is a graphic depiction of the forces being placed on the teeth to achieve the required results. It's *force systems, not teeth*.



In this ClinCheck plan, there are two areas that have been over-engineered. We have over-engineered the bite opening by adding *additional* reverse Curve of Spee to the lower arch. The second place is on the maxillary incisors, which need to be intruded and retracted. The tendency is for them to be tipped lingually just as if you were retracting these teeth on a round arch wire, which isn't the desired result because it's one of the main causes of posterior open bites — I will elaborate more on the topic of posterior open bites later in this book.

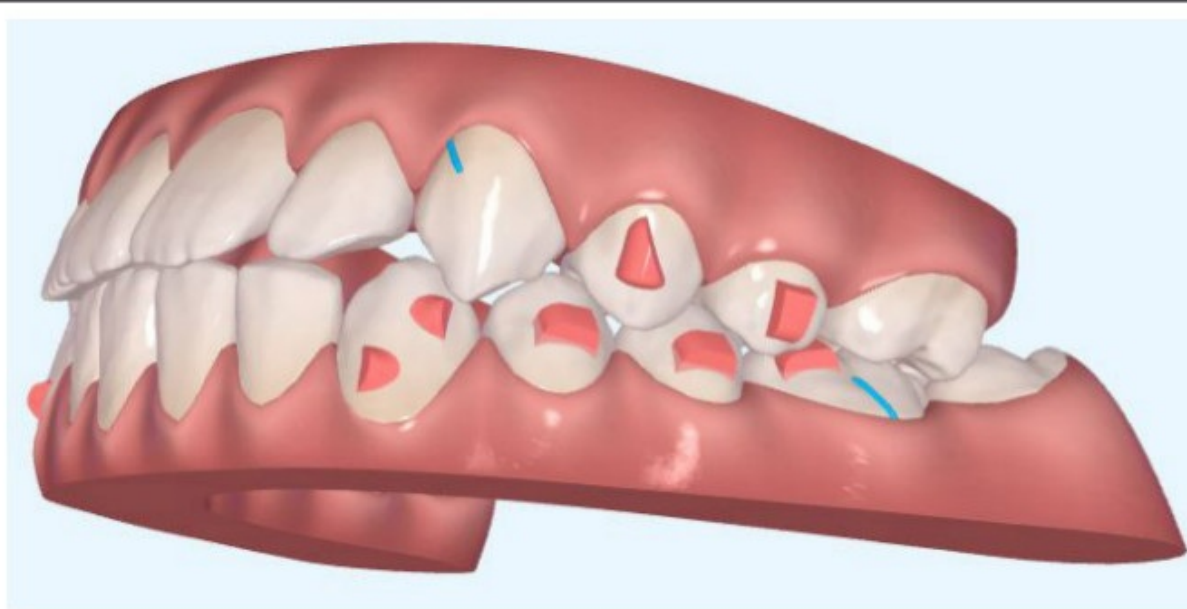


IMAGE 1-15

In Kyle's case if you look at the upper incisors in the final ClinCheck stage, notice an additional 30 degrees of palatal root torque (PRT) built in as counter tip. Since the idea is to avoid the upper incisors tipping lingually, this was used as an over-engineering move in the ClinCheck plan. The point of the information contained in this book teaches doctors to over-engineer their ClinCheck plans and how to modify them so the teeth ultimately wind up in the proper occlusion (image 1-16). As you can see, the final position of the teeth does not look like the final ClinCheck stage, and that's the point. **When you look at a ClinCheck plan, you are looking a graphic representation of the forces being applied to the teeth rather than a prediction of the final tooth positions.** It's *force systems, not teeth*.



PRINCIPLE NO. 5: TEETH NEED SPACE TO MOVE

This principle is short and direct but nonetheless fundamental: In order for a tooth to move from A to B it requires space to move. Binding of teeth is one of the main causes of non-tracking. Always check for tight contacts at the first indication of non-tracking. Chapter 11 deals with a variety of troubleshooting issues and how to get things back on track.

SUMMARY

Before beginning the next chapter here is one last abbreviated review of what this chapter just explained.

BASIC ALIGNER PRINCIPLES

1. Push only

2. Multiple movements at the same time
3. Anchorage required for efficient movement
4. Over-engineering ClinCheck plan is a **MUST**
5. Teeth need space to move

CHAPTER 2

What is the ClinCheck list?

The ClinCheck list is a tool we will be referencing throughout the pages of this book. My goal is for you to use the ClinCheck list as a guide to help you through the process of Invisalign treatment planning and to help properly set up your ClinCheck treatment plans for each patient to achieve the best results.

As I travel around the world lecturing to doctors about Invisalign treatment, and consult with doctors on my website AlignerInsider.com, a common theme I hear is that they don't understand how to interpret what they see graphically represented on the ClinCheck plan, nor do they understand what areas of their ClinCheck plan require modification. I often make the comment that "Invisalign isn't about a technician in Costa Rica telling you how to treat your patients, it's about you telling the technician what you want." It was this observation — that doctors need a systematic way of looking at and modifying their Invisalign treatment plans — that gave rise to the development of the ClinCheck list.

So what is the ClinCheck list? The ClinCheck list is a systematic approach to ClinCheck design and Invisalign treatment planning. It provides a step-by-step method for increased efficiency and predictability for your Invisalign treatment and results. Furthermore, it will help to reduce the number of times you will need to send the ClinCheck plan back to your technician, saving you precious time.

The ClinCheck list is NOT a cookbook, meaning it is not a "one-size-fits-all" proposition. While it will serve as a guide to assist you in working up your Invisalign treatment plans, the ClinCheck list allows for individual customization of each ClinCheck plan, tailored to the specific needs of each patient as well as the individual treatment philosophy of each doctor.

ClinCheck list can be pared down to these concepts:

1. Systematic approach to ClinCheck design
2. Step-by-step method
3. Reduces ClinCheck revisions
4. Increases Invisalign predictability
5. Is NOT a cookbook

ClinCheck software is a customizable virtual treatment-planning tool for each patient's orthodontic treatment. Within the ClinCheck list there are 10 Critical Parameters to guide you through customizing your Invisalign treatment plan.

The 10 Critical Parameters are:

1. Crowding
2. Spacing
3. Vertical
4. Sagittal
5. Transverse
6. Attachments
7. IPR
8. Staging
9. Overtreatment
10. Overcorrection

CROWDING AND SPACING

We begin here, thinking through the nuances of aligning teeth in the intra-arch dimension with Invisalign. It's surprising to me how many doctors instruct their technicians to simply "Level, align and de-rotate all teeth," and that's it! These types of vague, imprecise instructions place critical treatment decisions in the hands of the technician. While highly skilled at what they do, your technician is not a doctor, and they do not have the training and experience that you have. One of the beauties of virtual treatment planning with the ClinCheck software is the ability to control critical parameters such as arch form, expansion,

proclination and interproximal reduction (IPR) *before* actually treating the patient. To gain a high level of control with Invisalign we must learn to specify exactly how we want the teeth to move as well as defining the final position of all teeth for optimal esthetics and function. The chapters on crowding and spacing will teach you how to align malposed teeth, why certain situations are more predictable than others, and *when* ClinCheck modifications are necessary.

VERTICAL, SAGITTAL AND TRANSVERSE

The next three parameters: *vertical, sagittal and transverse* are inter-arch problems where we are looking to solve the patient's malocclusion in three planes of space. As I write this I have to laugh, because 10 years ago I would never have believed that routine correction of malocclusion would be possible with clear aligners. However, as the science of Invisalign treatment has advanced, so has my understanding of the specific ClinCheck moves required to achieve an excellent final result. We will look at correction in each of the three planes of space in detail in the corresponding chapters. A word of caution — Invisalign clear aligners, like traditional fixed appliances, is effective at treating dento-alveolar problems. In addition, mild skeletal discrepancies may sometimes be successfully camouflaged with dento-alveolar movements as well. Nevertheless, I do not advocate attempting correction of moderate to severe skeletal problems with an appliance that is designed to move only teeth. If we plan realistic correction of malocclusion using sound orthodontic principles, Invisalign treatment for vertical, sagittal and transverse problems can be very gratifying to both doctor and patient.

ATTACHMENTS, IPR AND STAGING

The next three parameters in the ClinCheck list are *attachments, IPR and staging*. These fall under what I call “Housekeeping”. In this respect, housekeeping encompasses frequently overlooked items that can bog treatment down. For example, have you ever considered when to place new attachments or perform IPR? You should, because staging these events at normal visits helps to

reduce unnecessary appointments and keep treatment as efficient as possible.

This may seem trivial, but these parameters are the areas where many doctors lose a lot of efficiency in treatment. By looking closely at the following:

- Attachment design and placement
- IPR location and quantity; and combined that with...
- Looking at the staging of our cases

We can then make our ClinCheck treatment plans more efficient as well as make our treatment more efficient with fewer office visits and refinements.

OVER TREATMENT AND OVER CORRECTION

The final two parameters fall under the concept of over-engineering (mentioned in the first chapter), and they are your prescription for Invisalign treatment, similar to the prescription built into pre-adjusted brackets.

Over treatment refers to moves we make in our ClinCheck plan to build in additional forces for some specific clinical situations. Over treatment happens gradually throughout the ClinCheck plan from beginning to end. The four over treatment areas we will explore are *overbite, tip, torque and expansion*.

Over correction, on the other hand is represented by three aligner stages at the end of treatment designated with a “+” sign. Over correction should be routinely prescribed for two specific clinical situations: *rotations and ins and outs*.

Here are (see example 2-1) of 10 critical parameters. Under each category we have subheadings. These subheadings are the areas the doctor will look through for each Invisalign treatment plan. Doctors will check off these boxes and make notations to help guide them through the treatment. We will explore each of these in detail in the following chapters. When you sign up for AlignerInsider.com, you will have access to a free download of the ClinCheck list. Now let's get to those ClinCheck treatment plans!

CROWDING

Space Analysis: Expansion Proclination IPR Extraction
Esthetic Analysis: Negative Space Lip Support Dark ▲'s
Stability: Intercanine Width _____ Posterior Expansion _____

SPACING

Closing Spaces: Bodily Tipping Retraction
TSD: Lower IPR _____ Leave Upper Space _____

VERTICAL

Incisal Display Gingival Display Gingival Margins Smile Arc
Deep Overbite: Ant Intrusion U L Post Extrusion U L
Open Bite: Ant Extrusion U L Post Intrusion U L
Extrusion/Intrusion: Relative _____ Absolute _____

SAGITTAL

CL II: Distalization CL II Elastic Jump Extraction IPR
CL III: CL III Elastic Jump IPR Premolar Ext L Incisor Ext

TRANSVERSE

Pre Invisalign RPE Dental Expansion Overcorrection U Post BRT

ATTACHMENTS

Optimized Retentive Substitutions

IPR

Round Trip to Stage _____ Amount: U Ant _____ L Ant _____ U Post _____ L Post _____

STAGING

Perform IPR at Stages _____ Place New Attachments at Stages _____

OVER TREATMENT*

Deep/Open Bite _____ Tip _____ Torque _____ Expansion _____

OVER CORRECTION

Rotations (5°) _____ Ins/Outs (0.2mm) _____

*Over treatment Parameters: Deep bite-0 mm Open bite-2mm post open bite Tip-10 deg. Torque-10-30 deg. Expansion-50%

CHAPTER 3

Crowding

In this chapter, we are going to review the fundamentals of dental crowding and how to use the ClinCheck list to address the problem. After reading this chapter, I would hope that the instructions, “Please level, align and de-rotate all teeth” would be a thing of the past. Furthermore, the notion that the dental arches can be expanded in every case *ad libitum* to the extent that IPR is never required would be similarly relegated to the trash heap once and for all.

When we want to resolve crowding in a patient, we only have a limited number of options to choose from. Those options are as follows:

1. **Expansion**, which refers to lateral widening of the posterior teeth. As they are widened laterally, additional arch circumference is created to align the teeth. I also include posterior distalization to be a type of expansion treatment.
2. **Proclination**, which refers to labial movement of the upper and lower incisors, which can also gain arch length to unravel crowding.
3. **Interproximal Reduction (IPR)** is judicious removal of enamel between teeth, and by removing enamel we can also create space to resolve crowding.
4. **Extraction** of a tooth or several teeth.

The CROWDING section of the ClinCheck list helps guide you through the thought process to resolve the crowding problem.

In cases that present with crowding these four methods are the only four options for resolution. We have to select one or more of these methods to resolve crowding. Having said this, how does one decide which of these methods to use or which combination of methods to use?

For each of these approaches there are implications, including:

- Periodontal
- Esthetic
- Functional
- Long-term stability

CROWDING

<i>Space Analysis:</i>	Expansion	Proclination	IPR	Extraction
<i>Esthetic Analysis:</i>	Negative Space	Lip Support	Dark  s	
<i>Stability:</i>	Intercanine Width _____	Posterior Expansion _____		

PERIODONTAL IMPLICATIONS

When we are resolving crowding we have to take into account the patient's periodontal condition. A short list of things to consider are as follows:

Tissue type — does the patient have thick or thin periodontal tissue? As a rule of thumb patients with thick tissue can withstand more expansion and more proclination than a patient with thin, friable tissue.

Recession — does the patient present with areas of gingival recession? In these cases, one has to ask, “How far can I move this tooth labially in the presence of gingival recession before the situation becomes worse?”

Mucogingival Problems — if a patient presents with zones of inadequate attached gingiva we have to consider whether we can procline or move teeth labially or expand buccally at all. In these cases, would pretreatment gingival grafting change the treatment plan?

Fenestrations — could labial movements in the presence of bony fenestration of the labial plate invite disaster? Patients who present with significant gingival recession on the facial surface of the teeth have the potential for compromised amounts of labial bone as well. In patients that present with bony fenestration, wanton or unlimited expansion in the posterior or anterior part of the mouth can be disastrous, leading to worsening of the periodontal issues.

FUNCTIONAL IMPLICATIONS

When we are thinking about resolving crowding we also have to think about how the upper teeth are going to occlude with the lower teeth. Things we have to consider are setting up patients for:

- Incisal guidance
- Canine guidance
- Fremitus — we want to set up patients so their occlusion has no abnormal fremitus at the end of treatment.
- Abfraction — does the patient present with any cervical abfraction lesions, which may be related to abnormal occlusion?
- Non-working interferences
- Centric relation where in these cases we are looking to create a centrically related occlusion.

ESTHETIC IMPLICATIONS

The best way to think of esthetic implications is to consider the denture setup. When denture teeth are being set up, traditionally the first teeth to be set are the upper central incisors. We have a very good reason for this consideration. We want to set up the upper incisors for the best esthetics — Incisal display both at rest and while smiling, as well as for lip support. In addition, the upper incisors are set for ideal phonetics.

In a denture setup as well as an orthodontic setup, we want to accomplish the following:

- Set up patients with a pleasing amount of gingival display not either excessive or insufficient.
- Gingival margins to be level and symmetric.
- The smile arc of the upper incisors should follow the curvature of the lower lip.
- Limited amounts of negative space for a full smile.
- The position of the anterior teeth should support the upper and lower lips.

It's no different with Invisalign treatment. The final position of the teeth are dictated by the same esthetic considerations as the denture set up. Just as if a lab prescription for a denture would be inappropriately worded, "Please set up straight teeth," the ClinCheck instructions must be precise and specific to achieve optimal esthetics for the Invisalign patient.

Additionally, when we are treating patients orthodontically, we also want to take into consideration areas of papilla loss/dark triangles. We will discuss this in detail in the chapter on IPR.

At the beginning of this chapter, I made the statement that the instructions, "Level, align and de-rotate all teeth" should be eliminated from your lexicon. I hope that the preceding brief discussion of the major implications to consider when resolving a patient's dental crowding illustrate this point.

What does "level, align and de-rotate teeth" even mean? To me, these instructions are not only vague and imprecise, they also do not help your technician to understand how the teeth will align and where they will wind up in their final position. Your technician is very skilled at setting up your ClinCheck plan, and the more specific your instructions are the better they will be able to produce a ClinCheck treatment plan to achieve the results you want. It is incumbent upon the doctor to make the critical treatment planning decisions and then communicate these decisions effectively to the technician. Fundamentally, this is one of the central themes of this book.

As for planning unlimited expansion and proclination into every ClinCheck treatment plan without IPR, please consider the following brief literature review.

LONG-TERM STABILITY

In 1997, Burke and Associates published the paper, "A meta-analysis of mandibular inter-canine width in treatment and post-retention" in *The Angle Orthodontist*. The authors looked at 26 different studies all essentially asking the same question:

If the distance between the mandibular canines is expanded during orthodontic treatment what happens during retention and what happens in

retention?

The authors concluded, “Regardless of treatment modality, if mandibular inter-canine width is expanded during treatment, it will contract during post-retention and return to the pre-treatment dimension.” Based on these findings, if we endeavor to improve the chances of long-term stability for our patients, maintenance of the mandibular inter-canine width should be a central component of the routine ClinCheck set up.

POSTERIOR EXPANSION

What about posterior expansion distal to the canines? In a brief review of the literature, consider these papers:

- Walter, American Journal of Orthodontics, 1962
- Shapiro, American Journal of Orthodontics, 1974
- Gardner and Choconas, Angle Orthodontist 1976
- Glenn, Sinclair and Alexander, American Journal of Orthodontics, 1987

These four articles discuss long-term stability where teeth posterior

These four articles discuss long-term stability where teeth posterior to the canines were expanded. My interpretation of the data indicates that although *all expansion tends to relapse*, inter-canine width expansion shows the least stability while expansion of the premolars and molars shows the potential for less post-retention relapse. Ideally, we don’t want to expand cases at all, but in cases where we feel compelled to do it, we are going to at least invite the possibility of improved long-term stability when we expand the teeth posterior to the canines and not expand inter-canine width at all.

If look at your Invisalign Doctor’s Site (IDS) there are “Clinical Preferences” where you can set your default arch expansion parameters. Go into your Clinical Preferences on the homepage of the Invisalign Doctor’s Site. Here are my recommendations:

- » Homepage: Click on *Clinical Preferences* on the far right of the screen
- »

Look at 7. Arch Expansion

Select: Increasing the arch width between premolars and molars only (based on research that shows we have a fighting chance of better stability there).

»

8. Expansion per quadrant

Click on: 2+ mm per quadrant

CASE STUDY NO. 1 — JESSICA

Jessica was a teenage patient who presented with a CL I malocclusion, with moderate upper and lower crowding. Note the severely rotated upper canines. She has moderate lower anterior crowding and a normal profile (images 3-1 through 3-3). I would consider Jessica to be “Invisalign Teen low-hanging fruit”. She is a high school student who does not want braces for the prom or class pictures. These patients tend to be very compliant with Invisalign Teen.

Here is the ClinCheck list in reference to Jessica’s crowding.

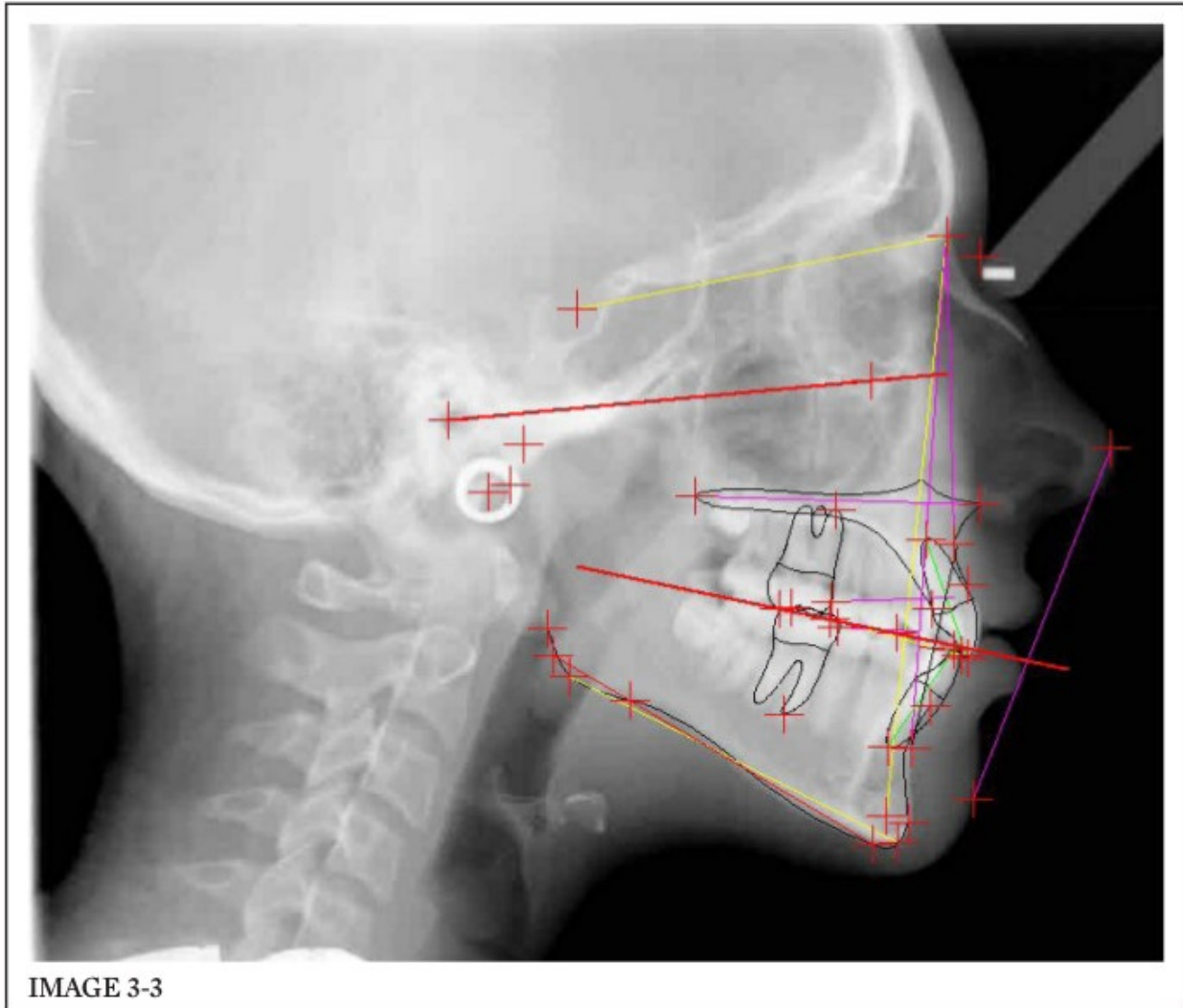
<u>CROWDING</u>				
<i>Space Analysis:</i>	Expansion	Proclination	IPR	Extraction
<i>Esthetic Analysis:</i>	Negative Space	Lip Support	Dark ▲'s	
<i>Stability:</i>	Intercanine Width	Maintain	Posterior Expansion	3mm



IMAGE 3-1



IMAGE 3-2



TREATMENT PLAN

1. I have determined that Jessica will be treated non-extraction.
2. The crowding will be resolved from a combination of the following:
 - a. Posterior expansion
 - b. Incisor proclination
 - c. IPR

One of the beauties of 3D controls in ClinCheck Pro is that the doctor can dial in different amounts of expansion, proclination and IPR to get the desired results. You have the ability to virtually treat the patient and customize the ClinCheck set up *before* treatment begins. This truly revolutionary technology

allows you to control the final outcome as well as the path the teeth travel from beginning to end. In Jessica's case, I want to *maintain* her mandibular inter-canine width to try and improve her chances for long-term stability. Based on this, I made the decision to balance posterior expansion, anterior proclination, and IPR to resolve the crowding.

CLINCHECK TREATMENT PLAN

Her ClinCheck plan was set up with posterior expansion, proclination of select lingually positioned lower incisors and anterior IPR from canine to canine to resolve the crowding. If you look at the position (image 3-4) initially of the lower right central incisor you can note that tooth is placed somewhat labially out of the arch. Since this tooth is too far to the labial, the treatment plan is to move this tooth lingually during treatment.



IMAGE 3-4

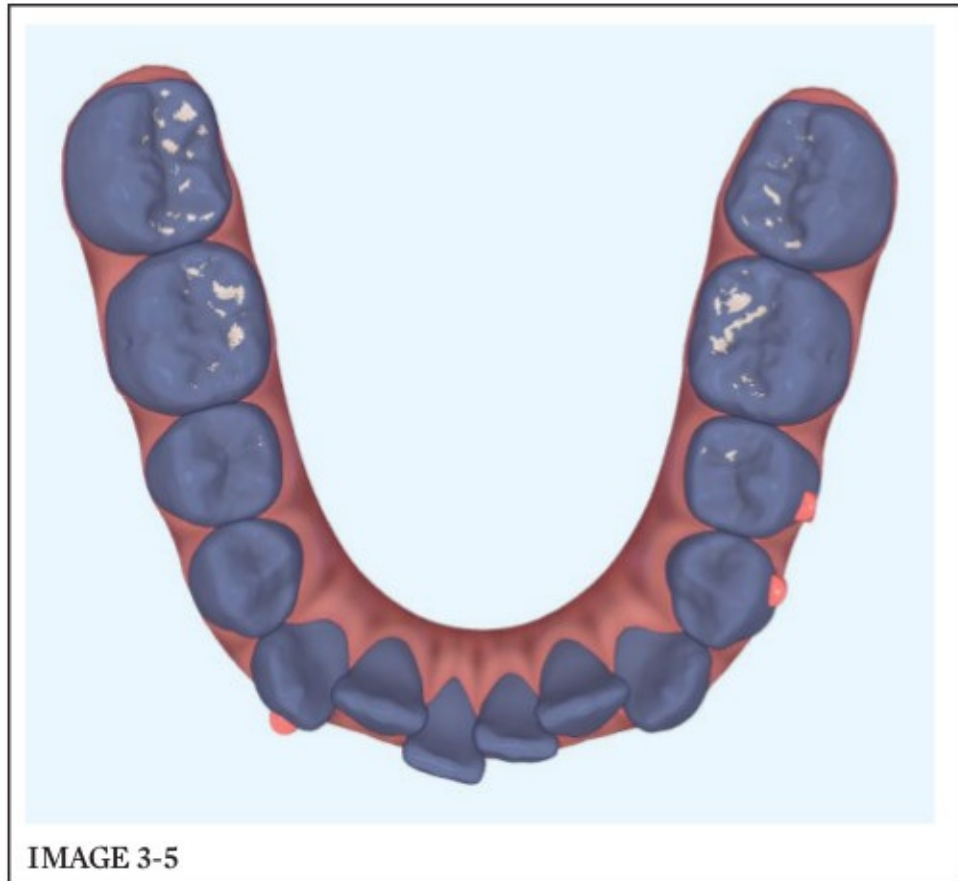
As the orthodontist it will be your job to instruct your technician on the particulars to set up the ClinCheck plan to meet the needs of the patient. This is how those instructions would look:

Instructions to the technician: these instructions are very specific because I want the lower right central incisor to finish lingually, upright over the basal bone. My instructions to my technician are:

- Please allow a maximum of 3mm buccal expansion (1.5mm per side) distal to the canines.
- IPR L3-3 maximum of 0.3mm per contact.
- The lower right and lower left lateral incisors may procline, but the lower right central incisor must finish 1mm lingual to its current position.

JESSICA'S CLINCHECK PLAN

Step 1: If you look at where the lower right central incisor is positioned at stage 12 (image 3-5) you will notice that it has proclined. Why would this happen? It proclines up until stage 12 to improve access for IPR. This is known as “round tripping”. Once the IPR is performed the LR1 begins to retract. Round tripping can be useful to improve access for IPR.



Step 2: My instructions to the technician are, “Please allow for labial movement of the lower incisors until stage 12 to allow for access of IPR.” At that point, the teeth retract and the LR1 ends up where I want it, 1mm lingual to its current position (image 3-6).



Note: The “Superimposition” Tool in *ClinCheck Pro* is very useful to see the overall movements of the teeth.

These two steps we just described are how we are going to align the lower arch so that the lower-inter-canine width is not expanded.

Jessica’s Upper Arch

Note the severely rotated maxillary canines (image 3-7). Despite the significant rotation, these teeth are set up for success for four reasons.

- These teeth present with broad, flat push-surfaces on both the buccal and palatal surfaces (basic principle #1, aligners move teeth by pushing).
- There is space present between the canines and adjacent teeth (basic principle #4, teeth need space to move).
- There are optimized rotation attachments placed on these teeth to place the appropriate force system to achieve the desired tooth movement.

- Smart Track™ aligner material works very well to deliver light forces to achieve predictable movement.



RESULTS

Note that the final results (image 3-8) and ClinCheck (image 3-9) agree nicely. The final panoramic radiograph is normal (image 3-10).



IMAGE 3-8

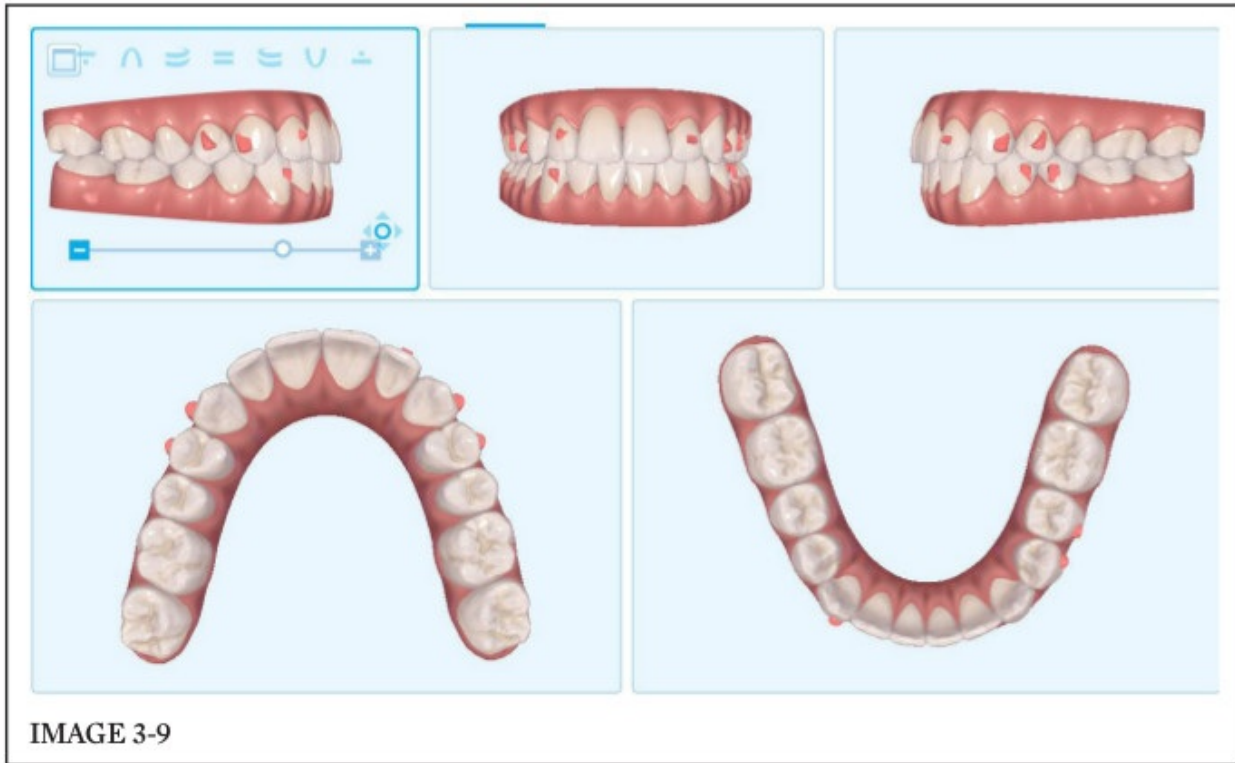


IMAGE 3-9

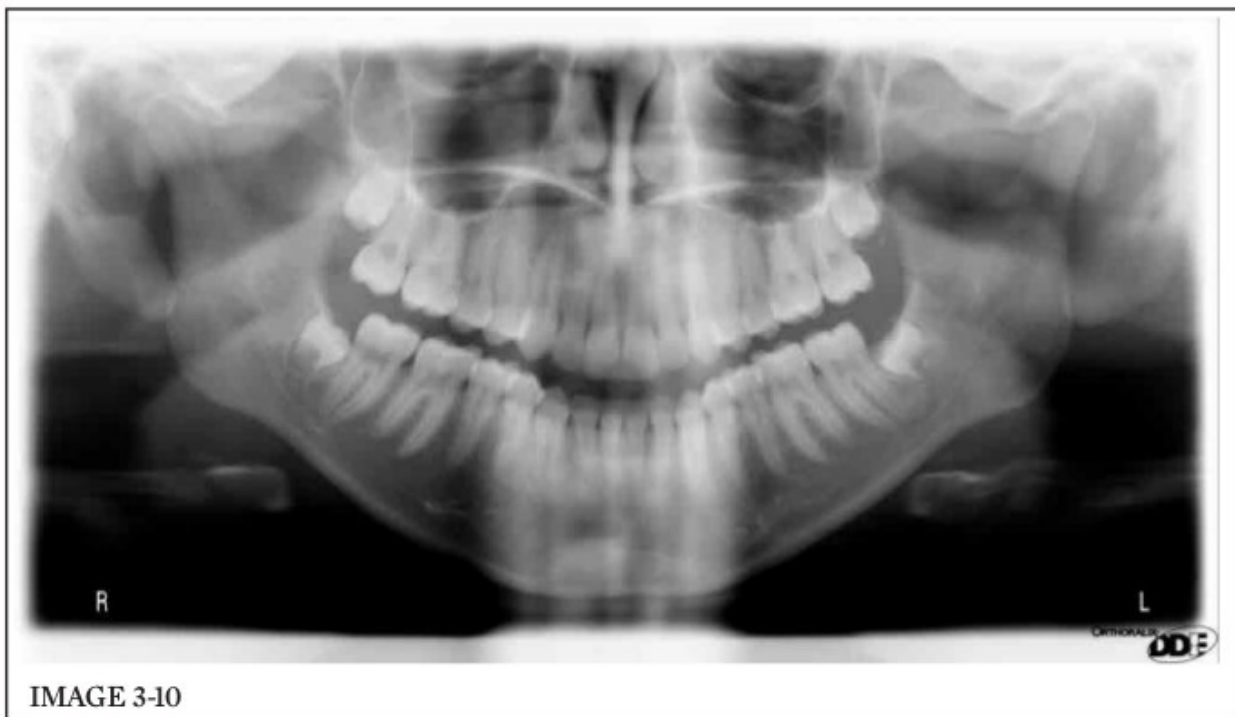


IMAGE 3-10

Summary: Total treatment time was 12 months. No refinements were needed.

Jessica's ClinCheck set up can serve as a guide for many of your moderately crowded, non-extraction cases. By balancing posterior expansion versus anterior proclination versus IPR, you can achieve excellent final alignment in a thoughtful and precise manner. **Please note:** If your personal preference is to perform IPR in the premolar region, it would be perfectly acceptable to set up your ClinCheck plan with posterior IPR.

To illustrate the aforementioned point that Jessica's case can serve as a template for many moderately crowded, non-extraction cases, let's take a look at Lailaa.

CASE STUDY 2 NO. — LAILAA

Lailaa presented with a crowding pattern similar to Jessica's, with the addition of a crossbite of the upper and lower right canines (images 3-11 through 3-13).

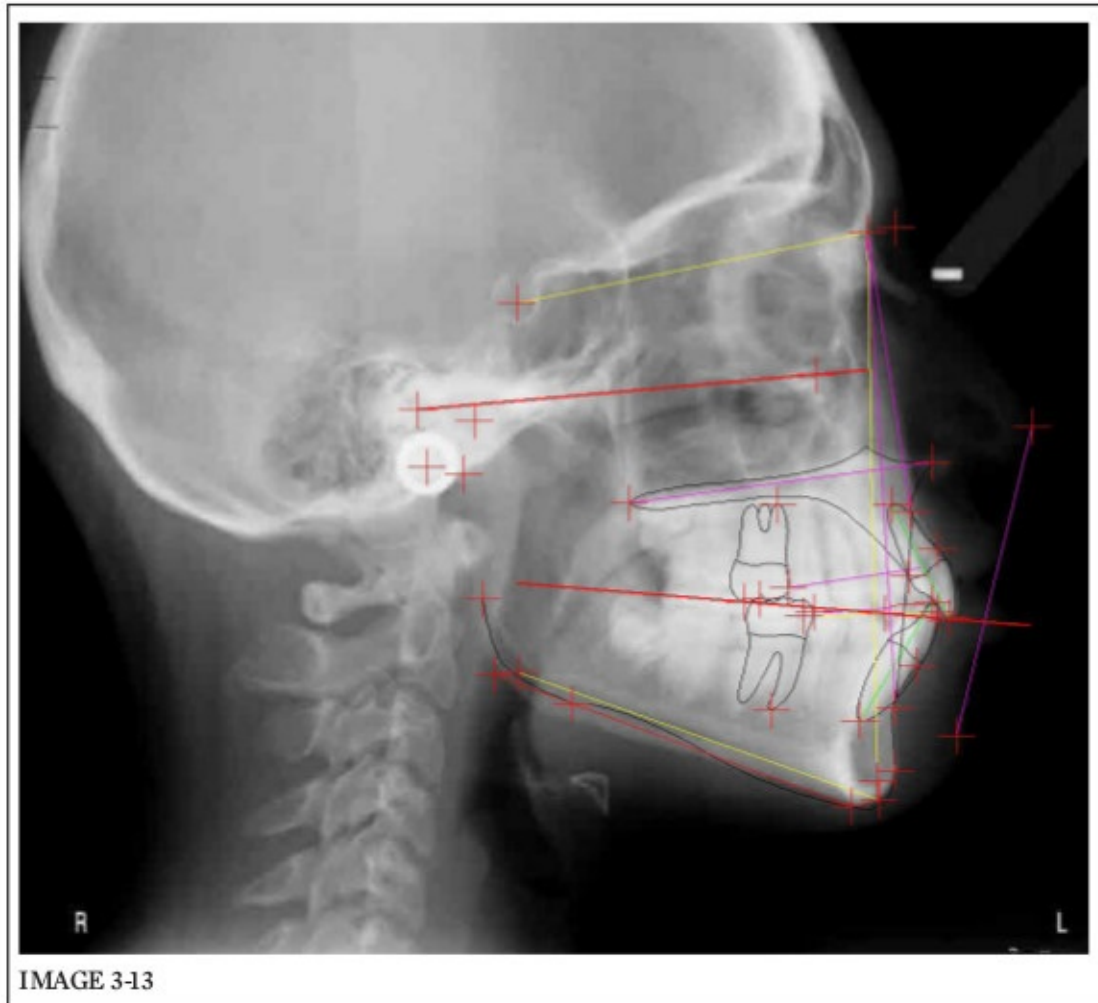
<u>CROWDING</u>				
Space Analysis:	Expansion	Proclination	IPR	Extraction
Esthetic Analysis:	Negative Space	Lip Support	Dark ▲'s	
Stability:	Intercanine Width	Maintain	Posterior Expansion	3mm



IMAGE 3-11

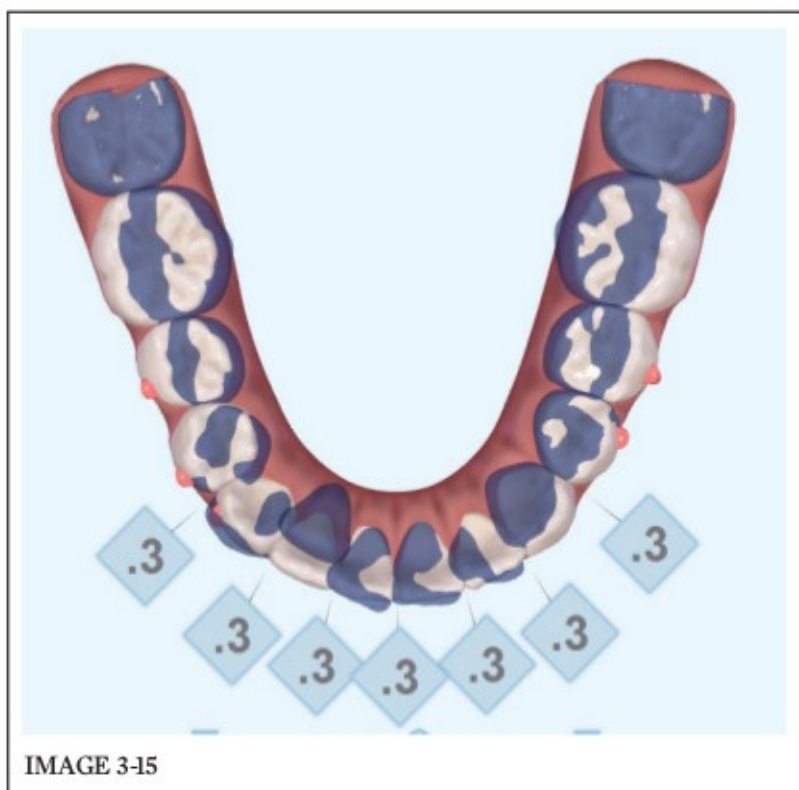


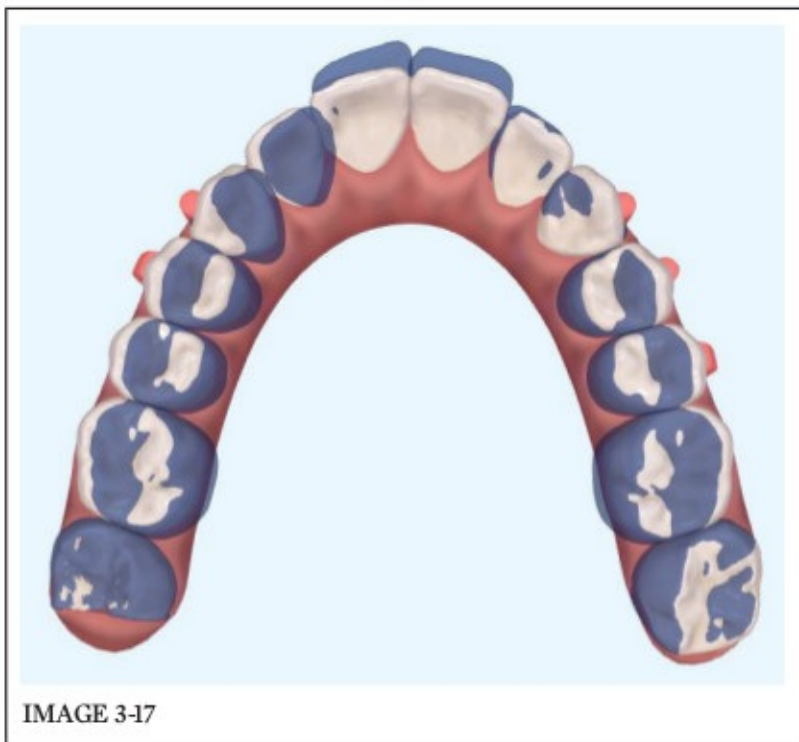
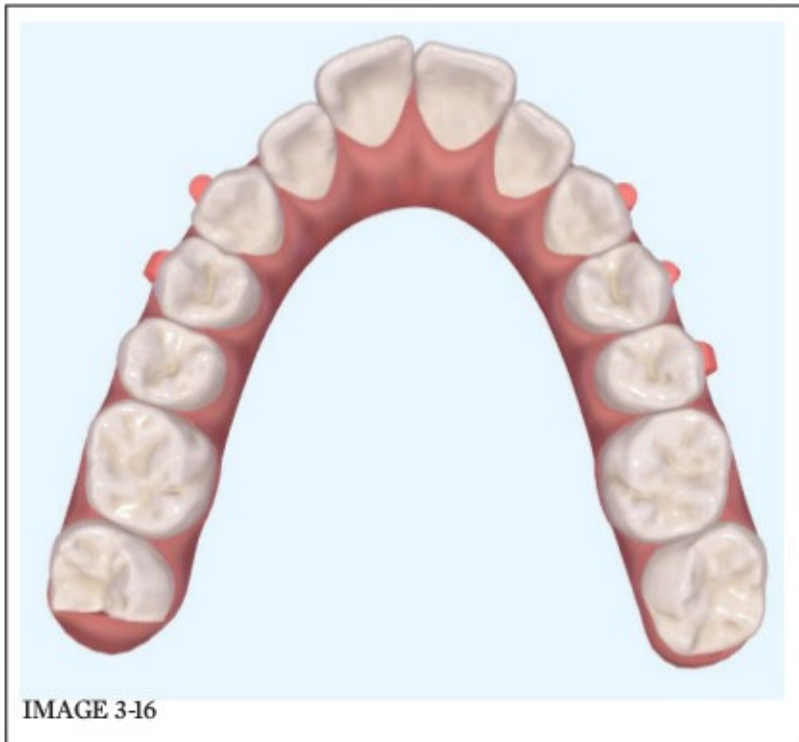
IMAGE 3-12



CLINCHECK TREATMENT PLAN

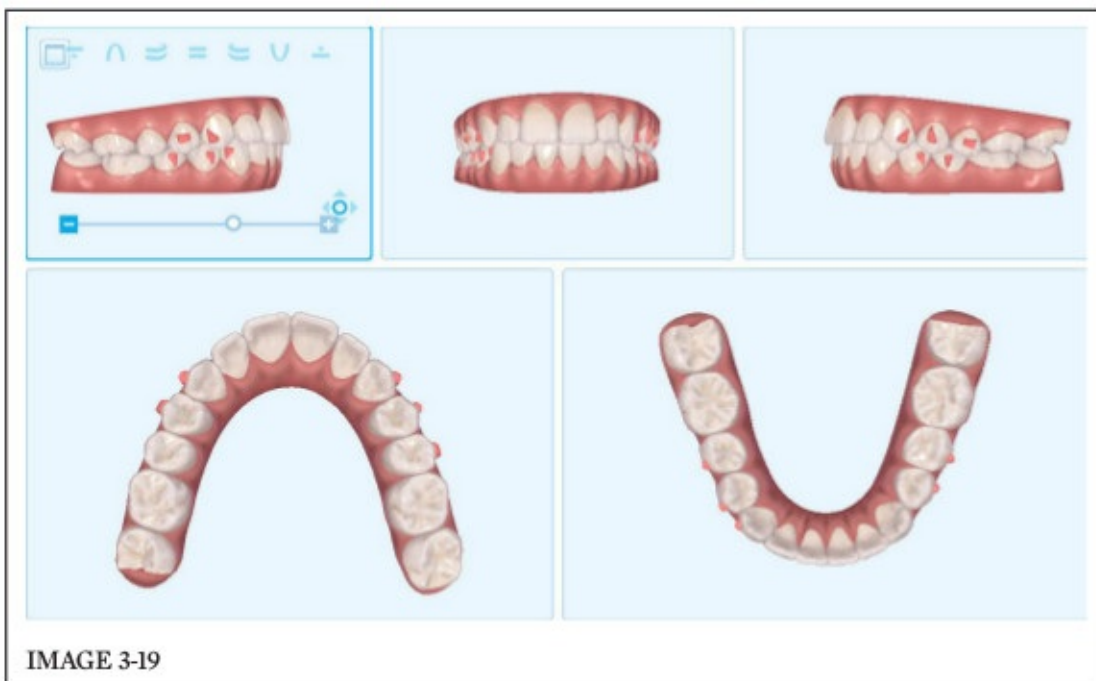
As you can see, Lailaa's ClinCheck list is identical to Jessica's. Her lower arch crowding will be resolved in a similar manner (images 3-14, 3-15). **In the upper arch, however, the instructions to the technician are different:** "Please expand the upper arch sufficiently to allow space for retraction and alignment of the UR1 and UL1." By slight widening of the arch form in the upper arch, sufficient space is created to allow for alignment of the protrusive UR1 and UL1 without the need for IPR. Arch form changes such as this can be helpful to create good alignment in cases such as Lailaa's (images 3-16, 3-17).





RESULTS

Images 3-18 and 3-19 show Lailaa's final result as compared to her ClinCheck plan. The final panoramic radiograph is normal (image 3-20).





Summary: Total treatment time was 22 months.

CASE STUDY NO. 3 — GILBERT

Gilbert presented with a Class I malocclusion, normal overbite, normal overjet, severe upper and lower crowding, challenging labially misplaced UR2 UL2 incisors, LR3 partially blocked out of arch and a normal profile. Gilbert (images 3-21 through 3-23) presented with severe crowding and constriction of the dental arches. His maxillary lateral incisors are labially displaced. We will discuss the management of the maxillary lateral incisors in detail in our discussion of the differences between relative extrusion vs. absolute extrusion.

TREATMENT PLAN

In Gilbert's case we are going to resolve his crowding with a combination of the following:

- Posterior Expansion
- Anterior Proclination
- IPR

CROWDING

Space Analysis:

Expansion

Proclination

IPR

Extraction

Esthetic Analysis:

Negative Space

Lip Support

Dark ▲'s

Stability:

Inter canine Width

Maintain

Posterior Expansion

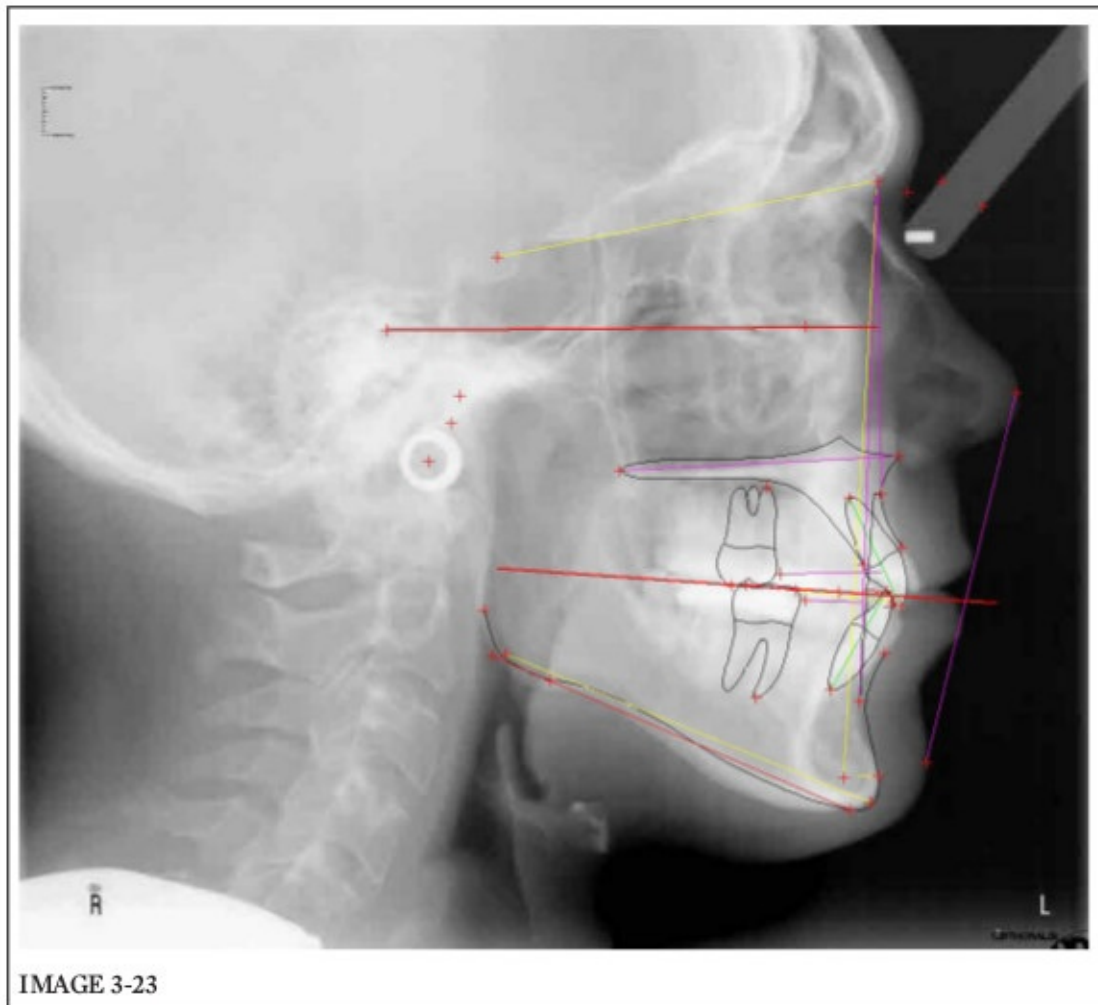
2-3mm/side



IMAGE 3-21



IMAGE 3-22



Gilbert presents with negative space (dark buccal corridors) with collapsed arches on both sides. Posterior expansion of 2-3mm per side to upright his lingually inclined posterior teeth, will help gain a fuller and more esthetic smile. Nevertheless, I still want to maintain Gilbert's mandibular inter-canine width.

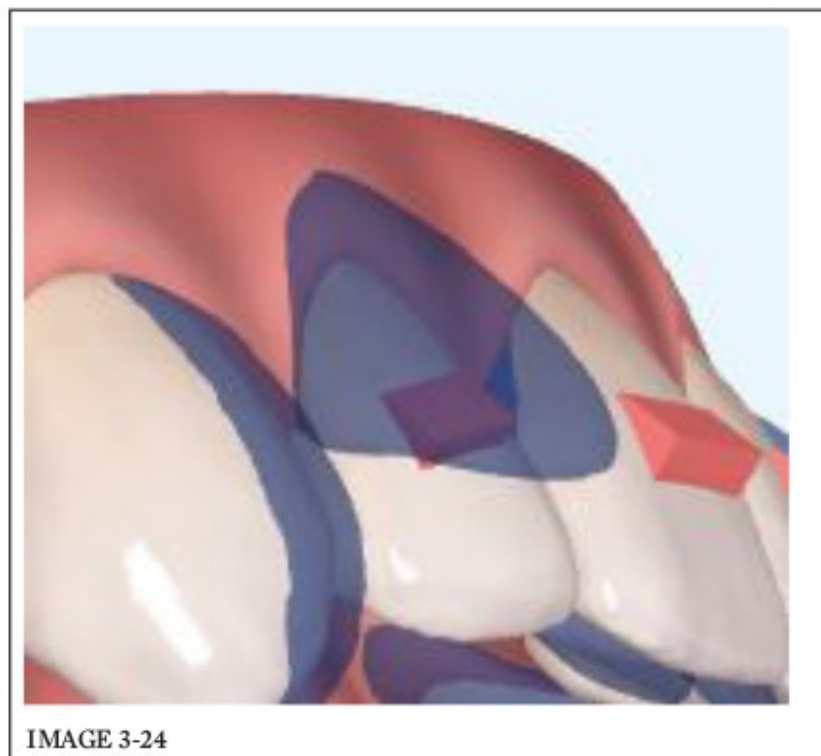
Note the initial position of the maxillary lateral incisors. They are proclined labially. This sets up beautifully for Invisalign treatment since palatal tipping of these teeth will result in *relative extrusion*.

There are two types of extrusion:

- Absolute extrusion
- Relative extrusion

Absolute extrusion involves physically “grabbing” a tooth and extruding it

in relation to the alveolus, and it can be a challenging movement with aligners. Relative extrusion is different — it is lingual tipping (image 3-24) in which you can see this concept on Gilbert's laterals, which is an "Invisalign free ride". As the teeth tip lingually they also tend to deepen automatically. It's not something that requires any specific ClinCheck modification — and it's very predictable. As you can see on Gilbert's ClinCheck plan, there are optimized extrusion attachments on the maxillary lateral incisors. This indicates that the software detected some degree of absolute extrusion, and these attachments are automatically placed with the active surface perpendicular to the force necessary to achieve extrusion. Please refer to chapter 5 for more information on relative vs. absolute extrusion, and chapter 8 for details on attachments that can be useful in cases where absolute extrusion is desired.

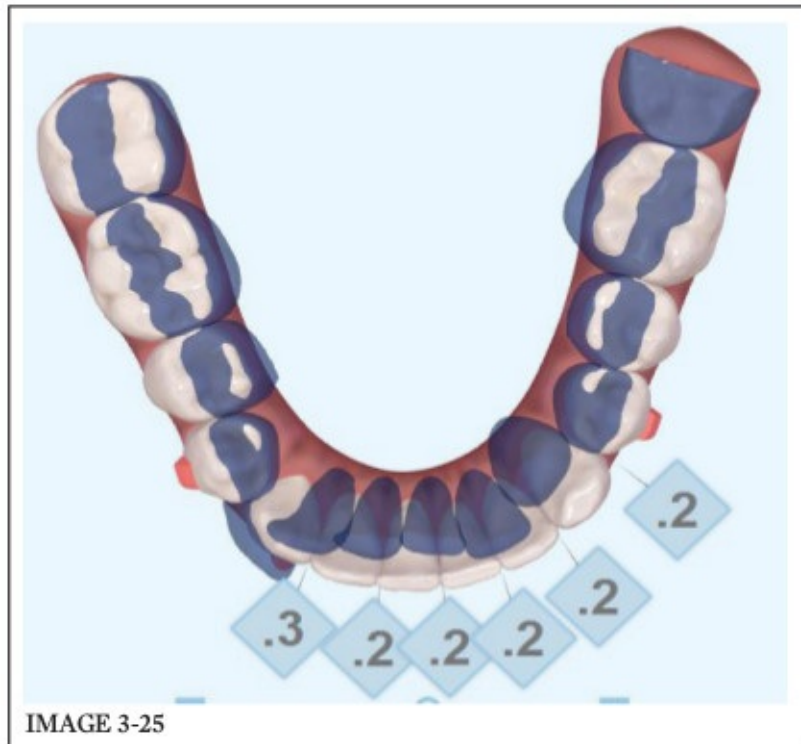


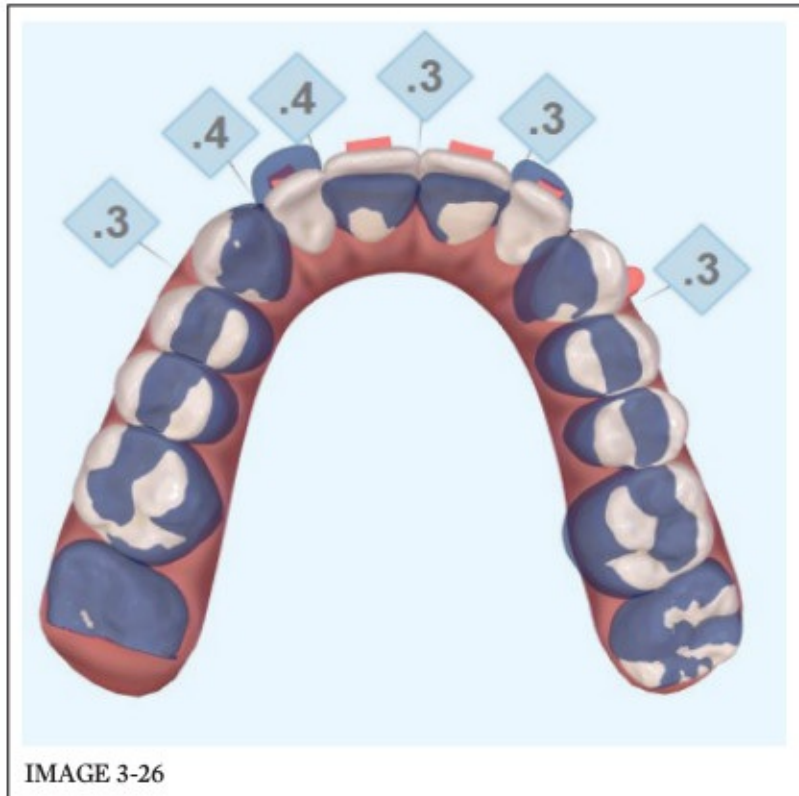
Pro Tip: *Relative extrusion of UR2 UL2 is very predictable movement.*

CLINCHECK TREATMENT PLAN

In the mandibular arch, we are creating space to resolve the crowding through

a combination of posterior expansion, proclination of the incisors, along with anterior IPR. (see image 3-25). In the maxillary arch, posterior expansion, proclination of the palatally tipped UR1 and UL1, and anterior IPR create space for alignment as well as palatal tipping of UR2 UL2 (image 3-26).

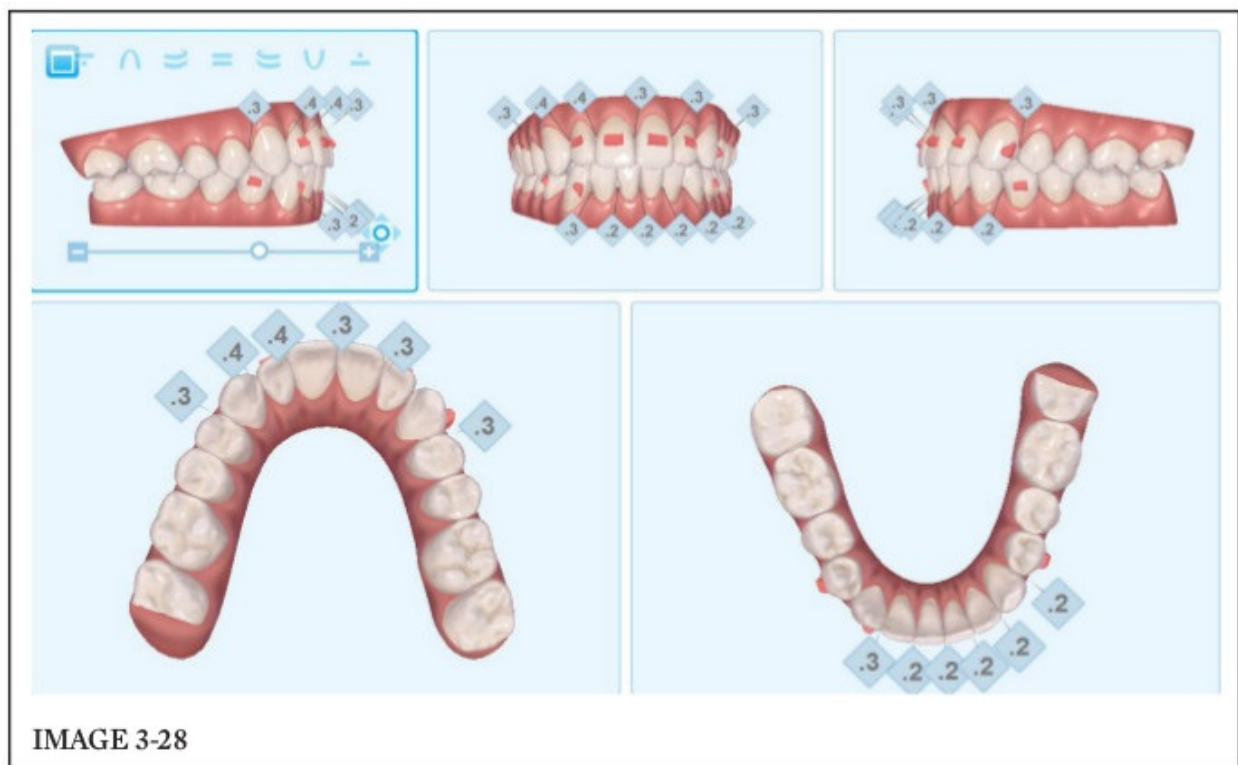




RESULTS

Images 3-27 and 3-28 show Gilbert's final results as compared to his ClinCheck plan — his arches are well-aligned; we've maintained the inter-canine width; maxillary arches are well-aligned; maxillary lateral incisors have predictably, relatively extruded; and we have achieved a functional and esthetic result.

Looking at the superimposition (image 3-29) note the 3-degree pro- clination of the lower incisors. Also note the maintenance of the vertical dimension and excellent control of the mandibular plane angle. His final panoramic radiograph is shown in image 3-30. Thirty months into re- tention his results are stable and are holding up well (image 3-31).



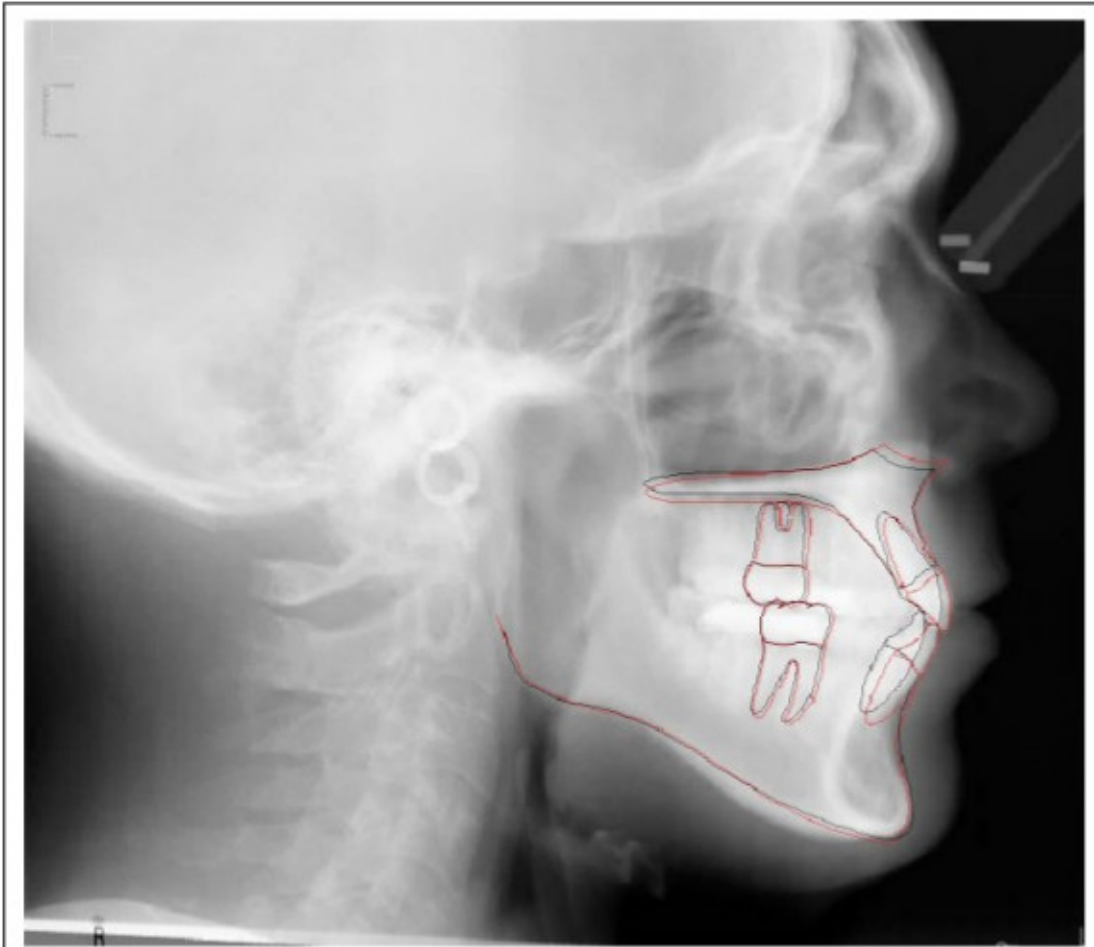


IMAGE 3-29



IMAGE 3-30



IMAGE 3-31

Summary: Total treatment time was 25 months with two refinements, and he

is being retained with Vivera[®] retainers. I look at Gilbert's treatment as an "index case," meaning that his treatment serves as a guide for many of the lesser-crowded cases that present in my practice. If I can manage Gilbert's severe crowding successfully with Invisalign clear aligners, I am confident I can handle the mild to moderately crowded cases as well. **And so can you!**

EXTRACTION TREATMENT

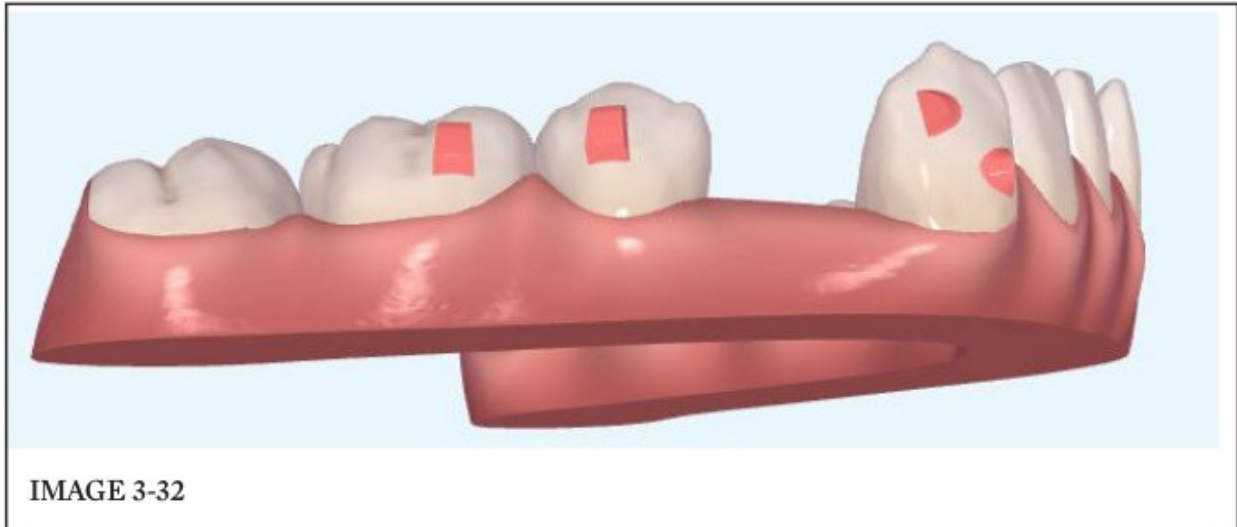
For those Invisalign patients requiring extraction of teeth to resolve their crowding (EXTRACTION in the Space Analysis section under "Crowding" on the ClinCheck list), it is important to revisit two of the fundamental principles of Aligner treatment discussed in Chapter 1 — Principle #1, *Aligners work by pushing*, and Principle #4, *over treatment is a must*. For the management of extraction spaces, or any spaces where bodily movement is required (see "Bodily Movement" in Chapter 4 — Spacing), it is most important to develop our ClinCheck setups in such a way as to properly control the position of the roots. We must identify the push surfaces available on the teeth adjacent to the extraction space that will help achieve bodily movement, as well as over-engineer the ClinCheck plan to place the appropriate force systems on the key teeth to keep the roots moving along with the crowns.

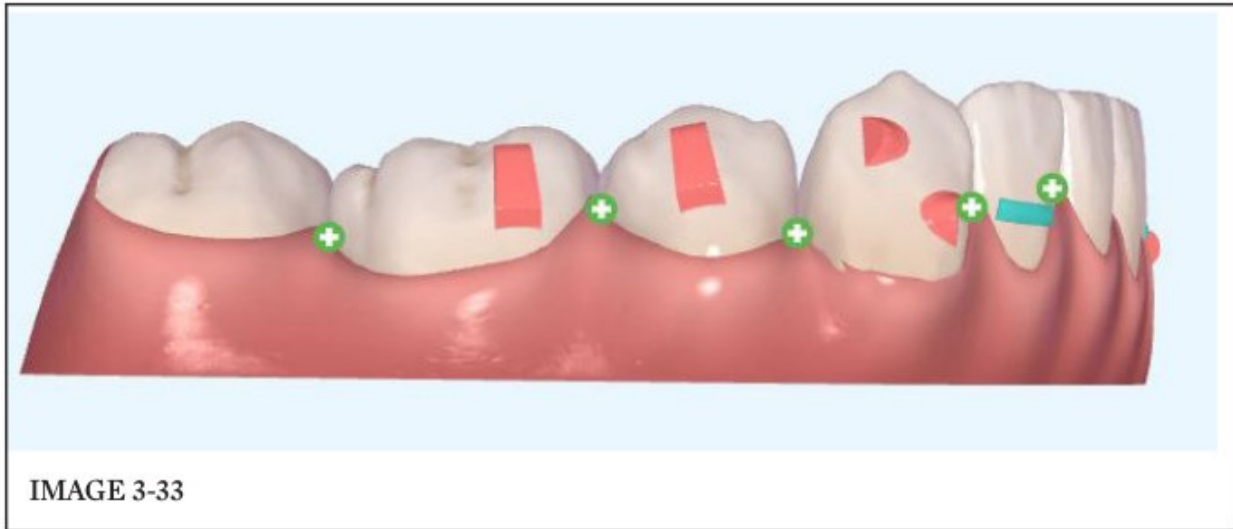
The three critical factors to examine when designing an extraction ClinCheck treatment plan are:

- Virtual Gable Bends
- Attachments
- Pontics

Virtual Gable Bends (VGB) are an over-engineering ClinCheck move designed to place anti-tip forces on the teeth adjacent to a space. Since the point of application of orthodontic force is at the level of the crown, some distance away from the center of rotation of a tooth, the tendency for teeth to tip during space closure must be neutralized. The VGB, as viewed on the ClinCheck plan, moves the root ahead of the crown to counteract the tendency for these teeth to tip,

similar to the use of a gable bend in an arch wire. However, keep in mind that the ClinCheck plan is a graphic representation of the forces being applied to the teeth by the aligners rather than a prediction of the final position of the teeth. In other words, the full extent of the VGB does not express clinically. *Force systems, not teeth.* For extraction space closure requiring bodily movement, a 30-degree VGB, 15 degrees on each tooth, is sufficient (images 3-32, 3-33). The before and after panoramic radiographs taken on the same patient depict the well-controlled position of the roots of the mandibular teeth after extraction of the lower first premolars and subsequent space closure (images 3-34, 3-35). Note the differences between the final positions of the teeth on the ClinCheck plan as compared to the final panoramic radiograph.





Attachments provide additional aligner “grip” to help control the movement of the teeth. We examine attachments in detail in Chapter 8. They may be optimized — placed automatically by the software and engineered to place the specific force systems necessary to achieve the desired tooth movement, or conventional. Optimized root control attachments are one of many SmartForce® features automatically placed by the software. In cases where an optimized root control is not triggered, a vertical rectangular attachment may be used to add additional root control when closing extraction spaces (see previous image 3-33).

Pontics provide esthetic replacement of extracted teeth. In cases where you are closing extraction spaces, I recommend eliminating them. Why? It’s all about push surfaces. In extraction spaces, the optimal push surfaces for the aligner plastic to provide anti-tip are the interproximal surfaces, represented by the green shaded area in image 3-36. The more the aligner material that wraps around the interproximal surfaces, the greater resistance to unwanted tipping. When a pontic is present, there is a void on the interproximal surfaces — and therefore no interproximal plastic at all. The best opportunity for the aligner material to resist tipping is lost. Therefore, whenever possible, ask your technician to remove any pontics in areas where extraction spaces will be closed. If a patient insists on having a pontic, your best bet is to ask for a thin pontic

with at least 1mm of space on each side to allow for as much interproximal plastic as possible.

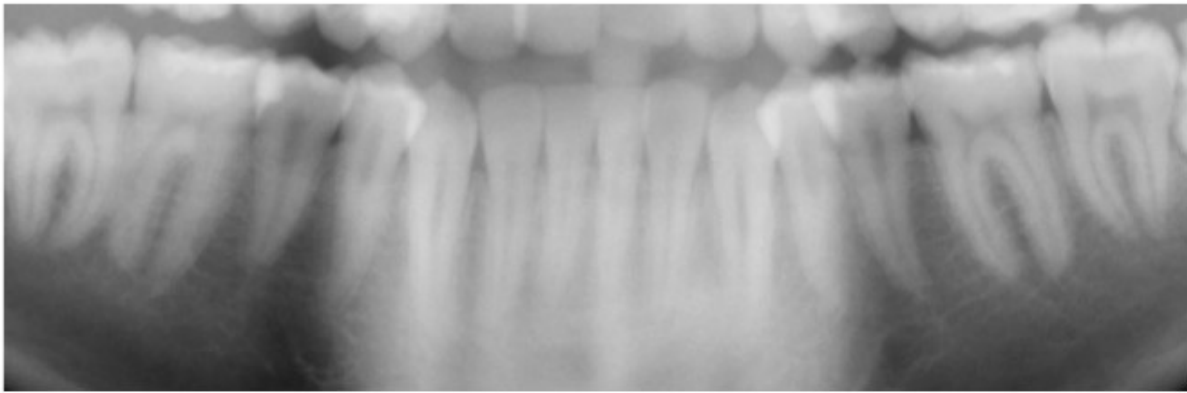


IMAGE 3-34

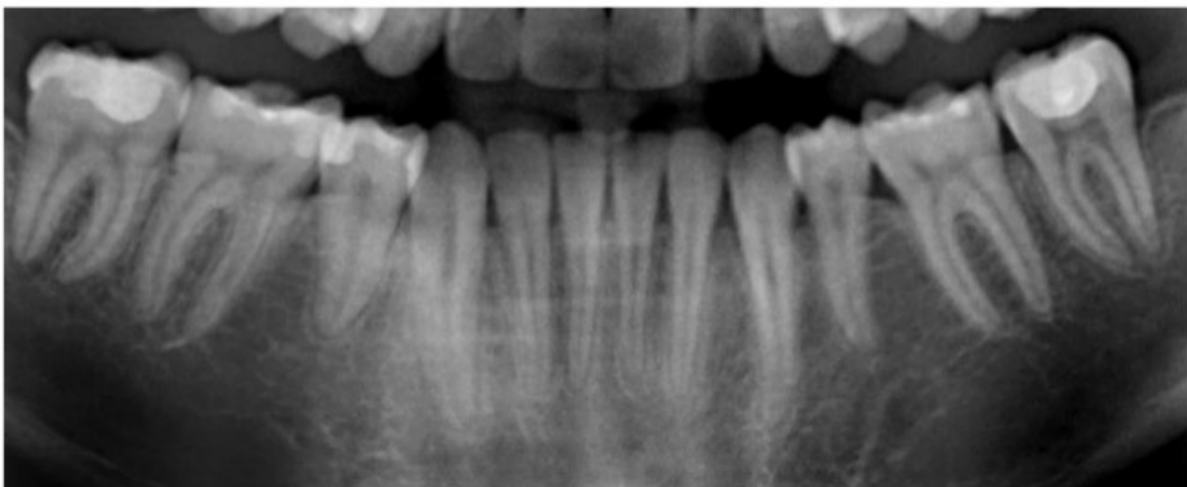
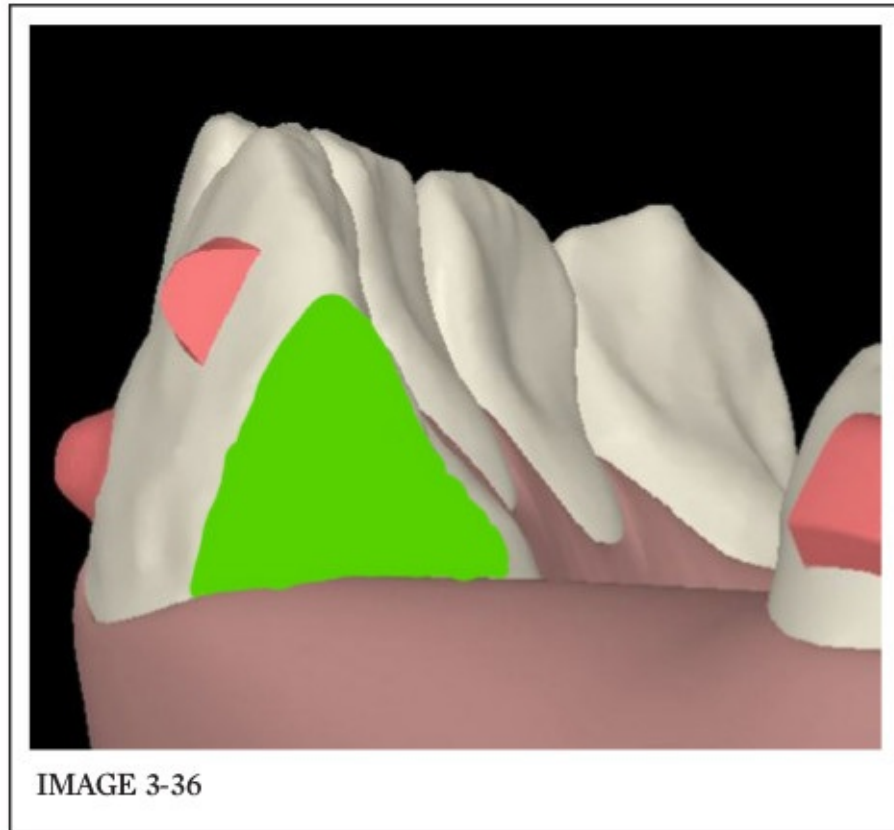


IMAGE 3-35



A new development in extraction treatment is Invisalign G6, which is a solution for maximum anchorage premolar extraction cases. At the time of this writing, Invisalign G6 innovations are being used throughout the world and along with Invisalign G7 innovations represents the latest evolution in Invisalign treatment.

SUMMARY

Crowding is probably the most common clinical issue to be resolved orthodontically. Use the ClinCheck list to guide you through the treatment decisions necessary to unravel crowding in a systematic, controlled fashion. The principles and examples outlined in this chapter will help you to achieve predictable results time and time again!

CHAPTER 4

Spacing

The next item on the ClinCheck list is spacing. Spacing is defined as teeth that have separated and lost proximal contact with adjacent teeth.

In orthodontics, there are only two ways to solve spacing problems, *tipping or bodily movement*. The SPACING section of the ClinCheck list helps guide you through your treatment decision on spacing cases.

SPACING

Closing Spaces:

Bodily

Tipping

Retraction

TSD:

Lower IPR

Leave Upper Space

Tipping is an “Invisalign free ride”. Since orthodontic forces are applied to the crowns of teeth — a distance away from the center of rotation — teeth orthodontically tend to tip as they move, something we can capitalize upon with Invisalign treatment when tipping is desired. When we are planning movements that require tipping, major ClinCheck modifications are not needed, and these tipping movements are quite predictable.

In cases like this one pictured in image 4-1, where the patient presents with the UR1 and UL1 tipped away from each other, Invisalign treatment is very predictable, and the final ClinCheck stage is identical to the final clinical presentation (images 4-2, 4-3).



IMAGE 4-1

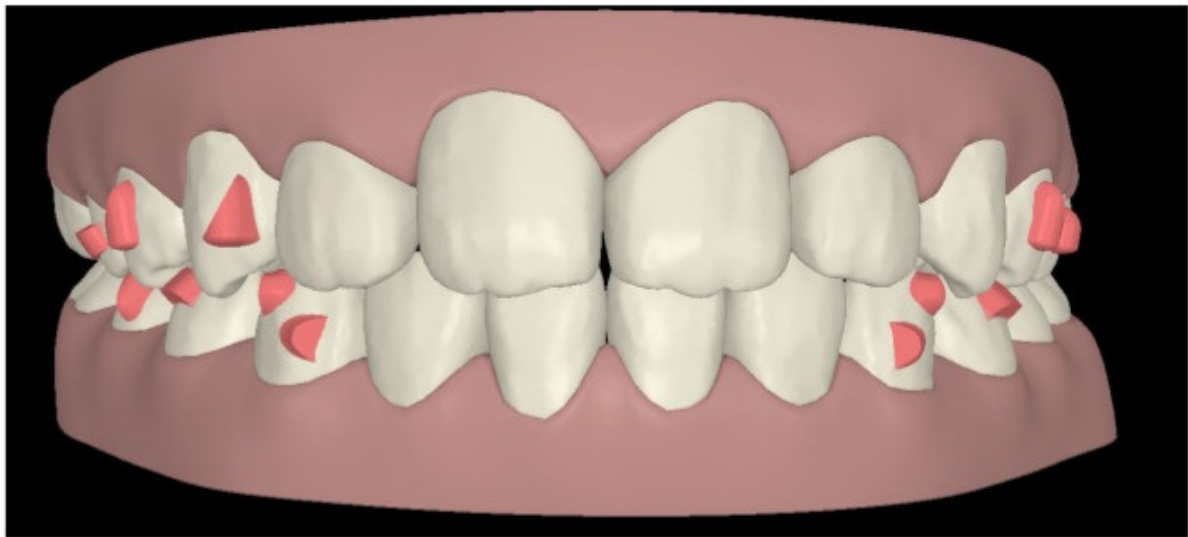


IMAGE 4-2



IMAGE 4-3

Tipping may also occur in cases of incisor retraction where the initial presentation is of flared and spaced upper and or lower incisors (images 4-4, 4-5). For the patient depicted in images 4-6, 4-7, the upper and lower anterior teeth were retracted via tipping to both close the spaces as well as upright the teeth. Another Invisalign free ride!



IMAGE 4-4

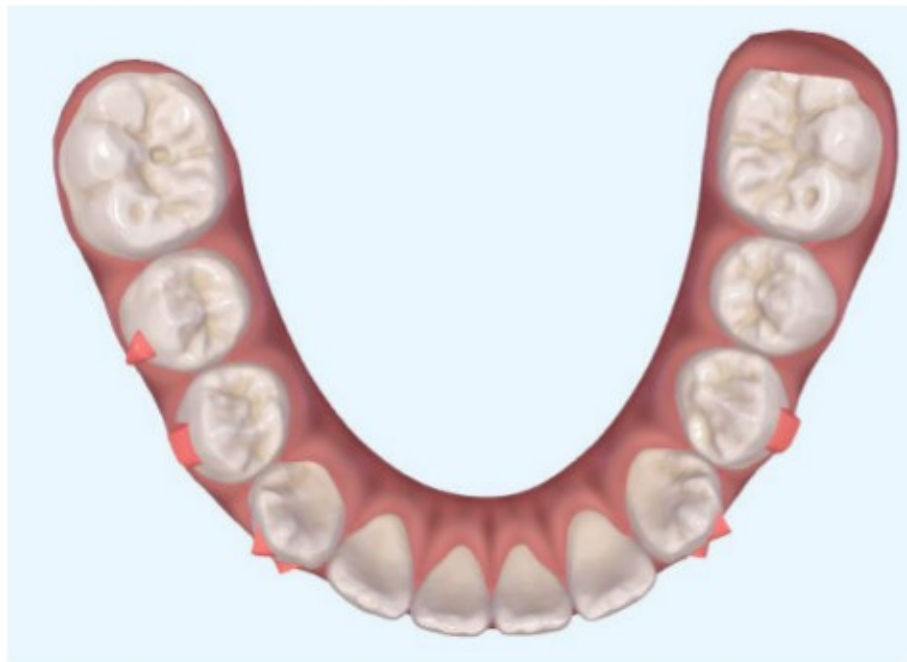


IMAGE 4-5



IMAGE 4-6



CLINICAL CHALLENGE: BODILY MOVEMENT OF TEETH

The second way to close spaces is with bodily movement. Bodily movement is more challenging and the force systems acting upon the teeth are more complex. There are two ClinCheck modifications to consider when closing spaces via bodily movement:

- *Attachments* — attachments provide additional aligner “grip”. They may be optimized — placed automatically by the software and engineered to place the specific force systems necessary to achieve the desired tooth movement, or conventional. Note the attachments on the UR1 and UL1 in this patient (images 4-8, 4-9) who presented with a diastema. On the UR1, there is an optimized root-control attachment. On the UL1, there is a conventional vertical rectangular attachment. Both attachments provide additional push surfaces to assist in bodily movement.



IMAGE 4-8



IMAGE 4-9

- *Virtual Gable Bends* are adjustments we make in the ClinCheck plan as anti-tip. For example, in the aforementioned patient with a diastema between the UR1 and UL1, we need to move the teeth bodily to close the space — we do not want them to tip. If the teeth tip as they move, the crowns will tip off axis, the incisal edges will not be aligned, and there will be a dark triangle between the teeth at the gingival aspect. Clearly not what we want.

Instruction to the Technician: *“Please add a 30-degree virtual Gable Bend URI UL1.”*

The Virtual Gable Bend (VGB) places forces to the teeth to counteract the

tendency to tip, similar to the use of a gable bend in an arch wire (image 4-10). Fifteen degrees of additional root tip is applied to each tooth, resulting in a total of 30 degrees. In images 4-11 through 4-14 we see the patient in progress and the teeth are still moving well, the diastema almost closed and the teeth still upright.



IMAGE 4-10



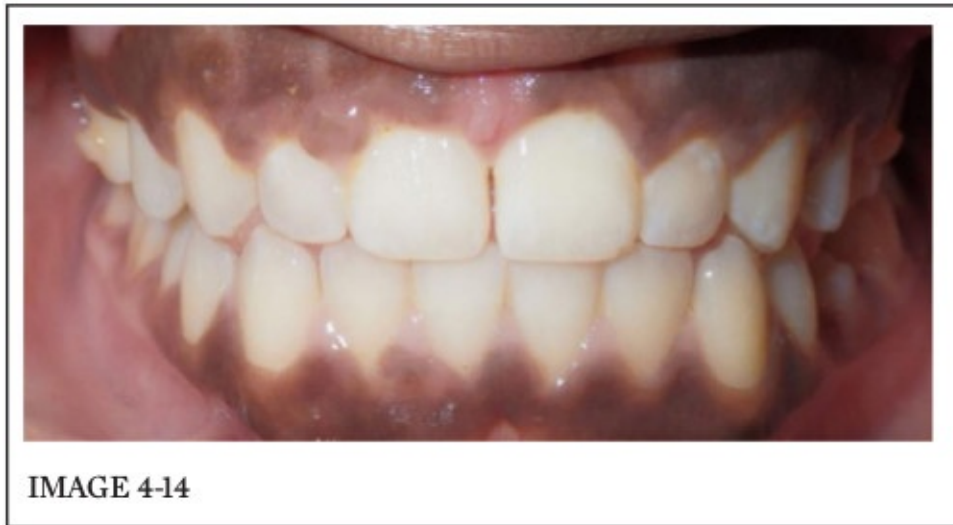
IMAGE 4-11



IMAGE 4-12



IMAGE 4-13



Note at Stage 16, image 4-10: There appears to be more root movement versus crown movement, which is deliberate. We are placing 30 degrees of mesial root movement into the ClinCheck plan as “anti-tip”. Clinically, however, the full extent of the VGB does not express. The VGB is an excellent illustration of looking at ClinCheck as *force systems, not teeth*, which is another central theme of this book. Clinically at stage 16 the teeth do not look like they are overly tipped — they are still upright.

Case no. 2 (images 4-15 through 4-19): This patient is missing the upper-left lateral incisor. Our treatment plan involves moving the upper-left canine distally into Class I and opening the space for an implant. If you look on her Panoramic X-Ray, you can see that UL2 is missing, and she has a peg-lateral tooth UR2.



IMAGE 4-15

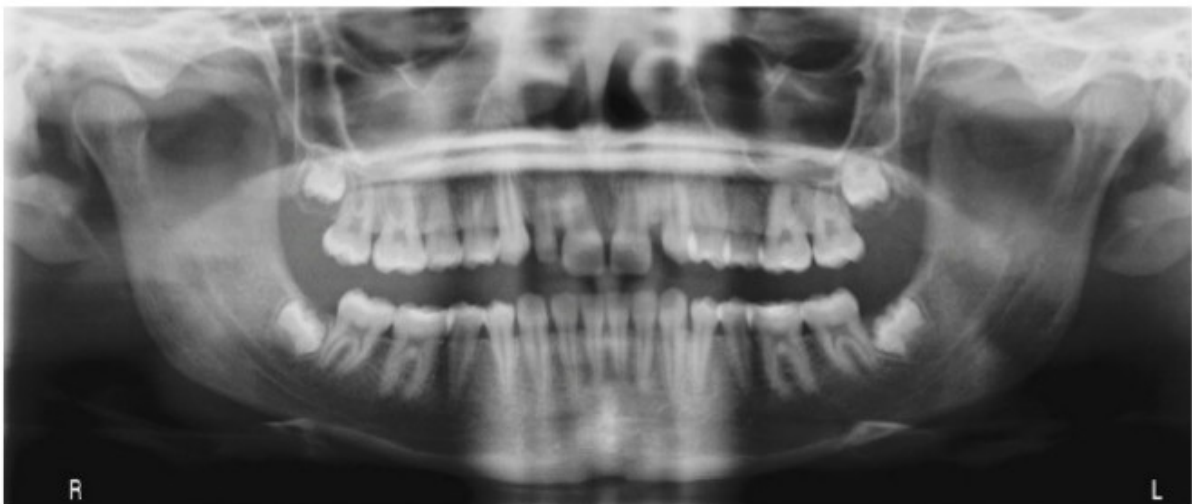


IMAGE 4-16

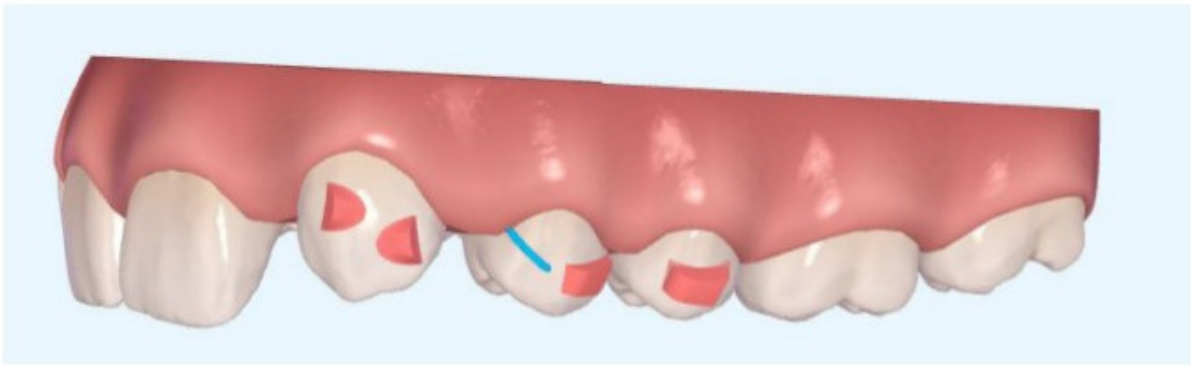


IMAGE 4-17

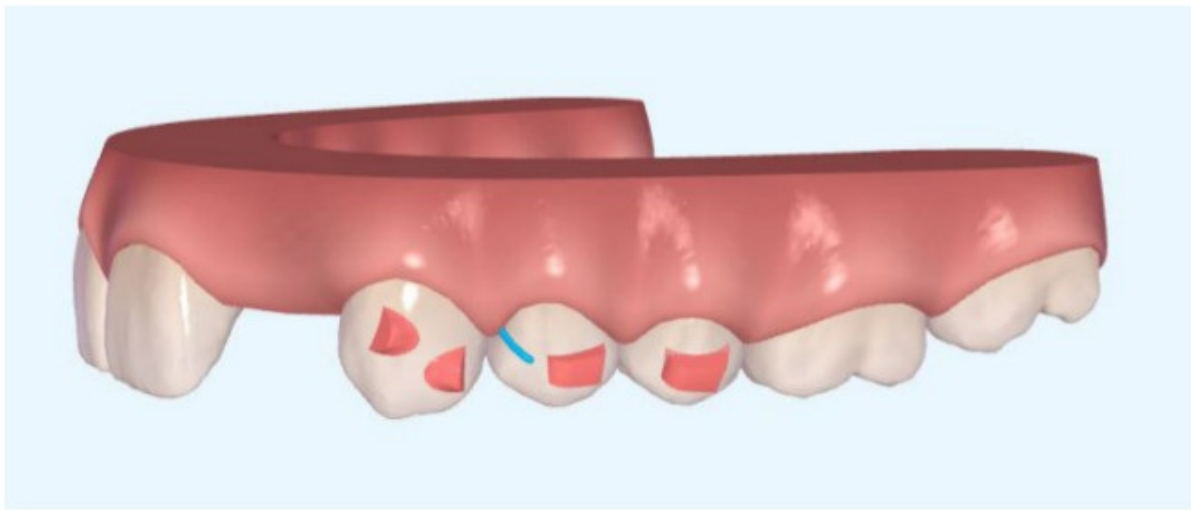


IMAGE 4-18



IMAGE 4-19

Instructions to the technician for case no. 2: *My instructions are going to direct the technician to add over-engineering. I am going to tell the technician, “Please over-treat the distal root tip of the UL3 by 30 degrees.*

Just like in the previous case, where I programmed 30 degrees of additional root movement in the ClinCheck plan that did not express clinically — the additional root movement is placed as a force system to keep the tooth from tipping. *Force systems*, not teeth. We are going to do the same thing in this case. I am not expecting to actually have 30 degrees of additional root movement, but as the UL3 moves distally, I am concerned about the crown tipping distally and root moving mesially via uncontrolled tipping. This would be undesirable, as there would be insufficient space for implant placement. Therefore, I am over-engineering the ClinCheck plan to set up the proper force system to achieve bodily movement.

In the final X-ray, notice we now have the UR3 in proper position and the implant space prepared (20 months total treatment time). In this situation, I over-engineered the ClinCheck plan to establish the proper force system to achieve bodily movement.

Root movement is one of the areas where I routinely over-engineer.

Please note: For details on how to manage the closure of extraction

spaces, please see Chapter 3.

TOOTH-SIZE DISCREPANCIES

Tooth-size discrepancies or TSD on the ClinCheck list (also known as a Bolton discrepancy) are an area sometimes overlooked by doctors when viewing their ClinCheck treatment plans. The Bolton ratio (named for Dr. Wayne A. Bolton) is a measure of the relative mesio-distal widths of the upper and lower teeth. In an ideal ratio, the widths of the mandibular teeth will be 77 percent of the maxillary teeth. This makes sense, since the mandibular teeth have to fit inside of the maxillary teeth. A Bolton discrepancy exists when the ratio falls outside of 77 percent. Most frequently, a Bolton discrepancy is the result of narrow maxillary lateral incisors. If we do not make up the difference and manage a Bolton discrepancy with either lower IPR or leaving space somewhere in the maxillary arch, there is going to be a problem. The problem frequently manifests itself as a *posterior open bite*.

Think about it like this: If a patient who presents with maxillary spacing does not have enough tooth structure in the maxillary arch (and they have a Bolton discrepancy where there is relative excess tooth structure in the mandibular arch) and we don't manage that problem, in our efforts to close the upper space the upper incisors are retracted into the lower incisors. This will in turn cause "heavy" anterior contact on the incisors and posterior open bites. In my teaching travels, I have more than once encountered a doctor who had difficulty understanding why their "easy" CL I upper spacing case developed a large posterior open bite. If this has happened to one of your patients, look at the Bolton analysis available for all cases in *ClinCheck Pro* and consider managing the problem with either:

- Lower IPR and lower incisor retraction, possibly supported with CL III elastics
- Leaving space for cosmetic buildup of narrow maxillary lateral incisors
- Leaving space distal to the upper canines or in-between the premolars
- CL III elastics alone, or

- A combination of the above

CLINCHECK PRO

Now let's go into *ClinCheck Pro*.

Step 1: Open your case in ClinCheck Pro.

Step 2: On your *ClinCheck Pro*. menu, select *Bolton* (image 4-20)

A screen will appear with the Bolton analysis for your patient.



In this case (image 4-21), the patient has a 2.77mm Mandibular Excess that needs to be managed.

Bolton Analysis			
Excess		Value	
Mandibular Excess 3-3		1.55 mm	
Mandibular Excess 6-6		2.77 mm	
Upper Right		Upper Left	
Tooth ID	Width	Tooth ID	Width
UR1	8.45 mm	UL1	8.52 mm
UR2	6.64 mm	UL2	6.46 mm
UR3	7.69 mm	UL3	7.55 mm
UR4	7.35 mm	UL4	7.13 mm
UR5	6.93 mm	UL5	6.88 mm
UR6	9.65 mm	UL6	9.71 mm
Lower Right		Lower Left	
Tooth ID	Width	Tooth ID	Width
LR1	5.59 mm	LL1	5.51 mm
LR2	6.18 mm	LL2	5.86 mm
LR3	6.73 mm	LL3	6.65 mm
LR4	7.17 mm	LL4	7.02 mm
LR5	7.36 mm	LL5	7.56 mm
LR6	10.97 mm	LL6	11.05 mm

Step 4: Go back into your Invisalign Doctor Site homepage

Step 5: Find Clinical Preferences and click on it (image 4-22)



Step 6: Under ClinCheck no. 9 you'll see Tooth size discrepancy (image 4-23)



Step 7: You have three options (click on radial button of choice):

1. Leave space distal to the laterals
2. Leave space equally around the laterals
3. IPR opposing arch*

Note: You can override these preferences for any particular case. *NO. 3 is my preference: IPR opposing arch

Question: When wouldn't I IPR the opposing arch?

Answer: When a patient presents with small or peg-lateral incisors, which are going to be set up for cosmetic tooth build-up later on when Invisalign treatment has been completed.

SUMMARY

This chapter will help guide you through the treatment decisions and ClinCheck moves to achieve predictably excellent results in your Invisalign spacing cases. Use the SPACING section of the ClinCheck list, along with the principles discussed in this chapter when analyzing your ClinCheck set-ups. Learn to recognize tipping movements versus bodily movements and you will be on your way to great results!

CHAPTER 5

Vertical Dimension

This chapter deals with managing problems that involve the vertical dimension. When we deal with Invisalign patients who have problems in the vertical dimension, we're looking at either deep-bite or open-bite problems. In addition, we will look at single tooth vertical movements as well.

Deep Bite — like the parameters we have already explored, there are only a limited number of ways to correct deep bites. We can correct deep bites with the following:

- Anterior intrusion
- Posterior extrusion
- A combination thereof

There are considerations for each of these moves. How does one make the decision in any given case to intrude the anterior teeth, extrude the posterior teeth, or both? In deep-bite cases requiring anterior intrusion, what criteria does the doctor consider in deciding to intrude the lower anterior teeth, upper anterior teeth, or both? Let's look at the ClinCheck list for guidance:

VERTICAL

Incisal Display	Gingival Display		Gingival Margins		Smile Arc	
<i>Deep Overbite:</i>	Ant Intrusion	U L	Post Extrusion	U L		
<i>Open Bite:</i>	Ant Extrusion	U L	Post Intrusion	U L		
Extrusion/Intrusion:	Relative _____			Absolute _____		

Let's examine each of these separately:

- Incisal display — intrusion of the upper anterior teeth would be indicated in deep-bite cases with super-eruption of the upper incisors, but would be contra-indicated in deep-bite cases with insufficient incisal display.

- Gingival display — similar to incisal display, upper anterior intrusion may be beneficial in patients with vertical maxillary excess (VME) to reduce gummy smiles (image 5-1, 5-2).



IMAGE 5-1



IMAGE 5-2

- Gingival margins — intrusion or extrusion of key teeth may help to improve the symmetry of gingival margins. In patients with incisal wear and super-eruption of the worn tooth, anterior intrusion would be indicated to level the gingival margins prior to restoration of the tooth (image 5-3).



IMAGE 5-3

- Smile arc — when working up Invisalign treatment plans, we endeavor to create pleasing smile arcs where the curvature of the upper anterior incisal edges follows the curvature of the lower lip. Anterior intrusion or extrusion is a primary consideration in these cases (images 5-1, 5-2).
- Lower Curve of Spee — lower incisor intrusion and/or posterior extrusion are key components to correcting deep over bites. Some deep-bite cases requiring bite opening via posterior extrusion. For example, in patients with:
 - Short lower facial heights
 - Restorative cases with loss of vertical dimension
 - Hypodivergent, skeletal deep bites
 - CL II div.2 malocclusion

Open Bite — there are limited options here, too. We can do the following:

- Extrude the anterior teeth
- Intrude the posterior teeth, or
- A combination of the two.

Not surprisingly, the same considerations apply:

- Incisal display — anterior open-bite cases with insufficient incisal display

may benefit esthetically from anterior extrusion, whereas those patients with normal incisal display would be more likely to benefit from closure of the open bite via posterior intrusion.

- Gingival display — anterior open-bite cases with excessive gingival display would not benefit esthetically from upper anterior extrusion, whereas those with insufficient gingival display would.
- Gingival margins — leveling gingival margins may in some cases require extrusion.
- Smile arc — when an anterior open bite is related to a habit, the resultant reverse smile arc may be remedied with anterior extrusion.

RELATIVE VS. ABSOLUTE EXTRUSION/INTRUSION

Relative vs. Absolute Extrusion/Intrusion is another subheading in the vertical section of the ClinCheck list. Let's examine these movements more closely:

Relative Extrusion or Intrusion — these are predictable movements, another “Invisalign free ride,” and you don't need any specific attachments or major ClinCheck plan modifications to achieve relative extrusion or intrusion.

In cases that require *relative extrusion*, we achieve it by simply tipping teeth lingually. When teeth tip lingually, the incisal edges of the anterior teeth travel along an arc and the bite naturally tends to deepen, as do Gilbert's (from Chapter 3) UR2 and UL2 (images 5-4, 5-5). Again, this is a predictable movement, and no special ClinCheck plan modifications are required in open-bite cases where we desire *closure of the bite*. On the other hand, *in deep-bite cases that present with flaring and spacing of the anterior teeth*, retraction of the anterior teeth will also lead to relative extrusion, which would worsen the deep bite. In these cases, compensatory incisor intrusion should be built into the ClinCheck plan to counteract the bite-deepening effects of relative extrusion.



IMAGE 5-4



The same goes for *relative intrusion*. In deep-bite cases where the anterior teeth are lingually inclined, labial proclination will tip the crowns forward, resulting in the incisal edges traveling in an arc away from each other (images 5-6, 5-7). It's important to recognize cases requiring relative intrusion or extrusion, as these movements are more predictable. Similarly, in open-bite cases that require proclination of the anterior teeth — to resolve crowding for example — the proclination will result in relative intrusion, which would make the open bite worse. In these cases, compensatory absolute incisor extrusion must be built into the ClinCheck plan.



IMAGE 5-6



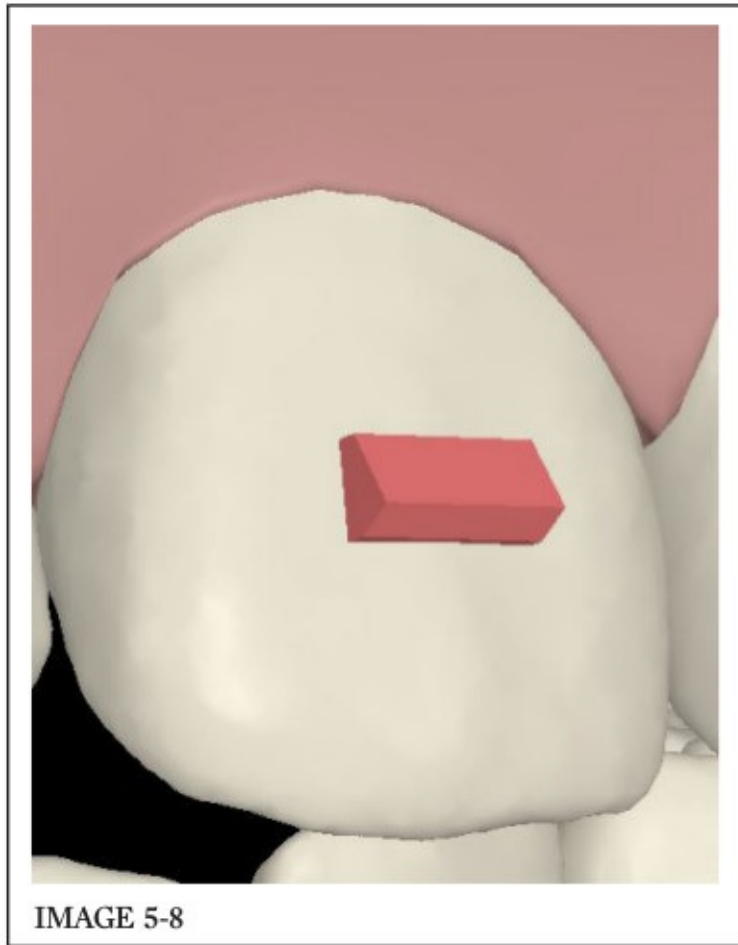
Absolute Extrusion/Intrusion — are more challenging movements with Invisalign treatment — this doesn't mean we can't achieve it — however it is important to “read” your ClinCheck plan and recognize teeth that are absolutely extruding or intruding. The superimposition tool can be helpful to determine absolute vs. relative movements. In certain cases, absolute extrusion requires specific:

- Attachment substitutions
- Over treatment moves, and/or
- Auxiliaries

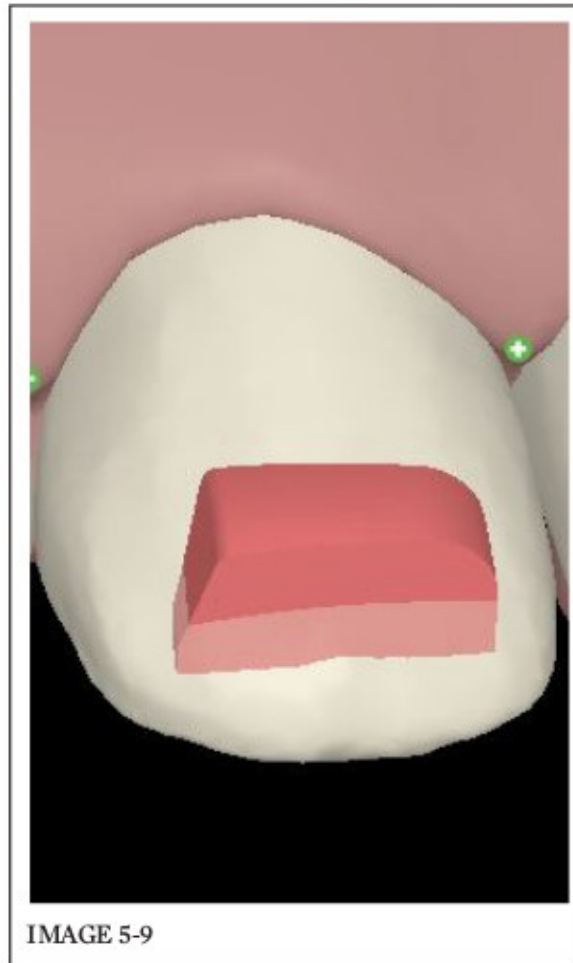
In cases of *absolute extrusion*, we are physically extruding a tooth or group of teeth relative to the alveolus. This requires “grip” — a lot of grip — most commonly on central and lateral incisors that have very smooth surfaces and minimal undercuts. In some cases that require absolute extrusion, optimized

extrusion attachments will be placed automatically by the software. The presence of optimized extrusion attachments on the anterior teeth is a tip-off that absolute extrusion is occurring.

Let's take a closer look at the orientation of the optimized extrusion attachment. (image 5-8). These attachments, like all optimized attachments, are placed automatically by the software to place the specific force systems on the teeth to achieve the desired tooth movement. It is important to understand that the forces will be perpendicular to the active surface of the attachment, and that the aligner surface interacting with the active surface will be pre-activated to create the proper forces. Furthermore, I strongly recommended that these attachments NOT be removed, despite the esthetic concerns of some patients. They are on the teeth for a reason — to achieve the desired movement — and if they are removed the likelihood of encountering a non-tracking situation increases.

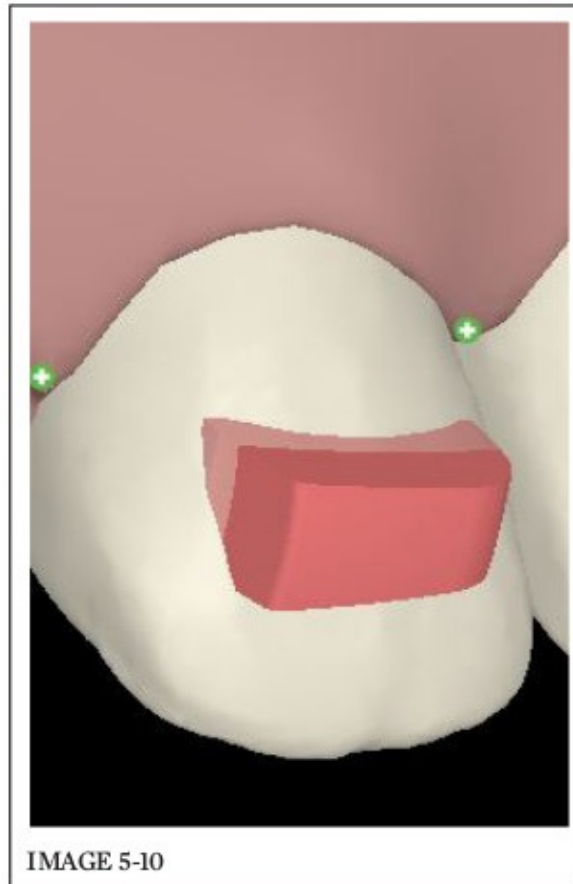


There are clinical situations, most often on non-tracking maxillary lateral incisors, where I will reengineer the attachments to provide additional aligner grip to help keep the teeth extruding. In my experience, I have found that a modified 4mm-long, gingivally-beveled, rectangular attachment can be quite useful (image 5-9). I will use 3D controls to move the attachment close to the incisal edge, where the aligner plastic is stiffer. In my experience this allows for better “grip” and more predictable absolute extrusion. Furthermore, I will use 3D controls to “roll” the bevel as gingivally as possible to create a bevel that blends smoothly into the labial surface of the tooth, to gain additional surface area on the attachment, and therefore more aligner “grip.”



In cases of absolute extrusion, I have had many doctors ask me, “Which way does the bevel go?” There are two options to answer this question: we can place the bevel *incisally* or *gingivally*.

Incisal — when we use this approach we can potentially get more “grip” where there will be a 90° ledge at the gingival aspect (image 5-10) that will engage the aligner. This makes sense because we’re going to get more aligner grip. However, there is a higher chance for failure mode. *Failure mode* occurs when the aligner loses tracking and becomes totally disengaged from the attachment. If this occurs, the aligner has the potential to place undesired lingual forces on the tooth, which can lead to inadvertent intrusion, just the opposite of what we want.



Gingival — if we bevel our attachments gingivally (image 5-9) we get somewhat less grip, but also we have less chance to encounter failure mode. *This is my personal preference* when I am looking to achieve absolute extrusion, and I find this attachment quite useful.

DEEP-BITE OPTIONS

Invisalign G5 innovations were designed to specifically address the challenges of correcting deep overbites with Invisalign. G5 features include:

- Pressure areas to intrude upper and lower incisors — these pressure areas direct the forces of intrusion along the long axis of the tooth for more predictable intrusion.
- Optimized premolar anchorage attachments — provide additional posterior anchorage to support lower incisor intrusion and leveling of the lower Curve of Spee.

- Precision bite ramps on upper incisors — disocclude the posterior teeth to remove posterior bite forces that may work against deep-bite correction.
- Conventional bite ramps on upper canines — when the overjet is greater than 3mm, the lower incisors will occlude behind precision bite ramps. Conventional bite ramps on the upper canines in this situation may be a better option.

When patients present with deep-bite problems, the doctor has choices to make toward correction. These choices include:

Anterior Intrusion — in cases requiring anterior intrusion, the G5 pressure areas are placed on any incisor requiring intrusion incisors automatically. You do not have to request them.

Optimized anchorage attachments on pre-molars are also placed automatically. These attachments provide anchorage to support lower incisors intrusion. You may be asking, “Why do I need posterior anchorage to support lower incisor intrusion?” Think Newton’s third law. *For every action, there is an equal and opposite reaction.* In cases requiring lower incisor intrusion, for example, the “action” force is placed by the lower aligner against the lower incisors to intrude them. The “reaction” is for the aligner to lift off the posterior teeth. Clearly, we don’t want this to occur. “Posterior lift off” will result in decreased intrusion force to the anterior teeth, and the deep bite may not correct. Optimized anchorage attachments help keep the aligners engaged on the premolars, resulting in more predictable deep-bite correction.

NOTE: A situation may arise where the optimized premolar anchorage attachments don’t appear on your ClinCheck plan. If the software detects greater than 5° rotations on the lower premolars the patient will not get the optimized G5 anchorage attachment. Instead, an optimized rotation attachment will be placed. In my experience, the optimized rotation attachment does not provide sufficient anchorage to support intrusion of the lower anterior teeth. At this point, it would be time for substitution of attachments. Let’s take a look at the Clin Checklist.

The **Attachment** section of the ClinCheck list helps guide you through this decision. In cases where you deem deep overbite correction to have priority over premolar rotation, substitute 4mm-wide, occlusally- beveled rectangular attachments on the lower first and second premolars (image 5-15). These attachments provide additional “grip” to prevent the aligners from lifting off posteriorly, and are very effective at supporting the intrusion of the lower incisors.



For the reader: We will look at attachments in more detail in chapter 8.

Posterior Extrusion — in deep-bite cases requiring posterior extrusion, you may request precision bite ramps on the U1’s and and/or 2’s. Precision bite ramps act like mini “bite plates” to disocclude the posterior teeth when wearing the aligners. If there is over-jet greater than 3mm bite ramps are not effective — the lower incisors will bite behind them. In these cases, we request conventional bite ramps on the U3’s. The conventional bite ramps or the precision bite ramps will disocclude posterior teeth and will remove posterior bite forces that work against deep-bite correction.

WHEN TO PRESCRIBE PRECISION BITE RAMPS

How do you determine when to prescribe precision bite ramps? Following are the times when I prescribe them:

Deep-Bite Cases Requiring Posterior Extrusion — we want the precision bite ramps to disocclude the posterior teeth, which will facilitate posterior

extrusion by removing occlusal forces.

Levelling the lower Curve of Spee — I also prescribe precision bite ramps when I want to lower the Curve of Spee (COS) when premolar eruption is needed, for the same reason. I want to remove the forces of occlusion that would interfere with the eruption of the premolars.

Class II, Division 2 Cases — I consider using precision bite ramps in skeletal low angle (hypodivergent) cases (i.e. CL II div. 2) where we're looking to open the vertical dimension and lengthen the lower facial height.

Bite Plate Effect — another place to use precision bite ramps is as a bite plate to facilitate correction of dental cross-bites. It may help to reduce the trauma to the tooth in cross-bite as it's moving through the zone of heavy contact with the opposing dentition.

DO NOT USE PRECISION BITE RAMPS

Deep-Bite Cases Requiring Anterior Intrusion — if deep-bite correction is via *anterior intrusion only*, precision bite ramps are *not* needed.

High Angle (hyperdivergent) Cases — for example, a patient who has a long facial height and an excessive gingival display upon smiling is not a candidate for precision bite ramps. In those cases, we are looking to not open the vertical dimension or rotate the mandible in a clockwise direction — I don't recommend using precision bite ramps.

CASE STUDY NO. 1 — HALEY

Haley is a 14-year-old girl who presents with a Class 1 Malocclusion with a deep overbite and upper and lower crowding (images 5-11 through 5-13). The VERTICAL section of the ClinCheck list is significant for Haley's case:

VERTICAL

Incisal Display	Gingival Display	Gingival Margins	Smile Arc
Deep Overbite:	Ant Intrusion U L	Post Extrusion U L	
Open Bite:	Ant Extrusion U L	Post Intrusion U L	
Extrusion: Intrusion	Relative <u>Lower Incisors</u>	Absolute <u>Upper Incisors</u>	



IMAGE 5-11



IMAGE 5-12

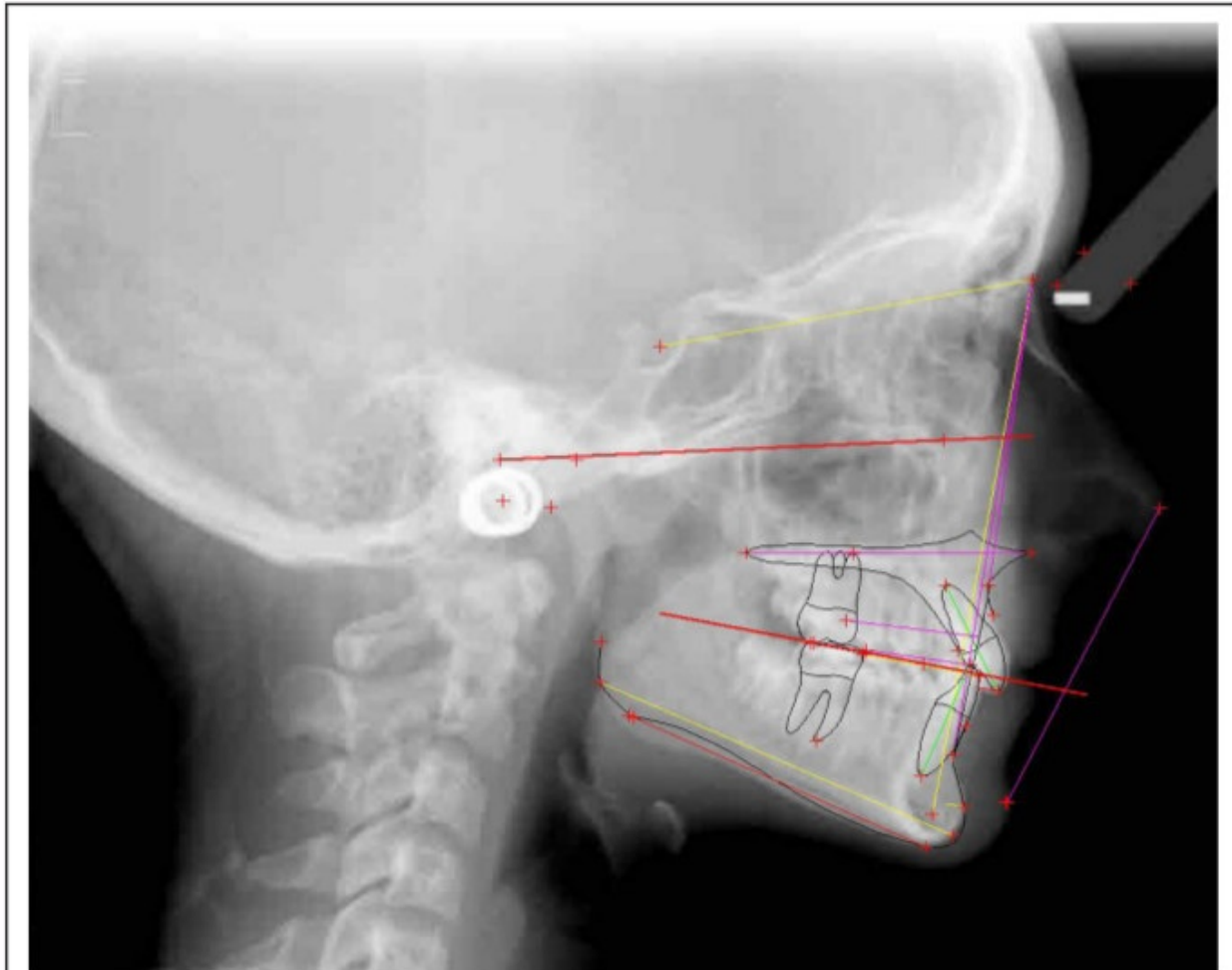


IMAGE 5-13

We need to devise a biomechanical system in our Invisalign treatment to correct her deep overbite.

TREATMENT PLAN

Step 1: Go to Vertical section of ClinCheck list

Step 2: Go to Incisal Display

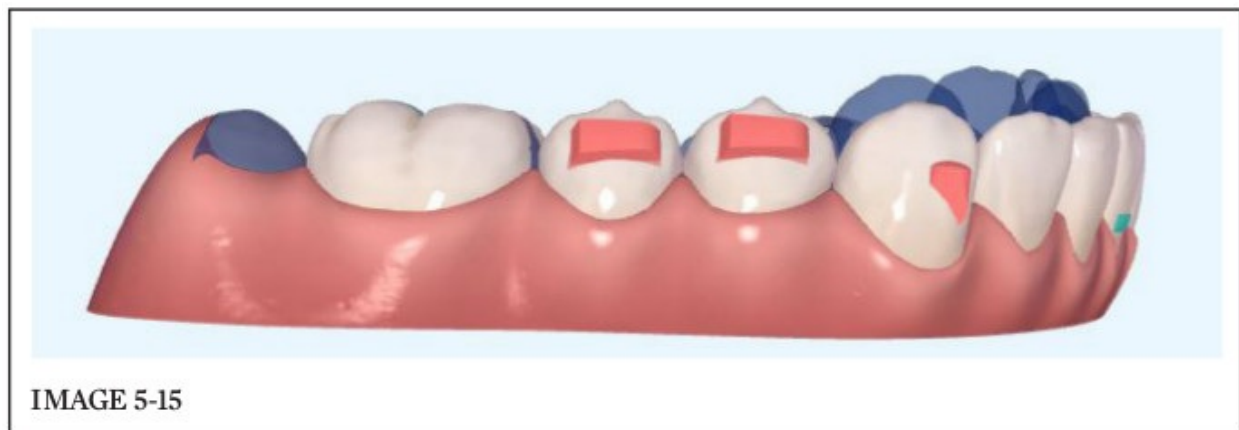
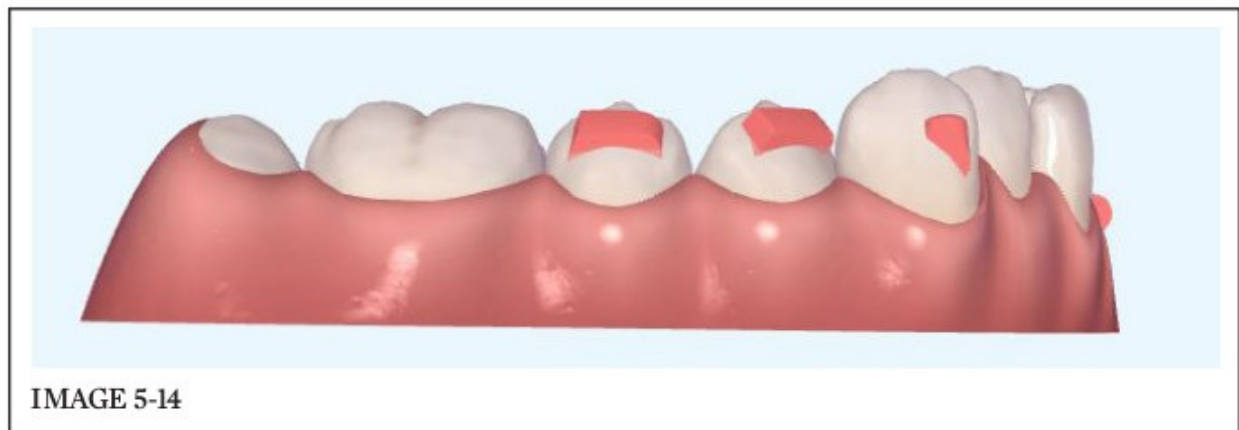
Step 3: *Gingival Display* is circled because Haley has excess gingival display upon smiling that speaks toward improving her *Smile Arc* via intrusion of the upper anterior teeth. If we can intrude her upper anterior teeth we will help to correct her deep overbite and it will also improve her smile esthetics.

Step 4: Leveling the deep Curve of Spee in the lower arch via lower incisor

intrusion will also contribute to correction of the deep over bite.

CLINCHECK TREATMENT PLAN

Haley has a deep COS, and the idea here is to level it (image 5-14). Since the lower incisors are retroclined, proclination will lead to predictable relative intrusion. Further examination of the ClinCheck superimposition reveals a combination of relative and absolute lower incisor intrusion, therefore 4mm-long, occlusally-beveled rectangular attachments are added to the lower 4's and 5's to support the lower incisor intrusion (image 5-15).



RESULTS

Look at her after images (image 5-16) and we've achieved leveling of the COS through appropriate attachment design and appropriate anchorage. The upper incisors were intruded to achieve a pleasing smile arc. In her initial and

final facial images (images 5-17, 5-18) notice the reduction in the amount of gingiva seen upon smiling and a pleasing smile arc. Her final panoramic X-ray (image 5-19) is normal and her superimposition (image 5-20) shows proclination of the lower incisors, which was desirable in this case both to alleviate the crowding as well as to achieve relative intrusion of the lower arch.





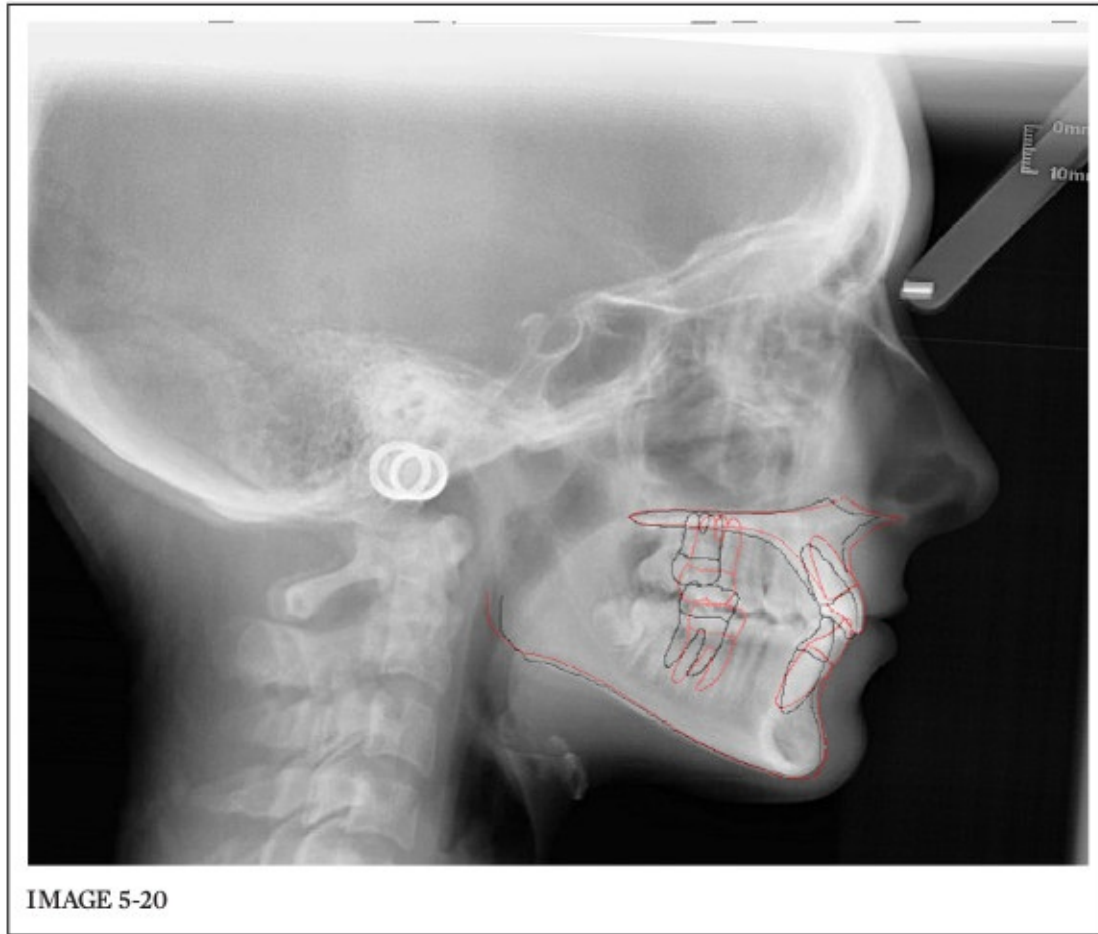
IMAGE 5-17



IMAGE 5-18



IMAGE 5-19



Summary: Halley's treatment took 24 months with one refinement.

CASE STUDY NO. 2 — ERIN

Erin presents as a 14-year-old female with Class I Malocclusion with moderate to severely deep overbite; moderate upper and lower crowding; the upper R3 is in cross-bite; she has a palatal supernumerary tooth; and she has a normal profile (images 5-21 through 5-23). In this case, we are going to discuss how we corrected both her deep overbite as well as how we corrected the cross-bite of the UR3.

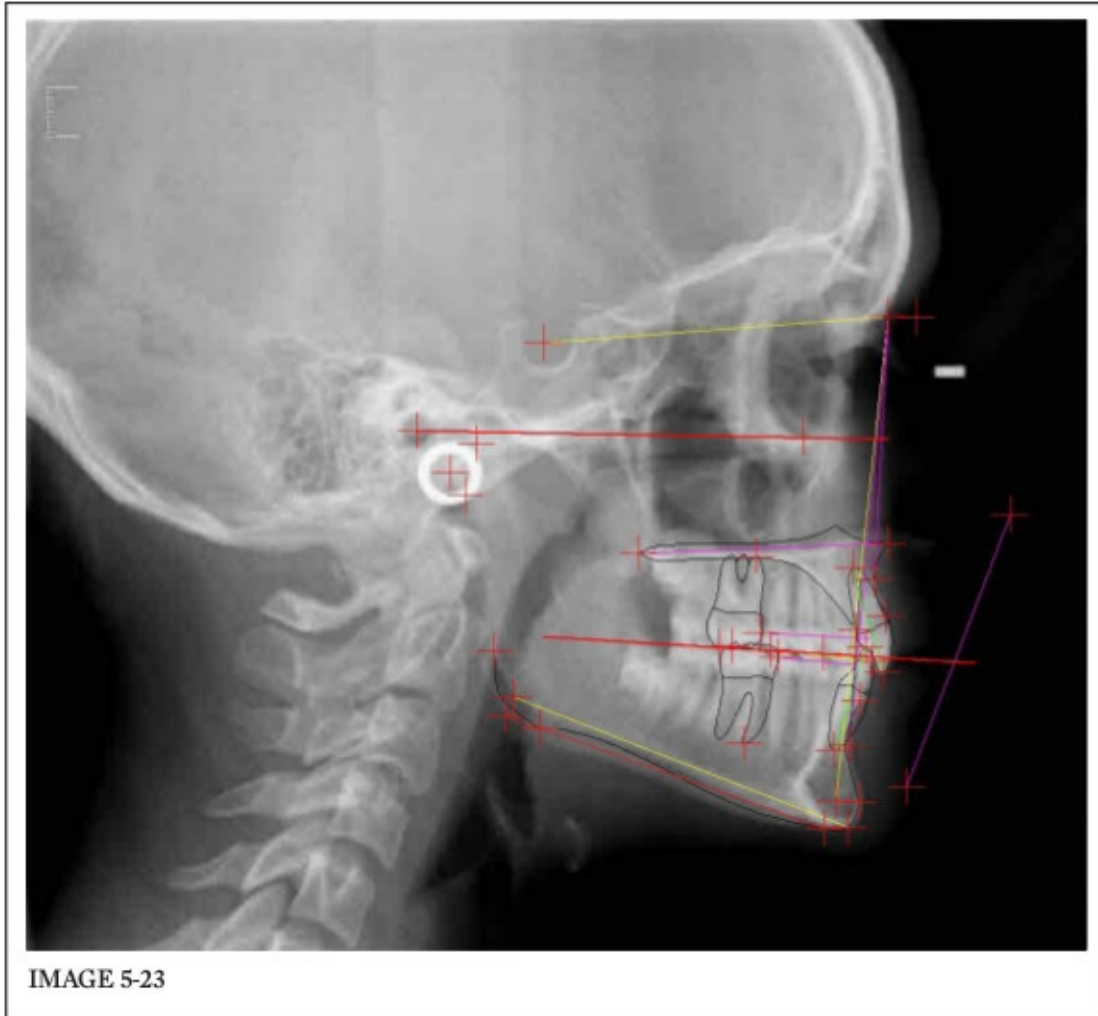
VERTICAL

Incisal Display	Gingival Display			Gingival Margins		Smile Arc	
<i>Deep Overbite:</i>	<u>Ant Intrusion</u>	<u>U</u>	<u>L</u>	Post Extrusion	U	L	
<i>Open Bite:</i>	Ant Extrusion	U	L	Post Intrusion	U	L	
Extrusion: Intrusion	Relative	_____			Absolute	<u>UR1 UL1</u>	



IMAGE 5-21





TREATMENT PLAN

Step 1: We want to resolve her deep overbite with a combination of intrusion of the upper and lower anterior teeth. The UR1 and UL1 require absolute intrusion.

Note: This is a case where I prescribed precision bite ramps. The reason was to give the patient a bite-plate effect to help ease the correction of the cross-bite of the UR3 by removing the forces of occlusion that would work against jumping of the cross-bite.

CLINCHECK TREATMENT PLAN

Note intrusion of the UL central incisors on the ClinCheck plan (image 5-24).

The precision bite ramps, which disclude the posterior teeth and help with the cross-bite correction (image 5-25). The labial tipping of the UR3 is a predictable movement.

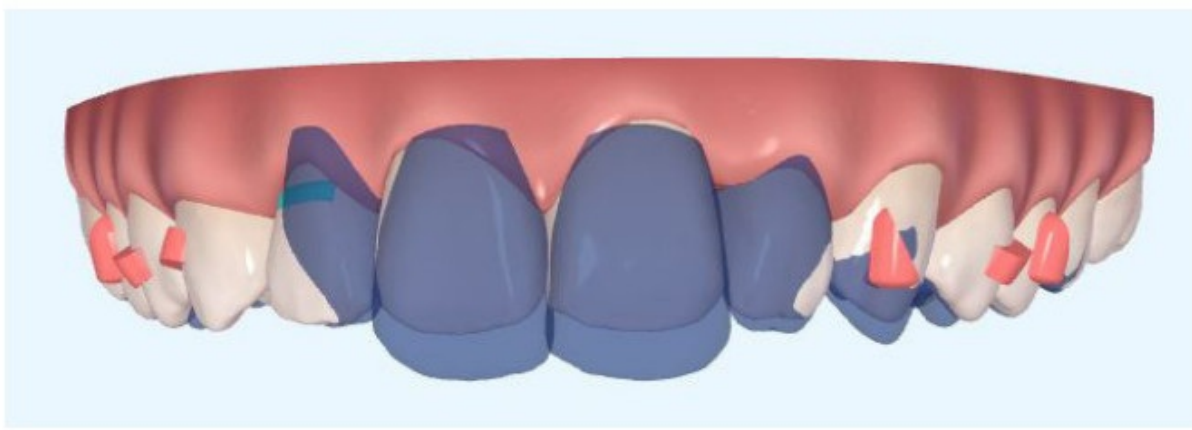


IMAGE 5-24

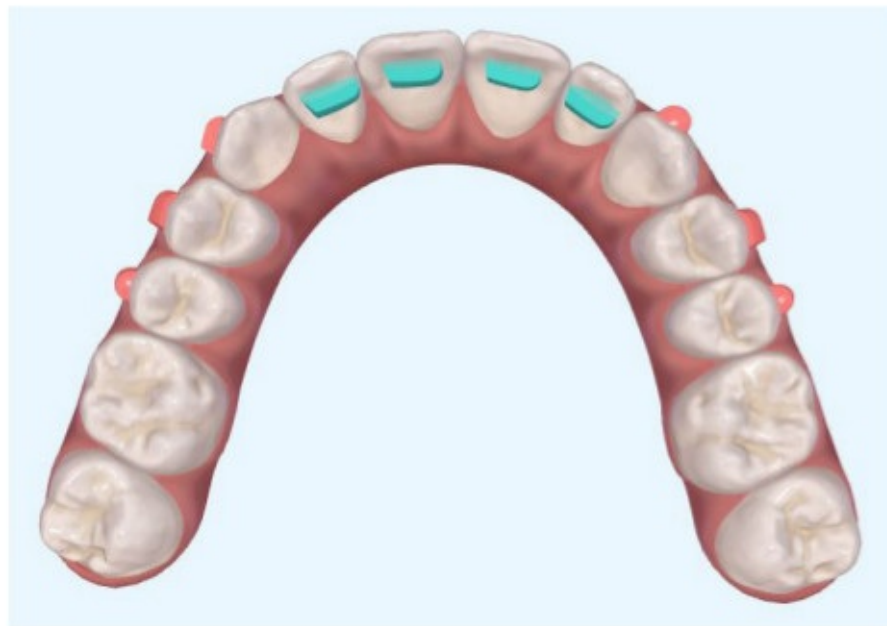


IMAGE 5-25

RESULTS

Erin's final results can be seen in images 5-26 and 5-27. The deep over bite was corrected and the cross-bite of the UR3 was successfully corrected.



IMAGE 5-26



Summary: Total treatment time was 16 months.

CASE STUDY NO. 3 — OSCAR

Oscar presents with a Class II Division 2 deep overbite malocclusion and a hypodivergent facial pattern (images 5-28 through 5-30).

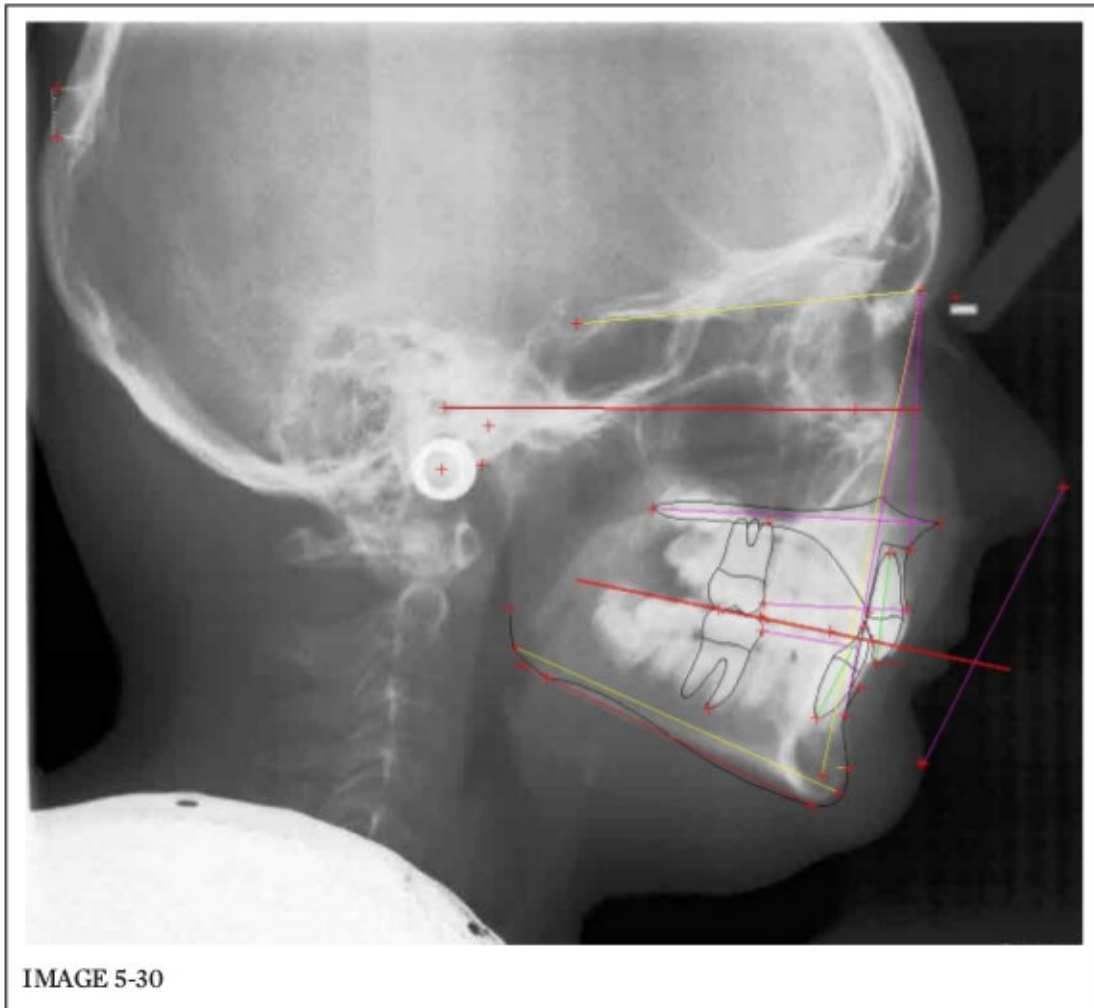
VERTICAL

<u>Incisal Display</u>	Gingival Display	Gingival Margins	Smile Arc
Deep Overbite:	Ant Intrusion U L	Post Extrusion U L	
Open Bite:	Ant Extrusion U L	Post Intrusion U L	
Extrusion/Intrusion:	Relative <u>Upper Incisors</u>	Absolute <u>Lower Incisors</u>	



IMAGE 5-28





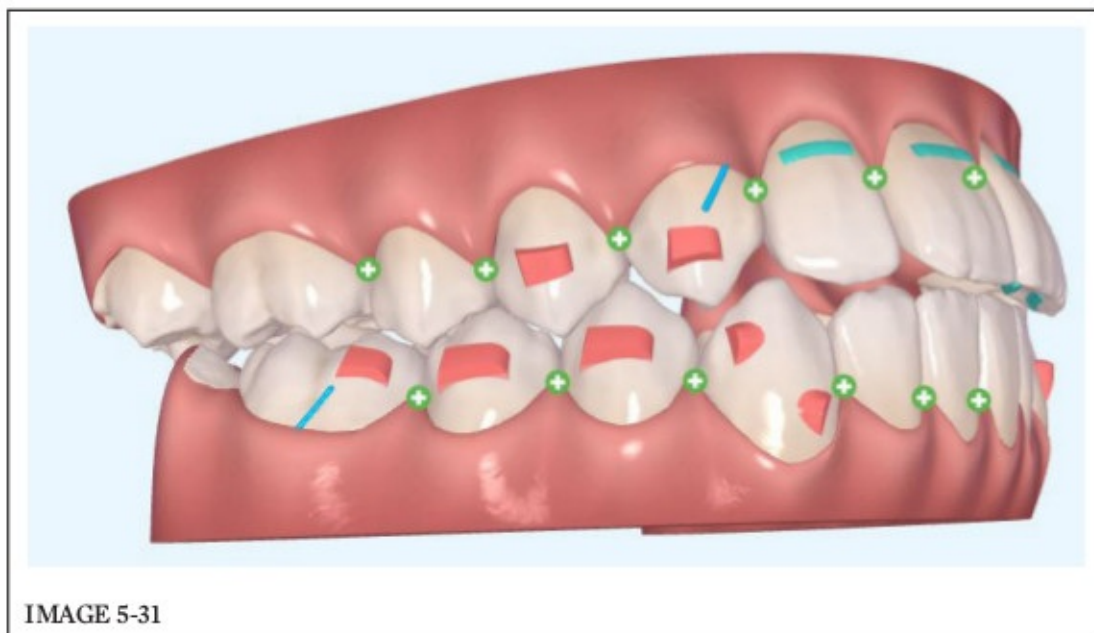
TREATMENT PLAN

The ClinCheck list reveals that the retroclined upper incisors require relative intrusion via proclination, while the lower incisors require absolute intrusion to help level the deep COS. In addition, posterior extrusion is desired to increase the vertical dimension in this hypodivergent facial pattern. Precision bite ramps are indicated in this case to eliminate posterior occlusal forces that can work against posterior eruption and deep bite correction in general.

CLINCHECK TREATMENT PLAN

The ClinCheck plan shows a typical over treatment of the deep over-bite via the moves outlined in Oscar's ClinCheck list (image 5-31). The instructions to

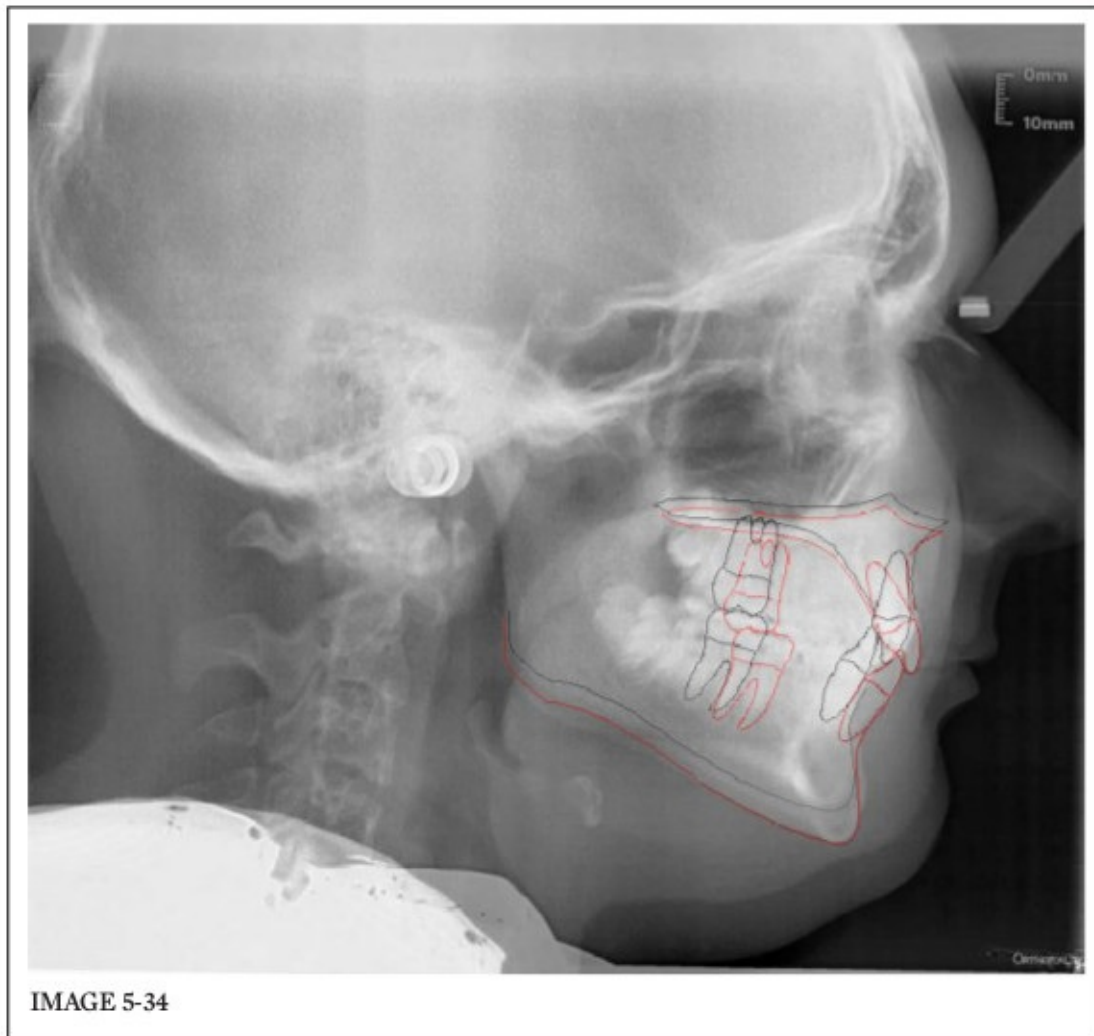
the technician to achieve this are, “Please set the final overbite at 0mm.” Why? Remember, the ClinCheck plan is a graphic representation of the forces being applied to the teeth by the aligners rather than a prediction of the final tooth positions. *Force systems, not teeth.* As if we were placing reverse curved arch wires, we want sufficient forces to open the bite. In addition, there is 30 degrees additional palatal root torque (PRT) U 2112 since the upper anterior teeth begin with severe lingual inclination. Please see chapter 10 for more details about over treatment.



RESULTS

The final result reveals excellent resolution of the deep overbite as well as the CL II malocclusion, achieved in 40 months of treatment using light CL II elastics (images 5-32 through 5-34). Please see chapter 6 for a detailed discussion of sagittal correction.





ANTERIOR OPEN BITE TREATMENT

Orthodontic treatment for anterior open-bite problems with Invisalign has inherent advantages. Compared with fixed appliances, the inter-occlusal plastic between the posterior teeth does an excellent job of controlling the vertical dimension, eliminating the possibility of inadvertent posterior extrusion. In addition, the ClinCheck treatment plan can be set up with selective posterior intrusion to allow for mandibular auto-rotation and subsequent bite closure. Combined with either relative and/or absolute anterior extrusion, depending on the requirements of the case, the orthodontist has a powerful tool at his or her disposal to manage anterior open-bite malocclusions.

As described by my friend and colleague Willy Dayan, D.D.S., Dip. Ortho, the key to successful anterior open-bite treatment is the development of “gentle, positive Curves of Spee in both arches” via selective intrusion of posterior teeth. The development of a “purposeful posterior open bite” in the ClinCheck treatment plan allows for mandibular auto-rotation and subsequent bite closure. Most frequently, the upper molars are intruded along with the “middle teeth,” the lower premolars and lower first molars, in the lower arch.

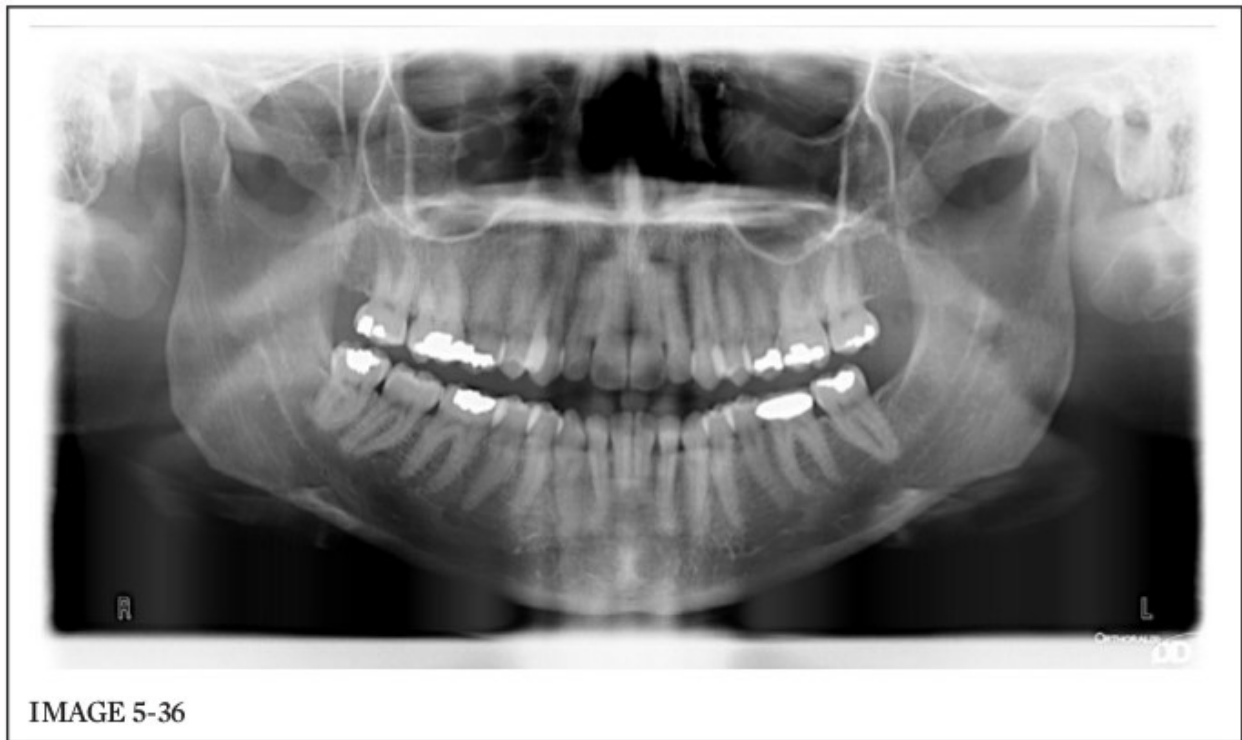
The teeth being intruded do not require attachments, since the occlusal tables provide sufficient push surface to gain intrusion. Horizontal rectangular attachments are placed on the teeth adjacent to the teeth being intruded to provide sufficient aligner “grip” to support the intrusion.

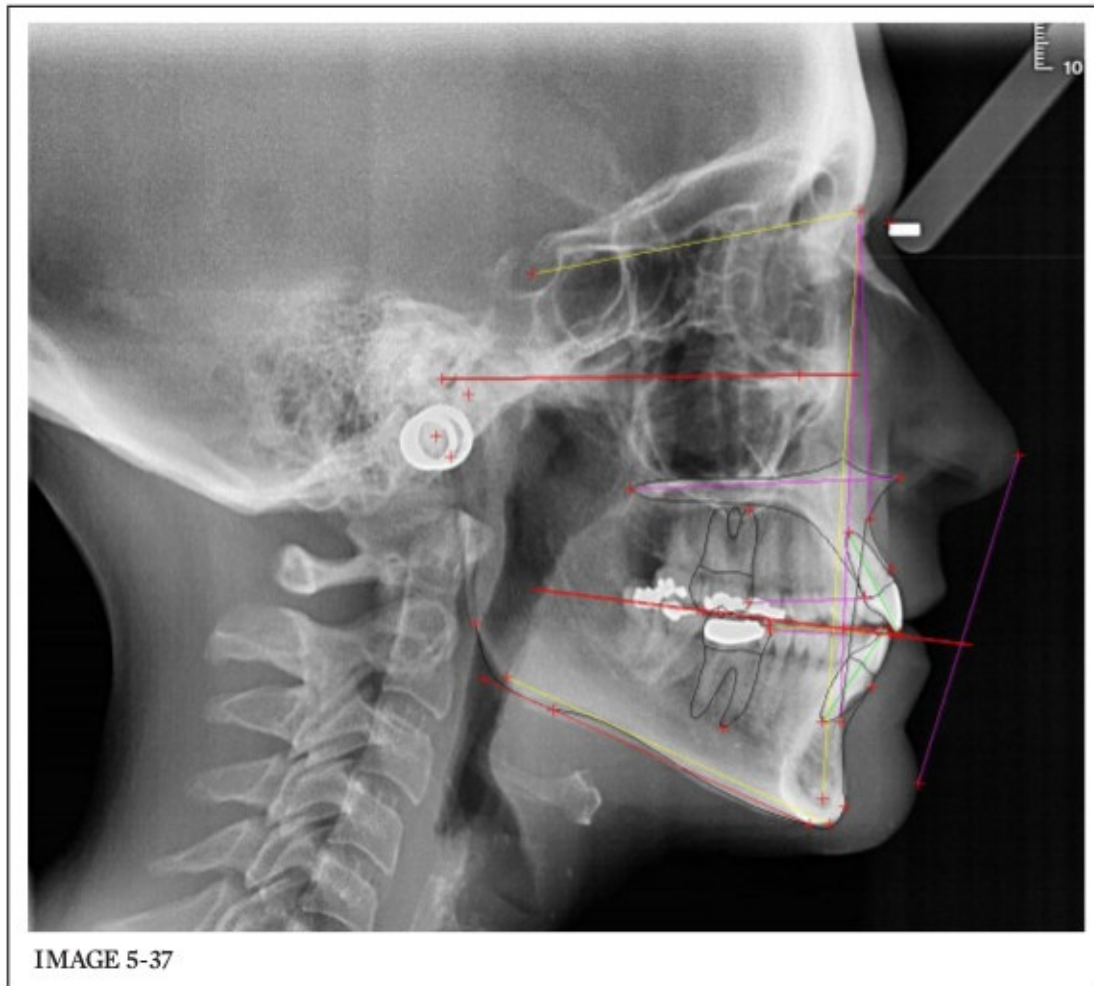
To illustrate these concepts, let’s examine an adult patient who presented with an anterior open bite.

CASE STUDY NO. 4 — MICHELLE

Michelle presents as a 41-year-old female patient with a Class I Malocclusion, mild upper and lower crowding, and an anterior open bite (image 5-35 through 5-37). Anterior open bites in particular are areas that aligners handle beautifully. Her ClinCheck list is as follows:

<u>VERTICAL</u>					
Incisal Display	Gingival Display		Gingival Margins		Smile Arc
Deep Overbite:	Ant Intrusion	U L	Post Extrusion	U L	
<u>Open Bite:</u>	<u>Ant Extrusion</u>	<u>U L</u>	<u>Post Intrusion</u>	<u>U L</u>	
Extrusion/Intrusion:	Relative _____		Absolute _____		✓





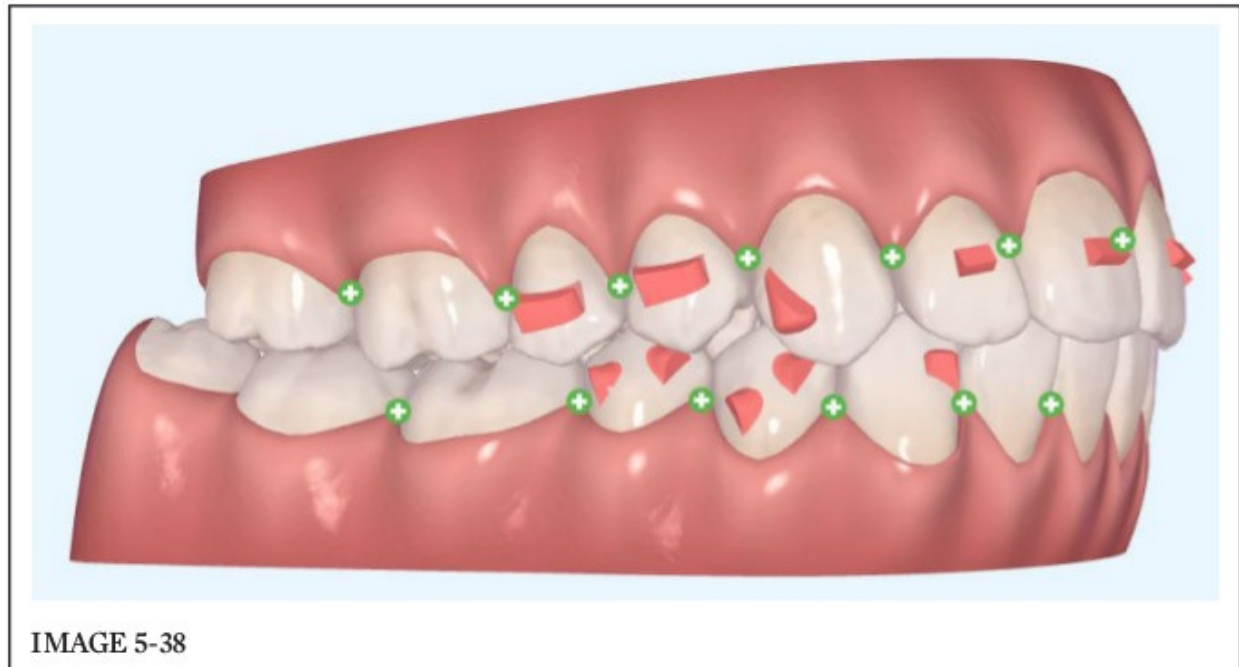
TREATMENT PLAN

We can take advantage of Invisalign's ability to intrude posterior teeth to achieve closure of the anterior open bite. In this case, the treatment plan was to intrude the upper molars along with the lower premolars and first molar to create gentle Curves of Spee in both arches. In addition, upper and lower anterior extrusion will be programmed into the ClinCheck as well.

CLINCHECK TREATMENT PLAN NO. 1

The first ClinCheck treatment plan that came back from my technician (image 5-38) shows what at first appears to be an ideal result. However, acceptance of this ClinCheck plan would most likely lead to insufficient bite

closure. This is another illustration of the concept that the final ClinCheck plan is not a prediction of the final occlusion. Instead, it is a graphic representation of the forces being applied to the teeth by the aligners. *Force systems, not teeth.* Therefore, the ClinCheck plan was modified as follows.

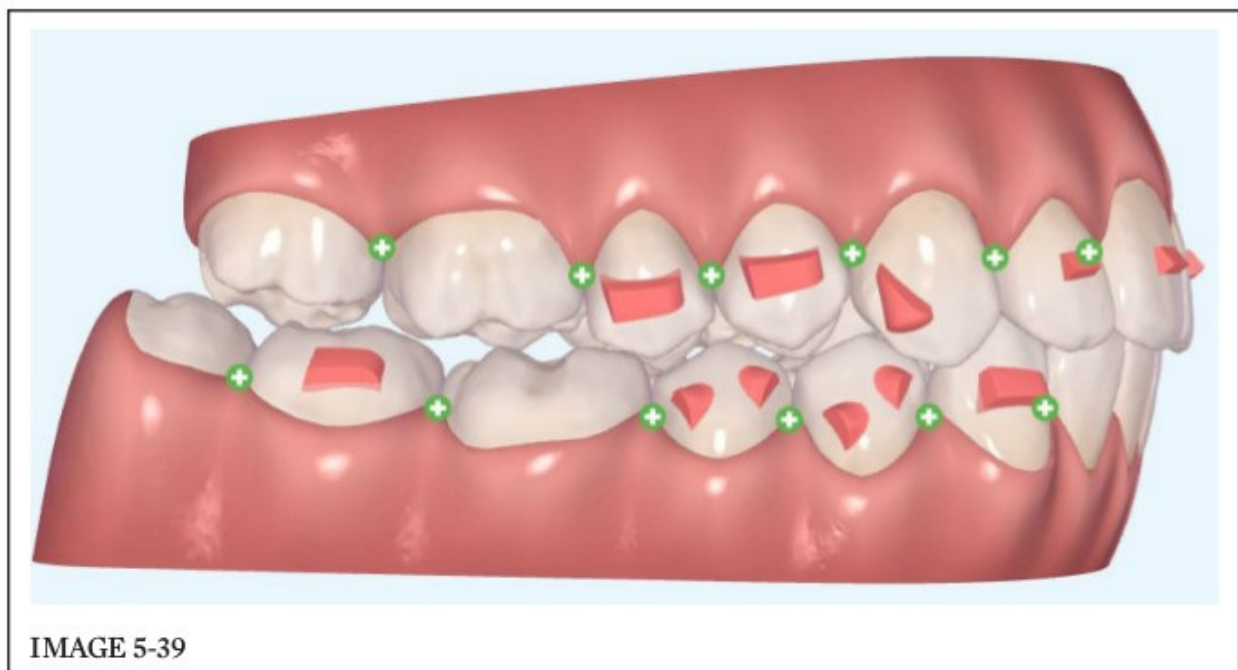


MODIFIED CLINCHECK TREATMENT PLAN#2 ***(image 5-39)***

One of the areas where I routinely over-engineer aligners is in the case of absolute intrusion. I do not expect the aligners to fully express in a movement as challenging as intrusion, so in a case like Michelle's the ClinCheck plan is modified a second time. I ask for an *additional* 2mm of intrusion on the upper 6's and 7's, as well as the lower 4's, 5's and 6's to the extent that at the final stage the patient displays a 2mm posterior open-bite on these teeth.

I have placed 4mm-long, conventional, occlusally-beveled rectangular attachments on the upper first pre-molar and the upper-second molar. Similar supportive attachments are placed on the lower second molars and lower canines. These attachments provide anchorage to support intrusion of the upper first and second molars. Let's revisit Newton's Third Law: in the upper arch, the

“action” force is intrusion of the UR6 and UR7 and the “reaction” force will tend to make the aligner dislodge in the premolar region. Anchorage attachments on the upper premolars prevent the dislodgment of the aligner, and support the absolute intrusion of the upper molars. Similarly in the lower arch, supportive attachments are placed on the lower 7’s and lower 3’s to support the intrusion of the lower 4’s, 5’s and 6’s. This setup, where there are supportive attachments on the teeth adjacent to those being intruded, is a common one for absolute intrusion.



Note: I do not expect the aligners to fully express, but I want to over-engineer the ClinCheck plan. Michelle’s ClinCheck plan is not an image of her final occlusion. It is a graphic representation of the force systems required to close the open bite. *Force systems, not teeth.* I want enough force of intrusion to get the bite closed. With this last modification, the ClinCheck treatment plan is ready to be accepted.

RESULTS

Michelle’s treatment took only eight months and her arches are well-aligned. Image 5-40 depicts successful closure of the open-bite, and in fact, illustrates the

patient did not finish with a posterior open-bite. This example shows that over-engineering gave us the appropriate movement without excessive movement. Michelle finishes with both an esthetic and functional result.



SUMMARY

Correction of problems in the vertical dimension with Invisalign treatment, whether deep bite or open bite, require the same basic concepts. Establishment of proper aligner anchorage in your ClinCheck setups to support either anterior or posterior intrusion along with over treatment of intrusion and extrusion will help you achieve predictably excellent results. For more specifics on over treatment, please turn to chapter 10, where we look at the scenarios where over treatment can be beneficial.

CHAPTER 6

Sagittal Dimension

This chapter deals with correcting problems in the Sagittal Dimension. When managing problems in this dimension we are handling Class II or Class III Malocclusions. I am going to take each of these clinical problems separately and guide you through them.

CLASS II MALOCCLUSIONS

The ClinCheck list indicates four potential non-surgical ways to correct Class II Malocclusions:

SAGITTAL

CL II:	Distalization	CL II Elastic Jump	Extraction	IPR
CL III:	CL III Elastic Jump	IPR	Premolar Ext	L Incisor Ext

- **Distalization** of the upper posterior teeth.
- **Class II Elastic Jump** — we can prescribe Class II elastic jumps in our ClinCheck plan to simulate the effects of our elastics on a growing teen patient.
- **Extraction** of teeth, typically upper first premolars, to correct Class II Malocclusion.
- **IPR** — this would be IPR performed in the upper buccal segments to create space for canine retraction into Class I coupling of the incisors when the patient presents with overjet.

These four areas are the non-surgical choices doctors have at their disposal. The next objective is to decide which of these to use to treat a patient's condition. Here are some resources that doctors might find helpful:

“Correction of Class II Malocclusion with Class II Elastics: A Systematic

Review by Janson et.al, March 2013, *American Journal of Orthodontics and Dental Facial Orthopedics* (AJODO.) — the authors started by examining over 400 papers devoted to the topic of correction of Class II Malocclusions. Out of those 400 articles they selected 11 papers that fit their criteria. Four of the papers looked at the effects of Class II elastics alone in correcting malocclusion. The other seven papers compared the effects between Class II elastics and another method to correct Class II Malocclusion — for example, fixed-functional appliances.

Now to examine the four papers on “elastics alone”:

- Nelson Associates, 1999
- Meistrell Associates, 1986
- Tovstein, 1955
- Combrink Associates, 2006

The authors concluded: *Class II elastics are effective in correcting Class II Malocclusion through a combination of dento-alveolar and skeletal effects.* The effects of Class II elastics in patients are:

Restraint of maxillary growth — the studies showed that in patients treated with Class II elastics the maxillary first molar tended to maintain its antero-posterior position at the same time that the SNA angle was reduced. In a sense, Class II elastics achieve a headgear effect.

Small amount of additional mandibular growth — the authors also found that when compared to untreated patients one could expect 1.2mm additional mandibular growth. **Dentoalveolar effects** — as far as the dental effects were concerned the studies found an average of 5.8mm overjet reduction. In summary, the authors concluded that Class II elastics work through *63 percent dental change in position of the teeth, and 37 percent were attributed to skeletal changes* (e.g., headgear effect and a small additional contribution to mandibular growth).

Note: Because 37 percent of the sagittal correction can be attributed to skeletal change, I do not recommend using Class II elastic-jumps in non-growing adult patients. I don't expect skeletal change, and that is why I feel it's much less

predictable in adults using Class II elastics than a growing teen patient.

The authors didn't find any significant deleterious side effects with the use of CL II elastics. When they looked at vertical changes in both the maxilla and the mandible were within normal ranges. No significant change in occlusal or mandibular plane was observed.

Summary: My interpretation of this paper is that Class II elastics are safe and effective in correction of Class II malocclusion in growing teen patients.

CLASS II ELASTICS VS. FIXED-FUNCTIONAL APPLIANCES

The other seven articles compared the effects of CL II elastics to fixed-functional appliances. The seven articles are:

Serbesis-Tsarudis and Pacherz, 2008

Jones et al, 2008

Nelson et al, 2007

Uzel et al, 2007

Nelson et al, 2000

Ellen et al, 1998

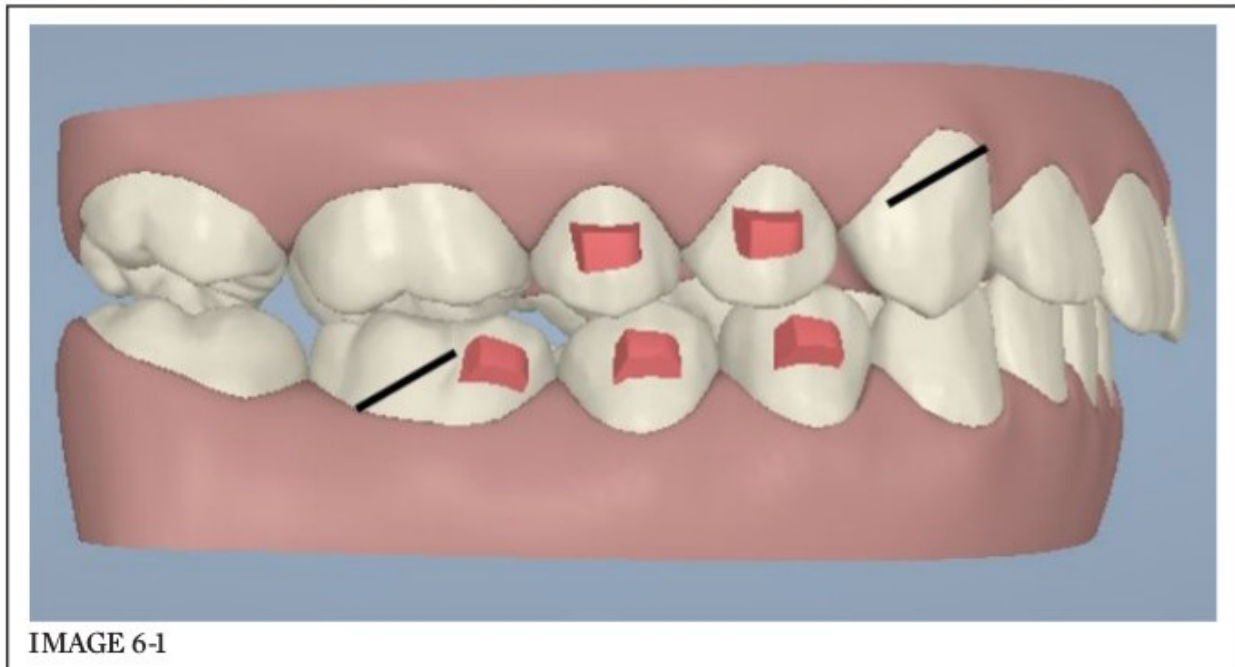
Gianelly et al, 1984

Here is a summary of what those seven articles collectively described: *Class II elastics are similar to the effects of fixed-functional appliances in the long term, placing two methods close to each other when evaluating treatment effectiveness.* In other words, both functional appliances and Class II elastics are safe and effective at correcting Class II malocclusion.

Class II Elastics Protocol Specifics:

Based on this research, I use the following elastic protocol for routine correction of Class II malocclusion for growing teen patients (image 6-1). Notice precision cut elastic hooks on the upper 3's and the lower 6's (for attaching Class II elastics) in addition to a 3mm-long, occlusally-beveled, rectangular attachment placed on the lower 6's act as retention to prevent the aligner from dislodging from the vertical component of force from the Class II

elastics.



Note: If you prefer a button bonded to the lower molars, prescribe a cutout on the lower 6's instead of an elastic hook.

Step 1: Place attachments at the first visit.

Note: If you choose not to place the attachments at the first visit, don't start Class II elastics until you've placed the attachments. The aligners are not retentive enough to withstand the pull of the Class II elastics without attachments.

Step 2: Start with light elastics (1/2" 2 oz.)

Step 3: I'll increase up to heavy (1/2" 4 oz.) — if necessary. I'll do this in cases where the Class II discrepancy is greater than 3mm or if the teeth or the malocclusion doesn't seem to be progressing toward Class I within a reasonable amount of time, which would be four to six months.

On the Invisalign prescription form, see no. 4 on your prescription: **Anterior-Poster (A-P) Relationship.**

See **Correction to Class I.** Click on the two radial buttons directly across on that row — click radial buttons R and L.

Next, click on radial button: Tooth Movement Options. Click on square

button: **Class II/III Correction Simulation (Elastics Required)**.

See “**Precision Cuts — may compromise aligner strength and durability**” and below it reads Yes or No, click on Yes (image 6-2).

4. Anterior-Posterior (A-P) Relationship

	R	L
Maintain	☐	☐
Improve canine relationship only	☐	☐
Improve canine & molar relationship up to 4 mm (specify details in Special Instructions)	☐	☐
Correction to Class I (canine & molar)	☒	☒

☒ **Tooth movement options** (if selecting more than one option, indicate amount and sequence in Special Instructions)

- ☐ Posterior IPR
- ☒ **Class II/III Correction Simulation (Elastics required)**
 - Precision Cuts - may compromise aligner strength and durability
 - ☒ **Yes** [\(Specify in Precision Cuts Interface\)](#)
 - ☐ No
 - ☐ Distalization (Elastics required)
 - Precision Cuts - may compromise aligner strength and durability
 - ☐ Yes [\(Specify in Precision Cuts Interface\)](#)
 - ☐ No
- ☐ Orthognathic surgical simulation

Specify extractions for A-P correction in the extractions grid under the Spacing & Crowding section.

IMAGE 6-2

CASE STUDY NO. 1 — ABBY

Abby presented as a 16-year-old female with a Class II, Division I Malocclusion in the permanent dentition. She has a normal overbite and a large overjet, mild upper and lower crowding, a V-shaped maxillary arch, and a normal profile (images 6-3 through 6-5). Her case will be an example of a case where we prescribe a Class II elastic-jump. Her skeletal pattern is normal. Her cephalometric radiograph reveals protrusive maxillary anterior teeth and a normal skeletal pattern. Her panoramic radiograph is normal. The SAGITTAL section of the ClinCheck list for Abby looks like this:

SAGITTAL

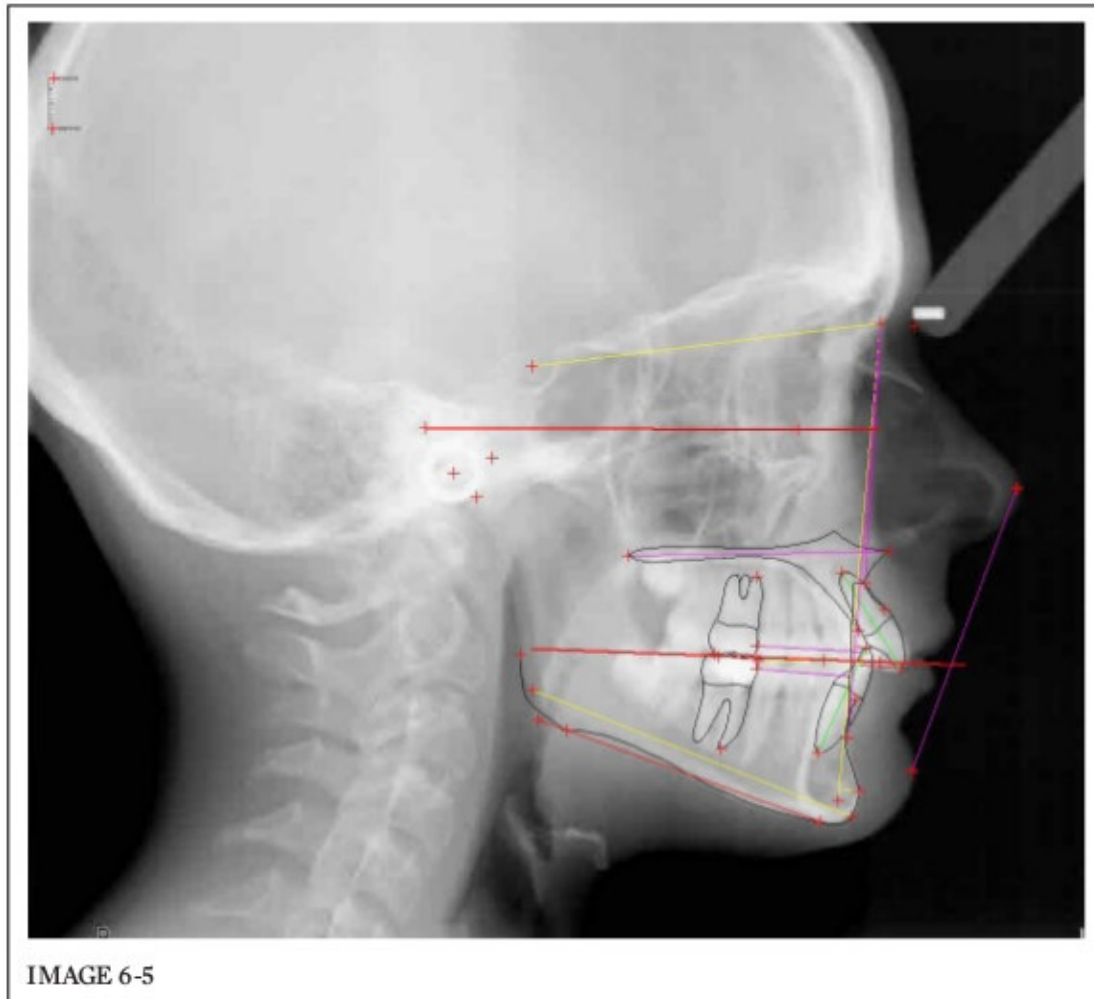
CL II:	Distalization	CL II Elastic Jump	Extraction	IPR
CL III:	CL III Elastic Jump	IPR	Premolar Ext	L Incisor Ext



IMAGE 6-3



IMAGE 6-4



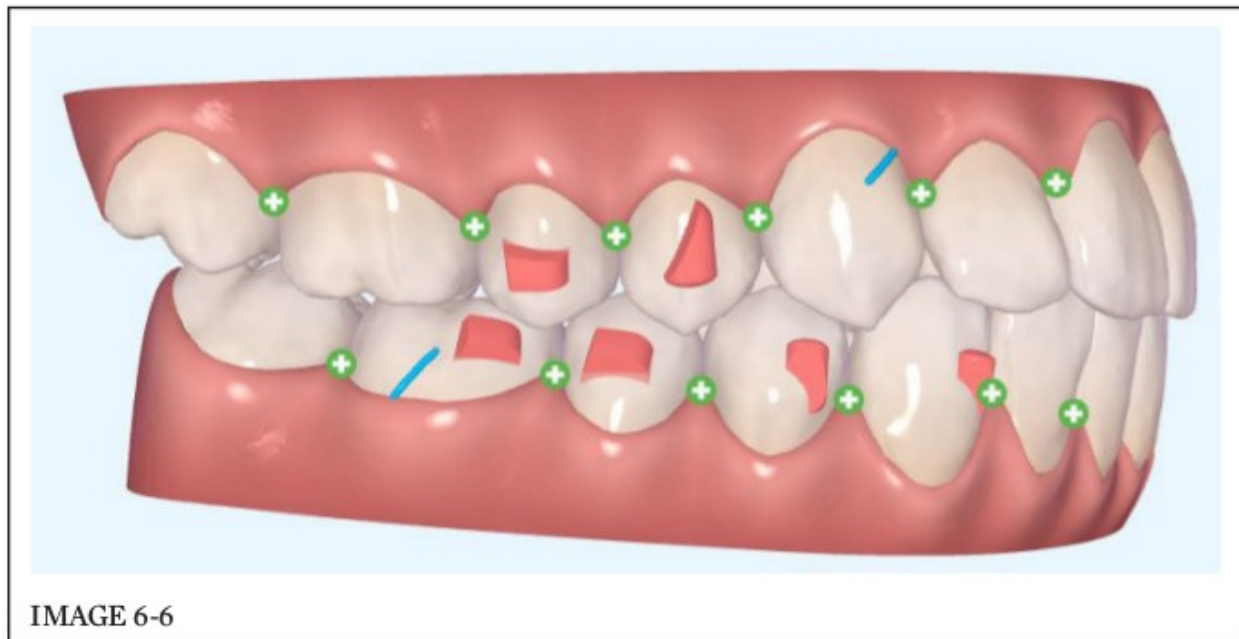
TREATMENT PLAN

A Class II elastic-jump was prescribed to address the sagittal discrepancy. A CL II elastic-jump is a ClinCheck simulation that occurs at the last stage to simulate the correction of the malocclusion Class I in order to determine if the final occlusion is acceptable. Four oz. elastics were selected in this case due to the large amount of sagittal correction required to achieve CL I.

CLINCHECK TREATMENT PLAN

As you can see in Abby's ClinCheck plan, there are precision-cut hooks on the U3's and L6's, along with retentive 3mm-long, occlusally-beveled, rectangular attachment on the lower 6's. Also note the CL II elastic jump (image

6-6).



Here are pictures (image 6-7) of Abby in treatment wearing her aligners and using 4oz. 1/2" elastics. As is typical for my Invisalign Teen patients, her hygiene is excellent, her tracking looks good, and she is progressing normally.



Note: Abby was going into her senior year of high school and she was a dancer and performer. She told her parents that if she couldn't be treated with Invisalign clear aligners she would rather keep her overbite and malocclusion the way it was previous to treatment. Therefore, for Abby's case Invisalign treatment was the only option. When she came to my office, I told her parents she would be an excellent Invisalign candidate provided that she was compliant. She had to wear her aligners and elastics the required 22 hours per day — and I

was confident we could get her case corrected. Most teens are compliant because they are motivated. If you treat enough teens with Invisalign you start to realize that in the teenage population, it is just as much about psychology as it is biology. If they are motivated, as in Abby's case where she didn't want to go into senior pictures or the prom wearing braces, this motivation keeps her wearing her aligners and elastics and makes her a terrific patient.

Progress

One year into treatment you can appreciate Abby's progress (image 6-8) with her Class II Malocclusion. She's not quite Class I yet, but she is progressing well. Continuing on through 16 months of treatment the progress (image 6-9), you can see her sagittal correction continues to improve.



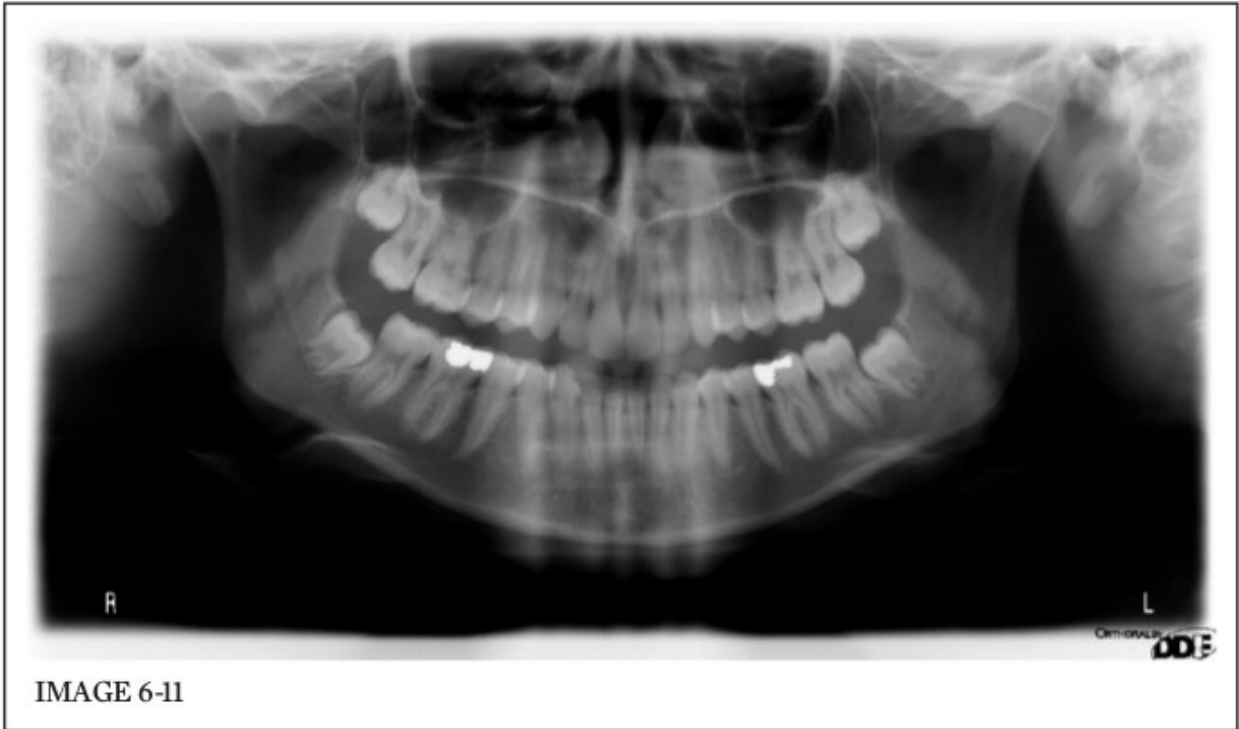


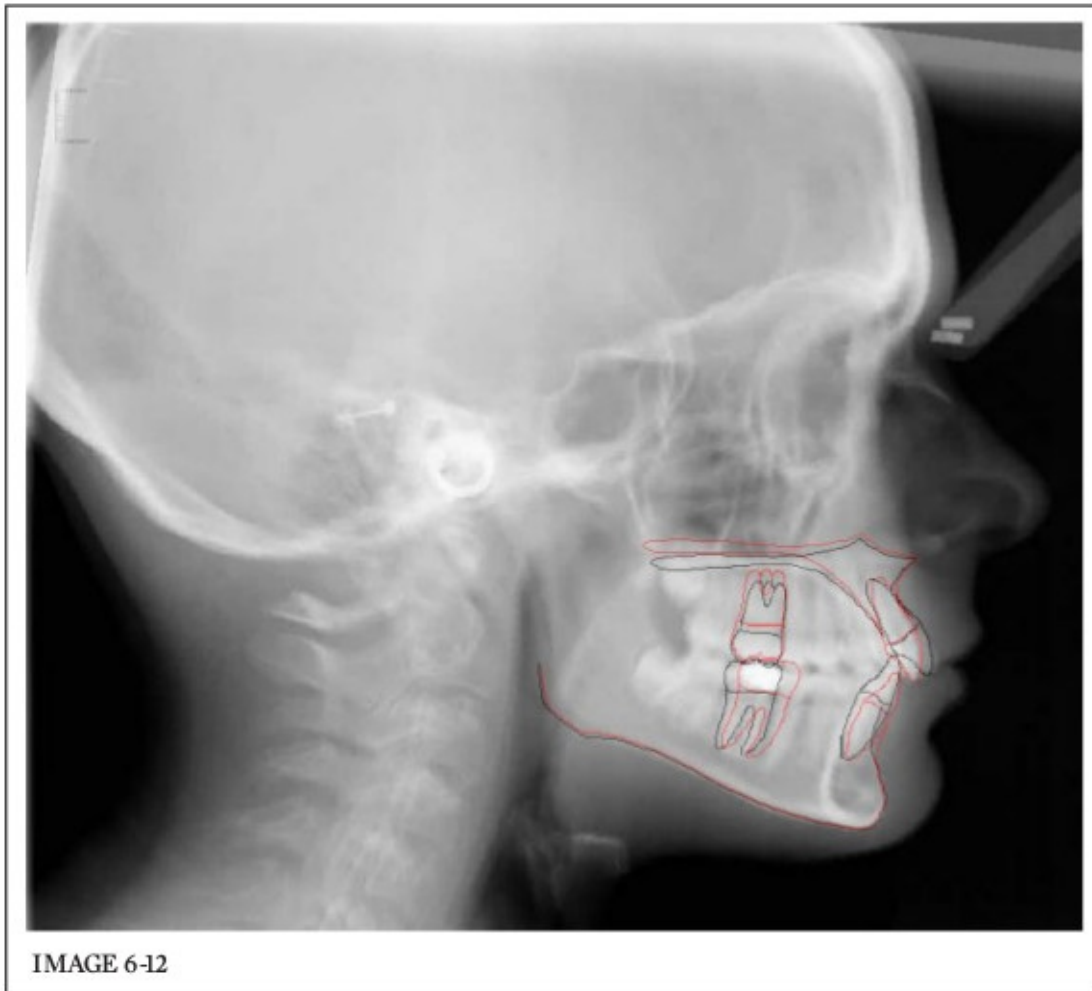
RESULTS

At the end of treatment (images 6-10 through 6-12) her malocclusion has been corrected from Class II to Class I. She has excellent arch alignment and normal overbite and over-jet with excellent esthetics. Her final panoramic radiograph is normal. Comparing her initial cephalometric radiograph to her final you can see significant change to the position of the upper incisors, and significant retraction and resolution of her overjet. She has excellent smile esthetics.



IMAGE 6-10





Summary: Total treatment time is 22 months, 25 aligners, 20 refinement aligners, and 4 oz. Class II elastics.

CASE STUDY NO. 2 — EMMA

Emma (images 6-13 through 6-15) presented as a 12-year-old female in the late mixed dentition. She has a Class II, Division I Malocclusion; she has a deep overbite; upper and lower crowding and severe lingual inclination of the upper and lower anterior teeth. If you look at image 6-13, you can appreciate the significant amount of lower incisor crowding. Her right and left lower incisors are blocked out to the lingual. We can also observe her deep overbite as well as the lingual inclination of the upper and lower anterior teeth. Her panoramic radiograph is within normal limits and her cephalometric radiograph reveals a

mild hypodi- vergent skeletal pattern and upright upper and lower incisors.

SAGITTAL

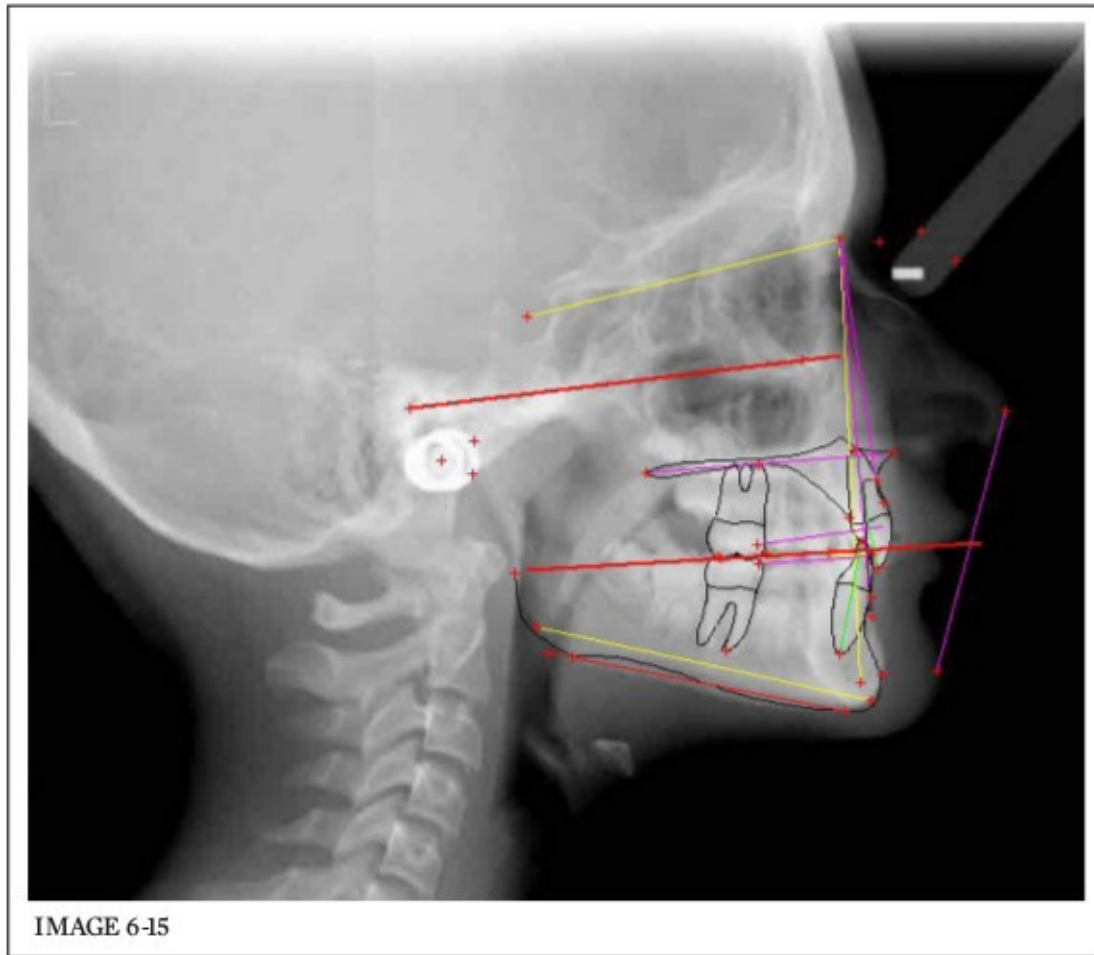
CL II:	Distalization	CL II Elastic Jump	Extraction	IPR
CL III:	CL III Elastic Jump	IPR	Premolar Ext	L Incisor Ext



IMAGE 6-13



IMAGE 6-14



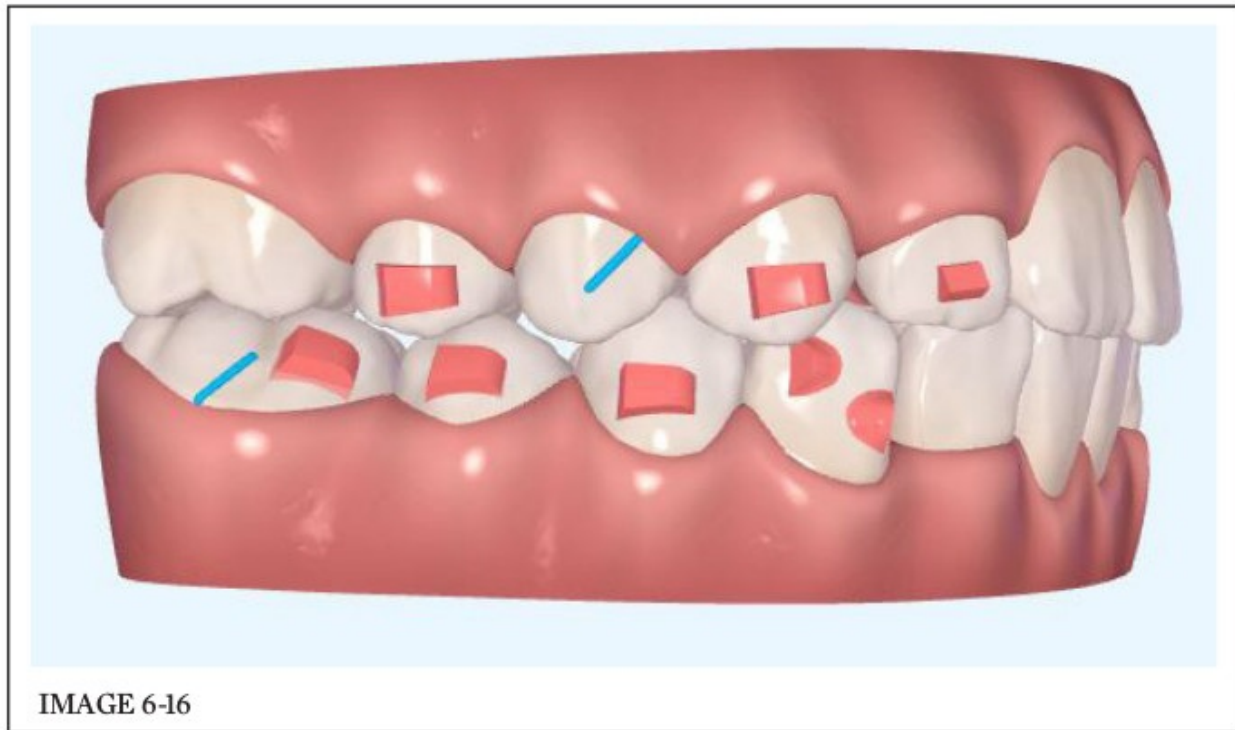
TREATMENT PLAN

Emma is a growing teen, and her Class II, Division I malocclusion will be corrected with CLII elastics. Her crowding will be resolved through a combination of posterior expansion and anterior proclination. The deep overbite correction was achieved via predictable relative intrusion.

CLINCHECK TREATMENT PLAN

The ClinCheck setup features precision-cut elastic hooks on her lower 6's, and 3mm wide rectangular occlusally beveled attachments on the lower 6's for retention (image 6-16). The deep overbite was managed with predictable relative anterior intrusion achieved with proclination of the upper and lower anterior teeth. The crowding was resolved through a combination of anterior proclination

and posterior expansion.



Note: One variation compared to Abby's case, Emma has her precision-cut elastic hooks running off her upper 4's because her upper 3's were insufficiently erupted to place a precision cut. It would have weakened the aligner so we placed them on the 4's. We simply run our Class II elastics from upper 4 to lower 6 instead of upper 3 to lower 6 — it works just the same. The crowding was resolved through a combination of proclination and posterior expansion, and the deep bite was corrected via relative extrusion gained during upper and lower proclination. Please refer to chapter 3 for more information on the options for resolution of crowding, and chapter 5 for the details of vertical dimension correction.

RESULTS

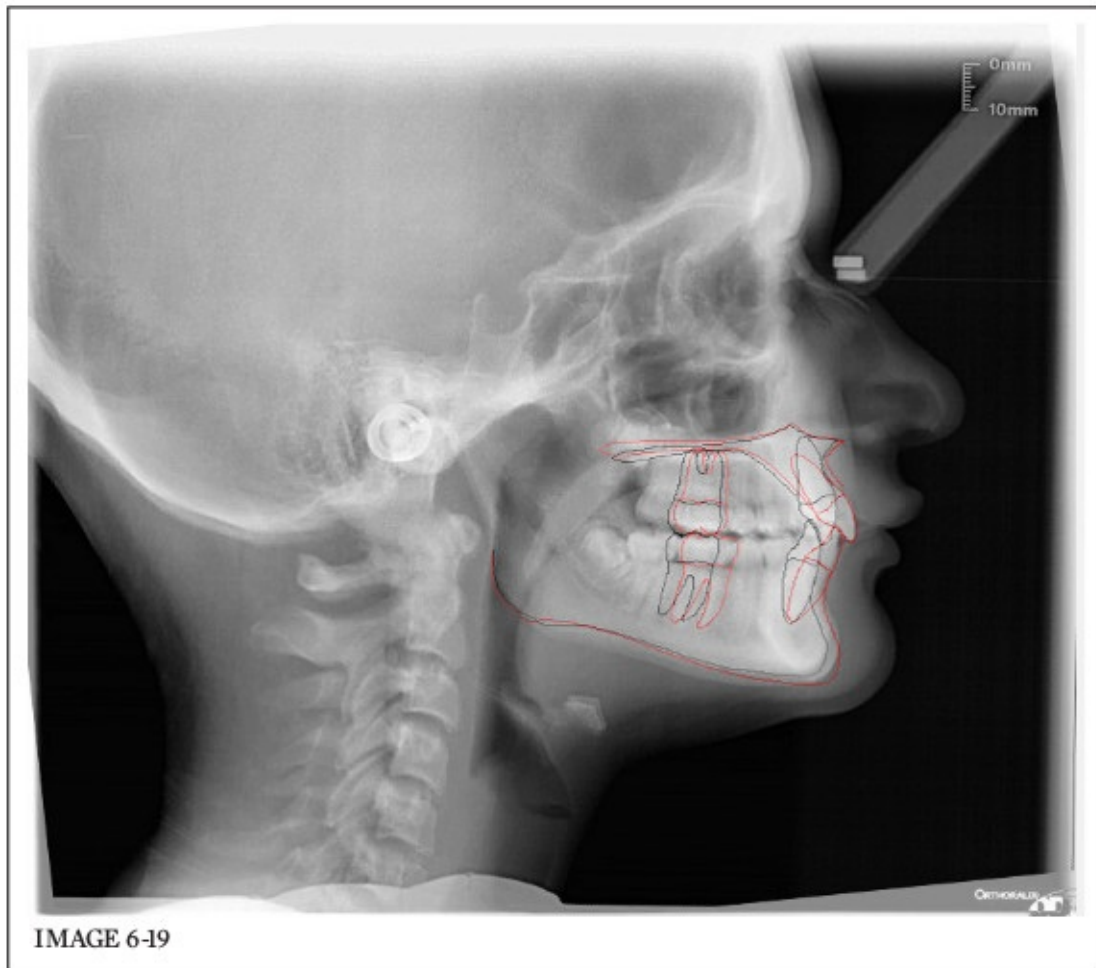
At the end of treatment, she has well-aligned arches and her malocclusion has been corrected to Class I (images 6-17 through 6-19). The final panoramic radiograph is within normal limits and her cephalometric superimposition shows the planned proclination of the upper and lower incisors.



IMAGE 6-17



IMAGE 6-18



Note: As was pointed out in the Janson et.al. systematic review referenced earlier in this chapter, the maxillary first molar tends to stay relatively the same antero-posteriorly as does A point. The superimposition shows the “headgear effect” which may be achieved with Class II elastics. You can also see there was growth of the mandible showing forward positioning of pogonion and reduction of facial convexity.

Summary: Treatment time was 28 months, with two refinements and the use of 2 oz. CL II elastics.

CASE STUDY NO. 3 — AVA

Ava presented as a 12-year-old female in the early permanent dentition with a Class II, Division I Malocclusion, deep overbite, upper spacing and lower

crowding. Her panoramic X-ray is in normal limits. Her cephalometric radiograph shows a Class II skeletal pattern with a moderate amount of mandibular retrognathism and a hyper-divergent facial growth pattern (images 6-20 through 6-22). Note the excessive gingival display on smiling. Ava's ClinCheck list is as follows:

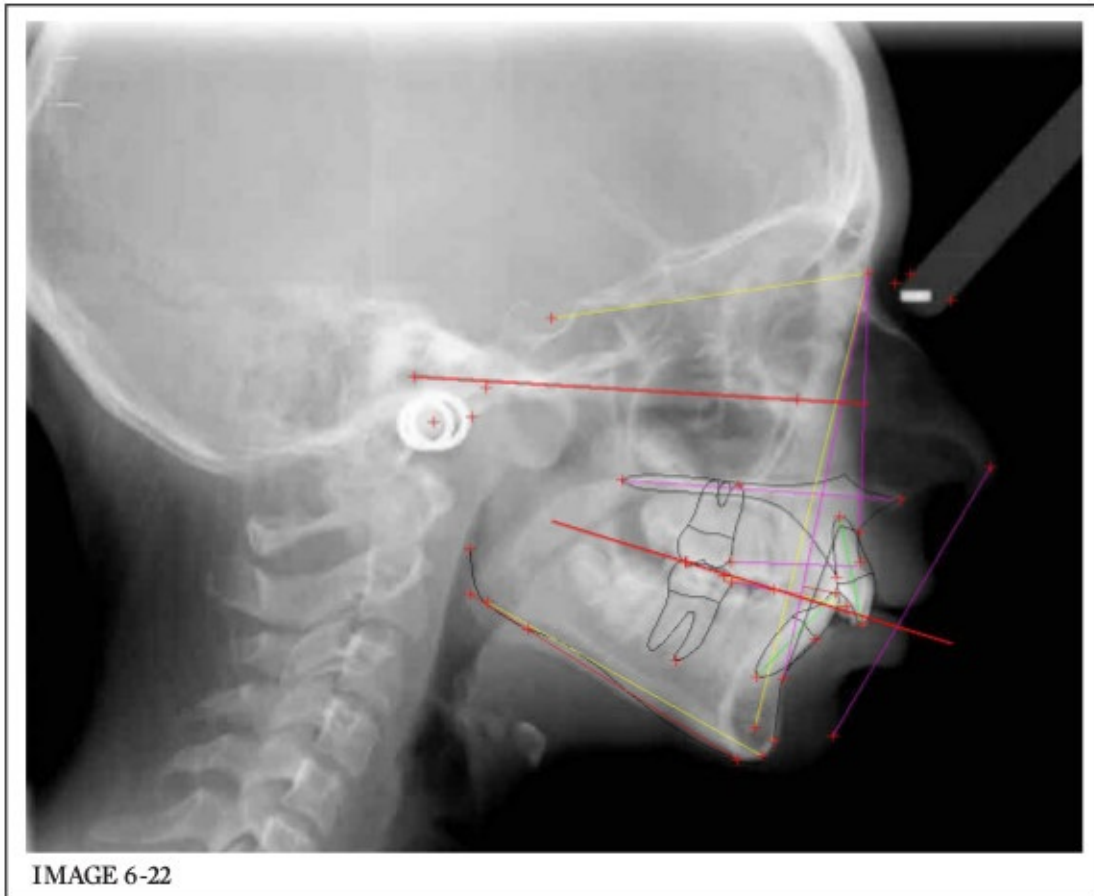
SAGITTAL

CL II:	Distalization	CL II Elastic Jump	Extraction	IPR
CL III:	CL III Elastic Jump	IPR	Premolar Ext	L Incisor Ext





IMAGE 6-21



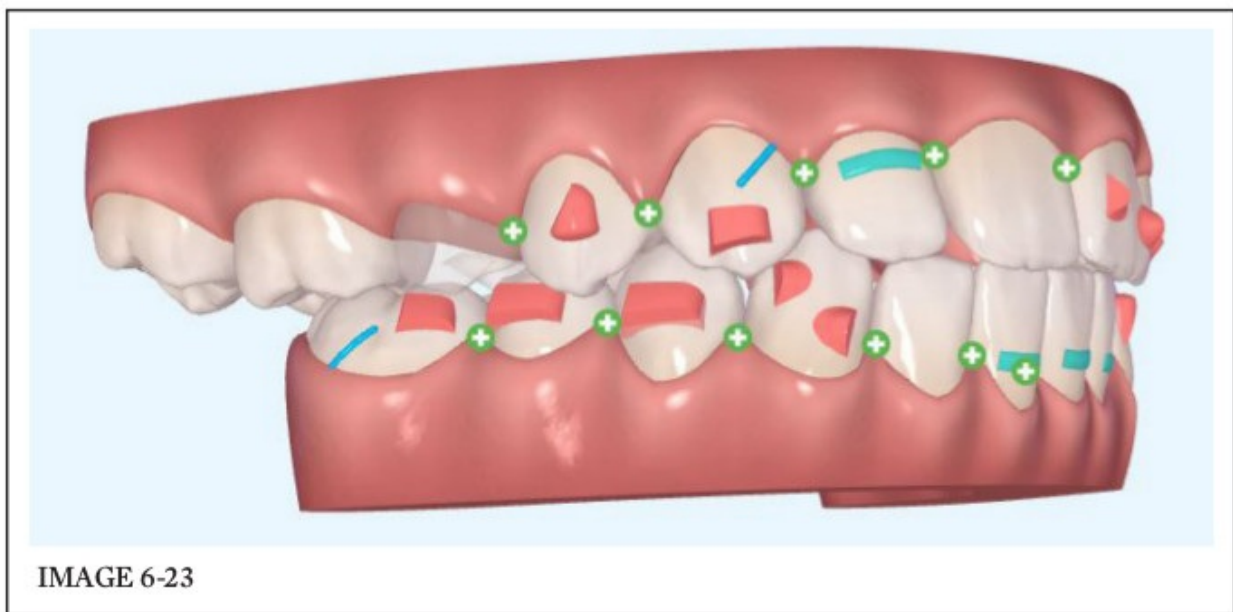
TREATMENT PLAN

A Class II elastic-jump was prescribed for this growing teen patient. Absolute intrusion of UR1 and UL1 was planned to reduce the gummy smile, and intrusion of the lower incisors and flattening of the lower Curve of Spee was planned to correct the deep over bite. Deep bite correction via *posterior- or extrusion* is contraindicated in this case. Posterior extrusion would lead to unwanted clockwise mandibular rotation, which would result in a more retrusive chin as well as a larger CL II discrepancy. An in-depth discussion of the do's and don'ts of deep-bite correction may be found in Chapter 5.

CLINCHECK TREATMENT PLAN

The ClinCheck setup (image 6-23) shows Class II elastic hooks on her lower 6's and upper 3's, retentive attachments on the lower 6's as normal. The final

ClinCheck stage depicts the Class II elastic-jump that we expect with the use of Class II elastics. The deep overbite is corrected through a combination of upper and lower anterior absolute intrusion, without extrusion of the posterior teeth. The aligner plastic between the upper and lower posterior teeth does an excellent job of preventing unwanted posterior extrusion. This excellent vertical control is helpful in a hyperdivergent skeletal pattern. Note the overtreatment of the deep bite to 0mm, as well as 4mm-long, occlusally-beveled rectangular attachments on the lower 4's and 5's to support the intrusion of the lower incisors.



RESULTS

See Ava's final result (images 6-24 through 6-26): excellent correction from Class II to Class I, normal overbite, normal over-jet, and well-aligned arches. Before and after comparison (images 6-27, 6-28) shows that when she presented initially she had excessive gingival display upon smiling. We can see the improvement in the amount of gingiva that is exposed pre- to post-treatment, which is indicative of the absolute intrusion achieved on the upper incisors. See chapter 8 for details on the attachment setup used in Ava's refinement ClinCheck plan to achieve this result. Her final panoramic radiograph is normal and her cephalometric superimposition shows her maxillary molar tended to maintain its

antero-posterior position as well as good control of the mandibular plane angle.



IMAGE 6-24



IMAGE 6-25

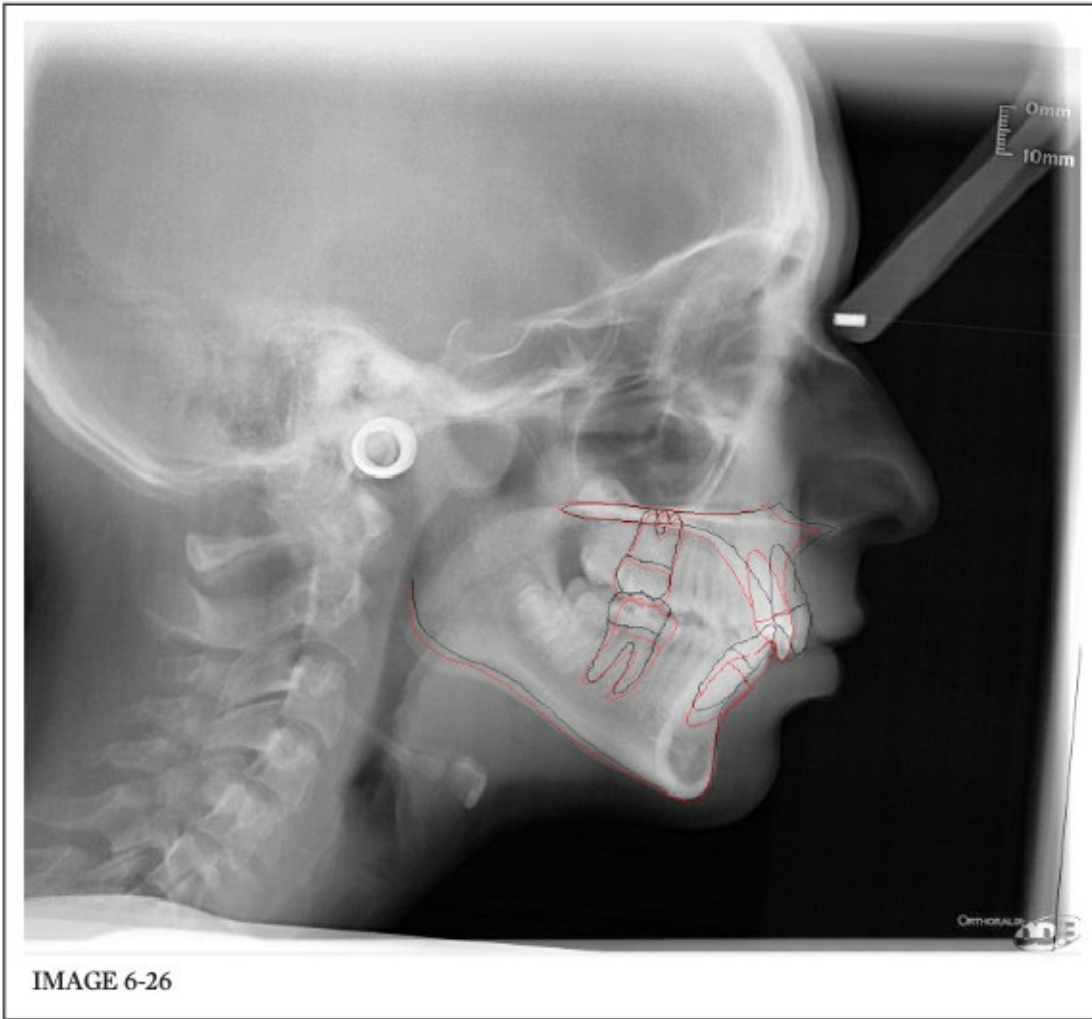




IMAGE 6-27

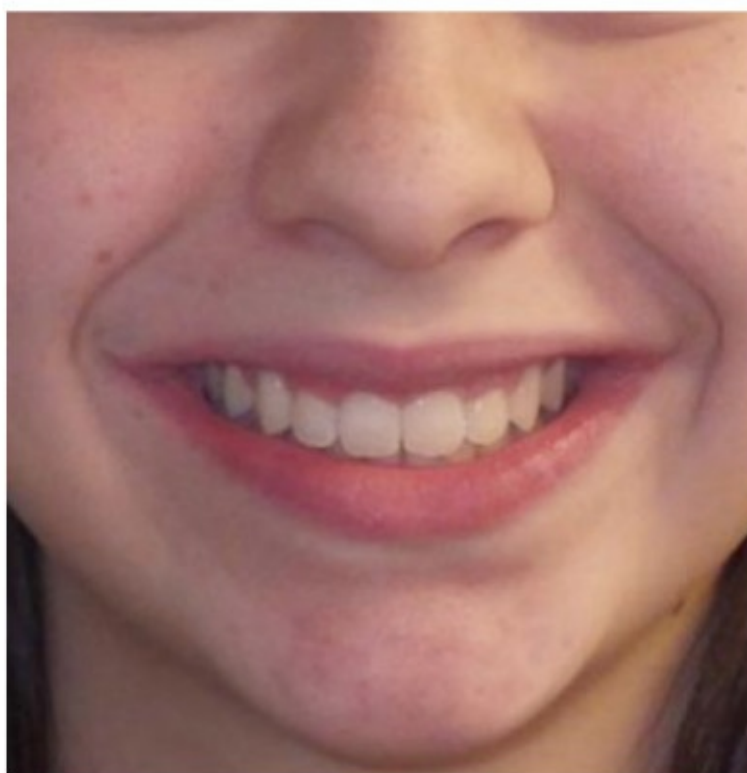


IMAGE 6-28

Summary: Treatment lasted 28 months, with two refinements, and 2 oz. CL II elastics.

CASE STUDY NO. 4 — CANDACE

Candace (images 6-29, 6-30, 6-31) presented as an 11-year-old female patient with a CL II div. 1 Malocclusion, deep over bite, upper and lower crowding, and UR2 blocked out to the labial. Let's take a look at the SAGITTAL section of Candace's ClinCheck list:

SAGITTAL

CL II:

Distalization

CL II Elastic Jump

Extraction

IPR

CL III:

CL III Elastic Jump

IPR

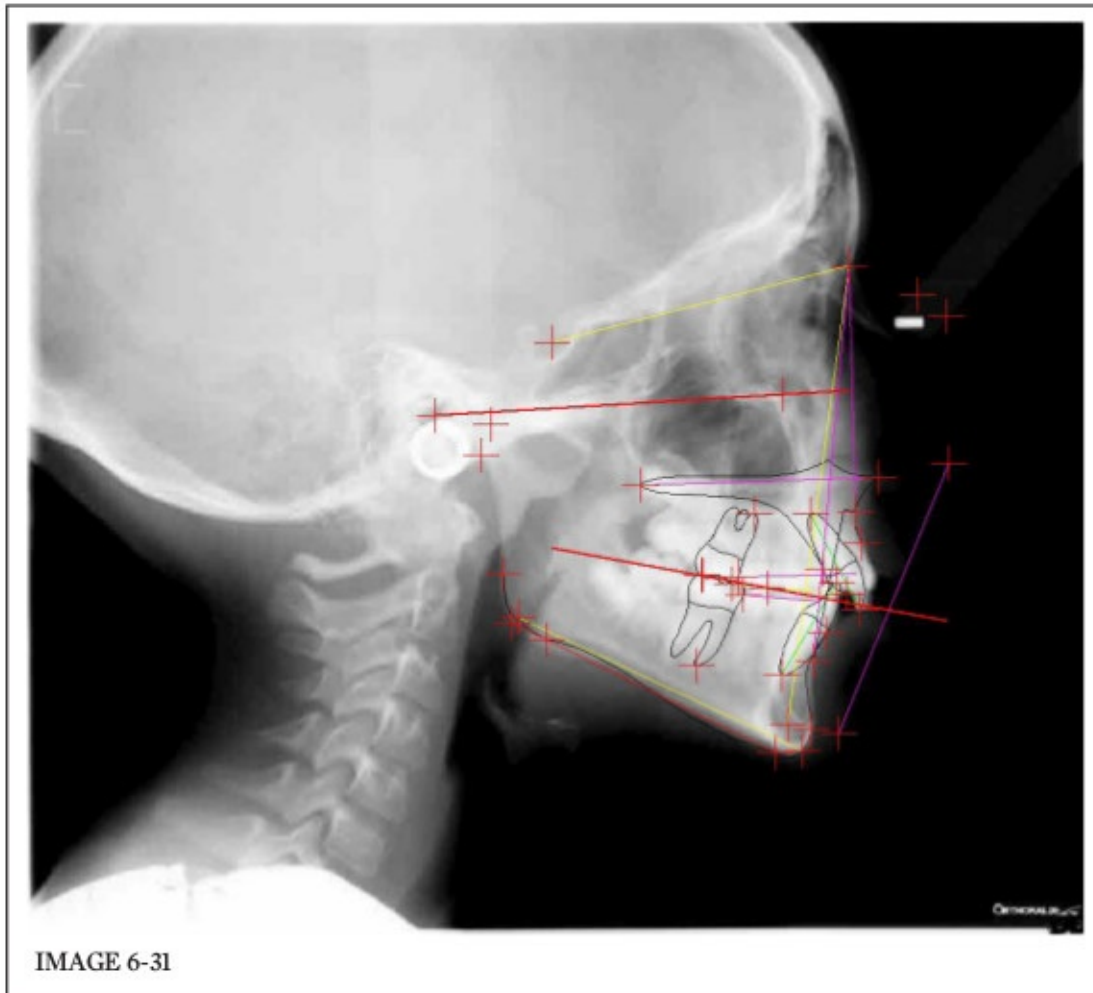
Premolar Ext

L Incisor Ext





IMAGE 6-30



TREATMENT PLAN

Distalization of the upper posterior teeth, supported with 4 oz. CL II elastics was selected in Candace's case to both address the CL II molar and canine relationship as well as creating space to align the UR2. You will see Candace again in Chapter 8 to learn the ClinCheck moves used to manage the absolute intrusion of UR1 and UL1, as well as the relative extrusion of UR2.

CLINCHECK TREATMENT PLAN

The ClinCheck plan reveals that the posterior teeth were distalized using sequential distalization. Images 6-32-6-34 depict the ClinCheck as the distalization progresses. Precision-cut elastic hooks are present so that the

patient can wear 4 oz. CL II elastics to both support the distalization and also block unwanted upper incisor proclination. The use of CL II elastics is critical to block reciprocal forces which would tend to flare the upper anterior teeth and increase the over jet. Image 6-35 shows the typical staging of sequential distalization — when each tooth achieves 50 percent of the desired distal movement, the next tooth in line begins to distalize.

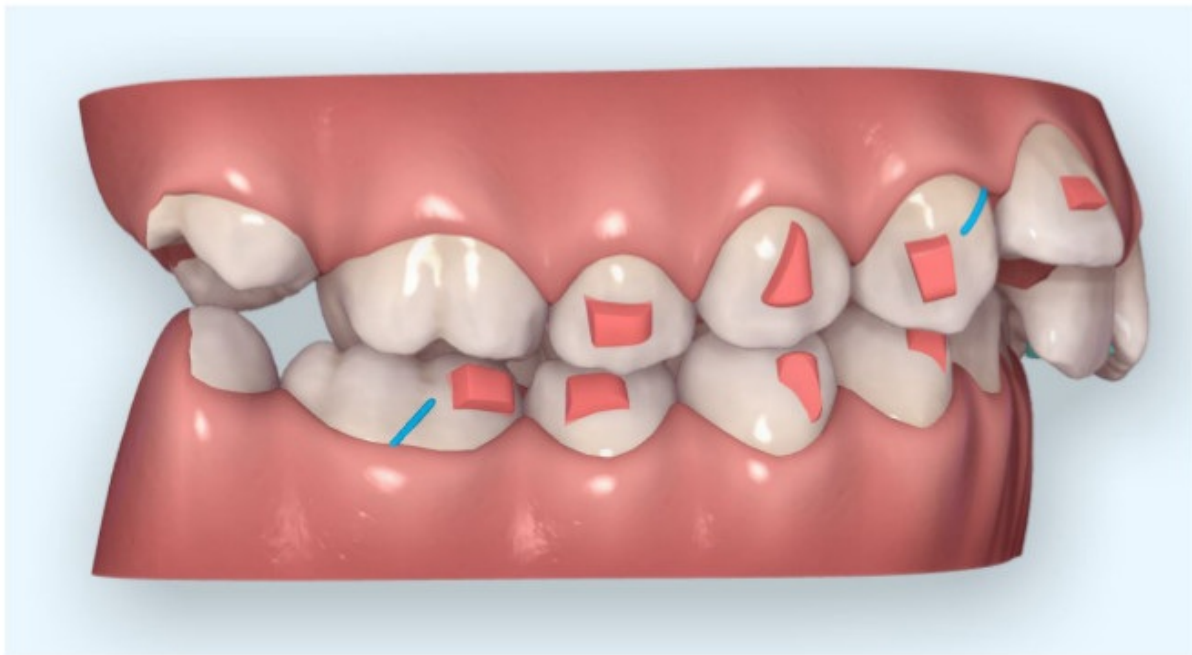


IMAGE 6-32

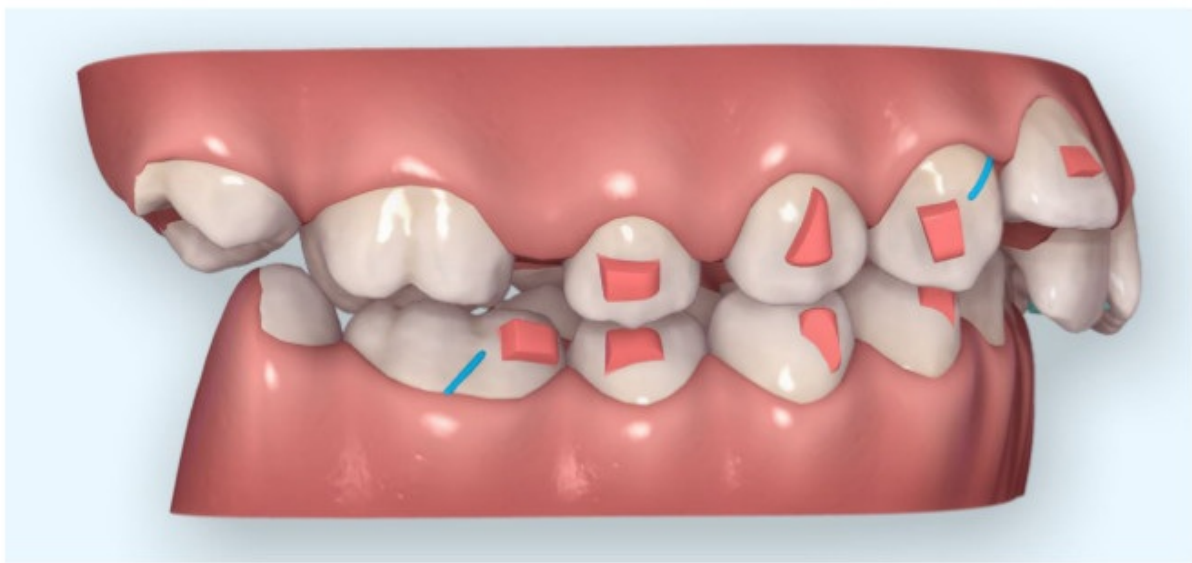


IMAGE 6-33

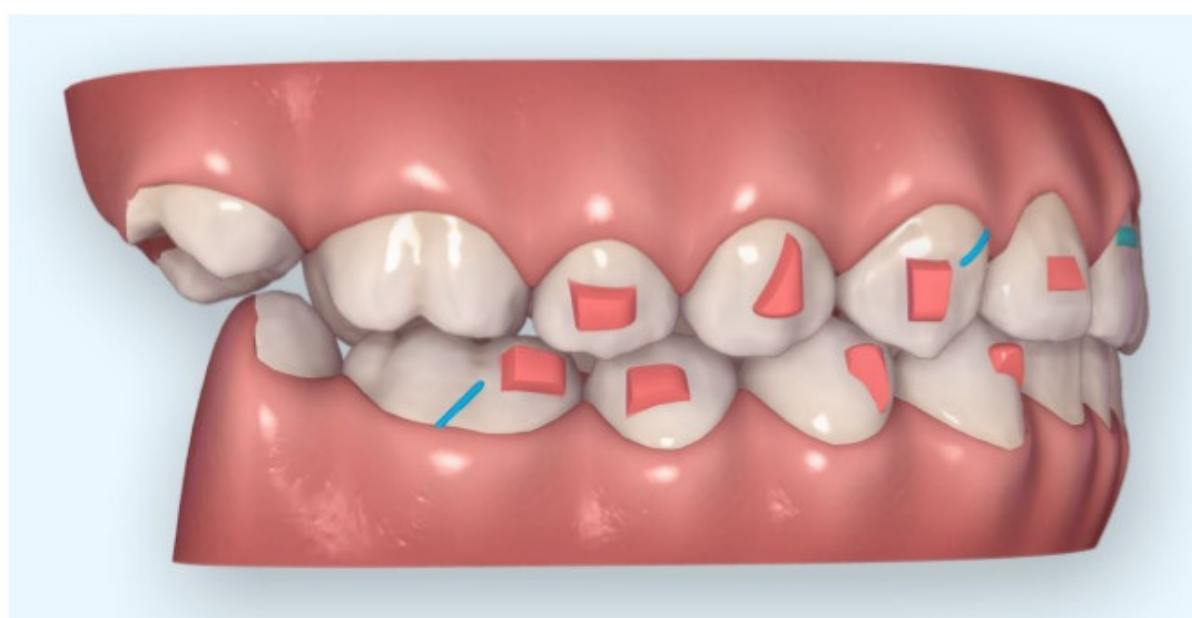


IMAGE 6-34



RESULTS

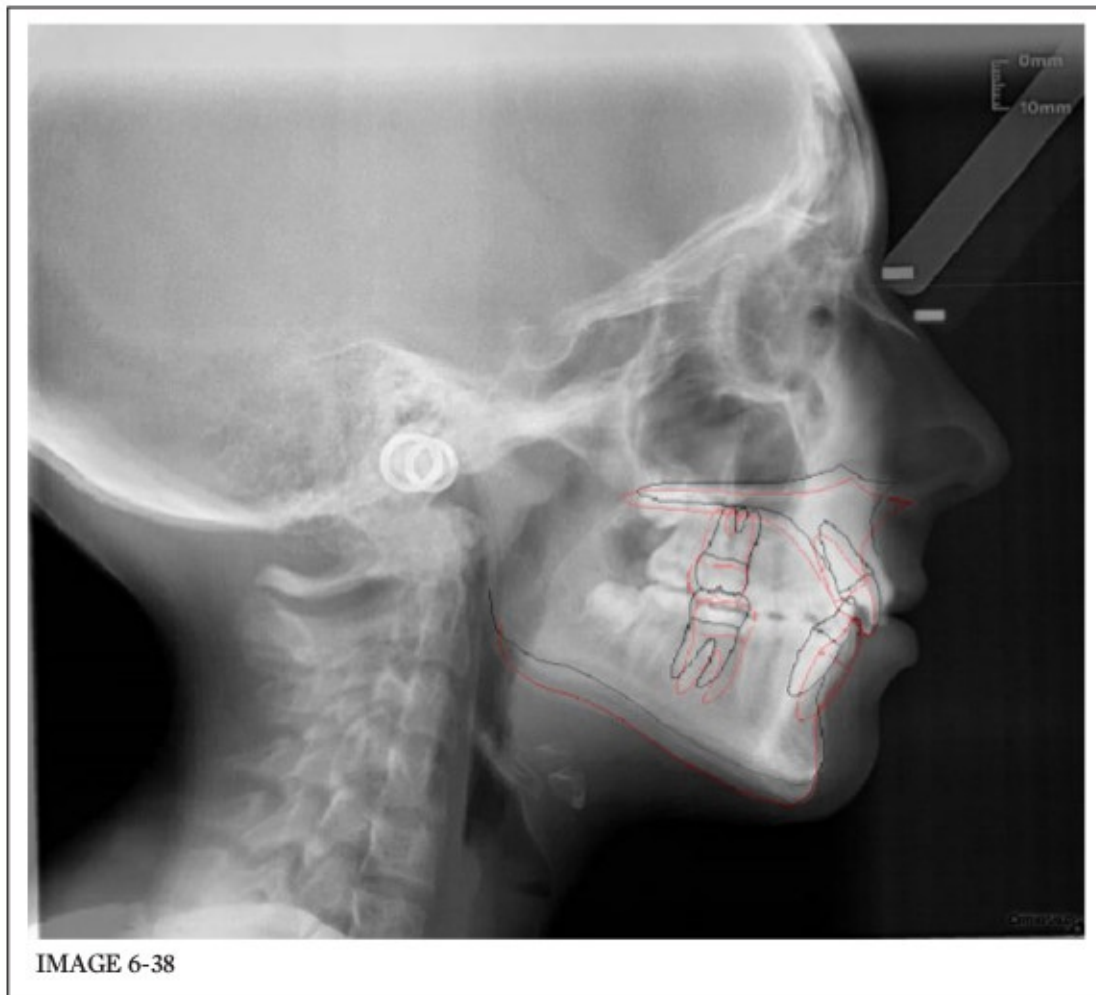
Candace's final records demonstrate the correction achieved (images 6-36-6-38). Note on the superimposition that the maxillary first molar remains in the same relative antero-posterior position while there is both growth of the mandible as well as dento-alveolar changes. Sequential distalization can be a useful treatment modality in teen cases such as Candace's.



IMAGE 6-36



IMAGE 6-37



Summary: Treatment lasted 40 months, with three refinements, and 4 oz. CL II elastics.

CL III CORRECTION

The non-surgical methods for CL III correction are elucidated on the SAGITTAL section of the ClinCheck list:

SAGITTAL

CL II:	Distalization	CL II Elastic Jump	Extraction	IPR
CL III:	CL III Elastic Jump	IPR	Premolar Ext	L Incisor Ext

Let's look at several CL III cases treated with different treatment methodologies.

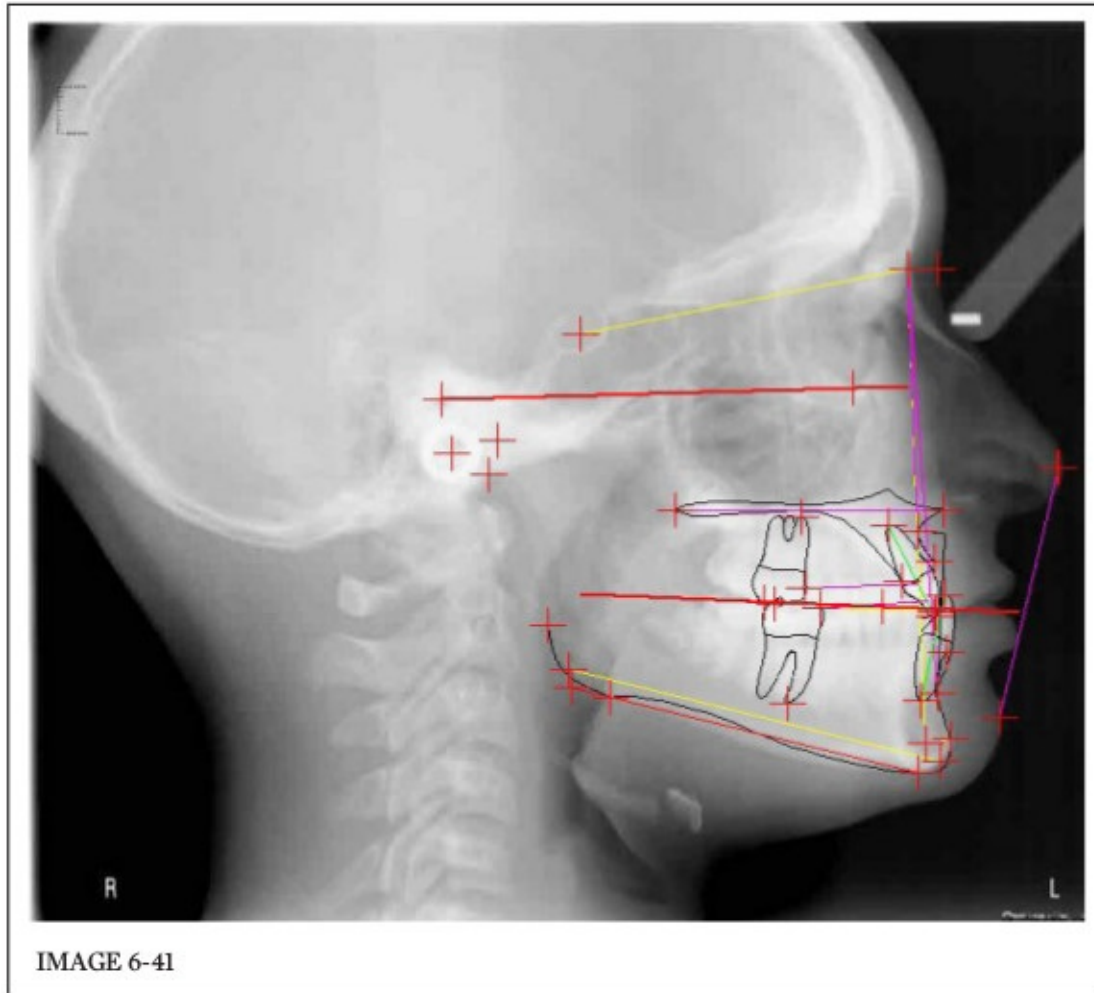
CASE STUDY NO. 5— GABRIELLA

Gabriella presented as a 12-year-old female with Class III Malocclusion, moderate upper and lower crowding and traumatic occlusion to her lower anterior teeth. Gabriella's initial presentation (images 6-39-6-41) demonstrates her significant under-bite. I felt compelled to commence Gabriella's treatment as soon as possible to prevent additional trauma to her lower incisors and reduce the chances of periodontal damage as well. Her panoramic X-ray is within normal limits. Her cephalometric X-ray reveals a Class III skeletal pattern.





IMAGE 6-40



TREATMENT PLAN

Gabriella's treatment plan revolves around treating her upper and lower incisors to Steiner's Acceptable Compromise, to compensate for the Class III skeletal pattern. This means I added additional proclination to the upper incisors and allowed for additional lingual tipping of the lower incisors to compensate for the Class III skeletal pattern, supported with CL III elastics.

CLINCHECK TREATMENT PLAN

One of the beauties of ClinCheck treatment planning is that it allows for virtual diagnosis and treatment planning. It gives us a virtual simulation on a patient's case before we even start. If you compare Gabriella's mandibular and

maxillary arch forms, (image 6-42) you will note she has a square arch form in the maxilla and a V-shaped arch form in the mandible. This is a result of the lower incisors are being forced labially and the upper incisors being forced palatally. The occlusal view of the final ClinCheck stage (image 6-43) shows the coordination of the upper and lower arch forms. Image 6-44 shows the anticipated improvement in the occlusion via arch form change only, without the need for a bite jump. Seeing this change in the virtual setup gave me confidence that Gabriella's malocclusion could be corrected. Also note the *virtual bite turbos* on LR1 and LL1. Virtual bite turbos are conventional bite ramps built into the aligners that helped disocclude the anterior teeth to ease the jumping of the anterior cross bite.

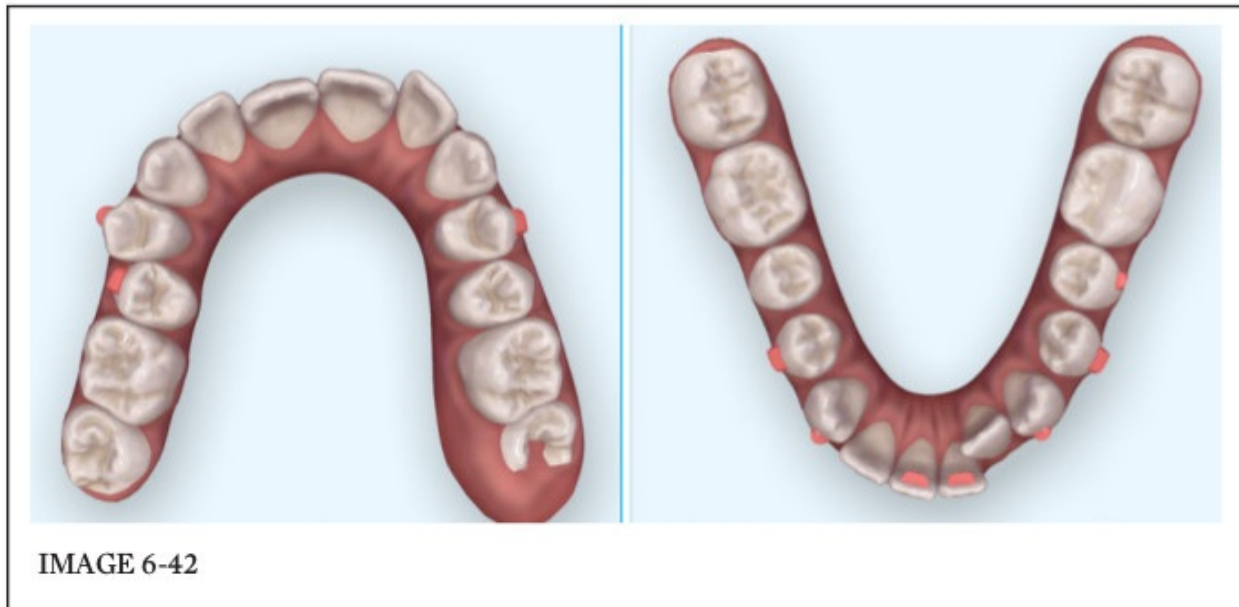




IMAGE 6-43

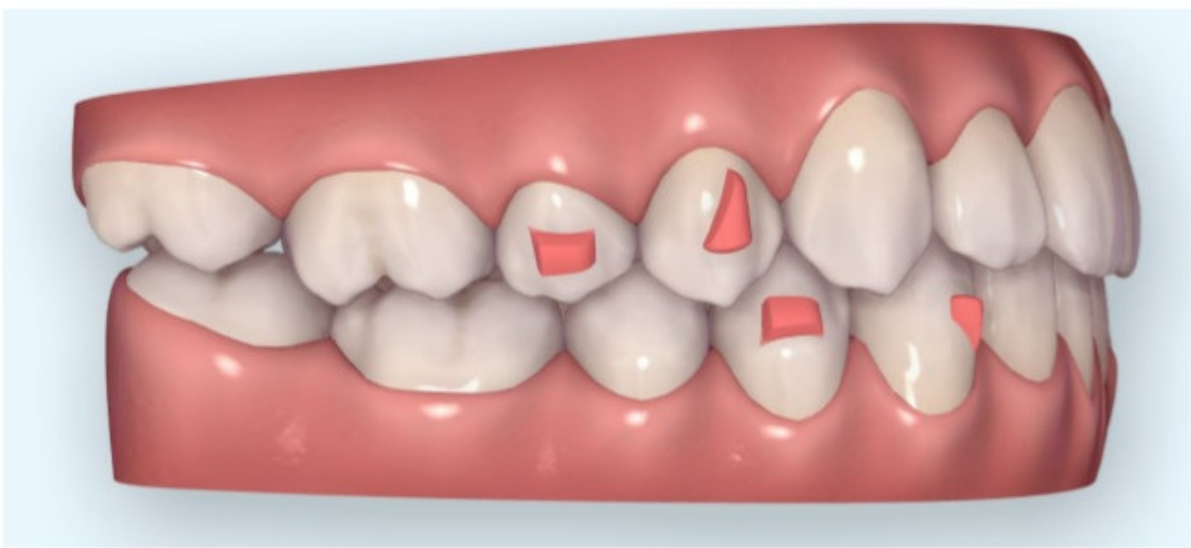


IMAGE 6-44

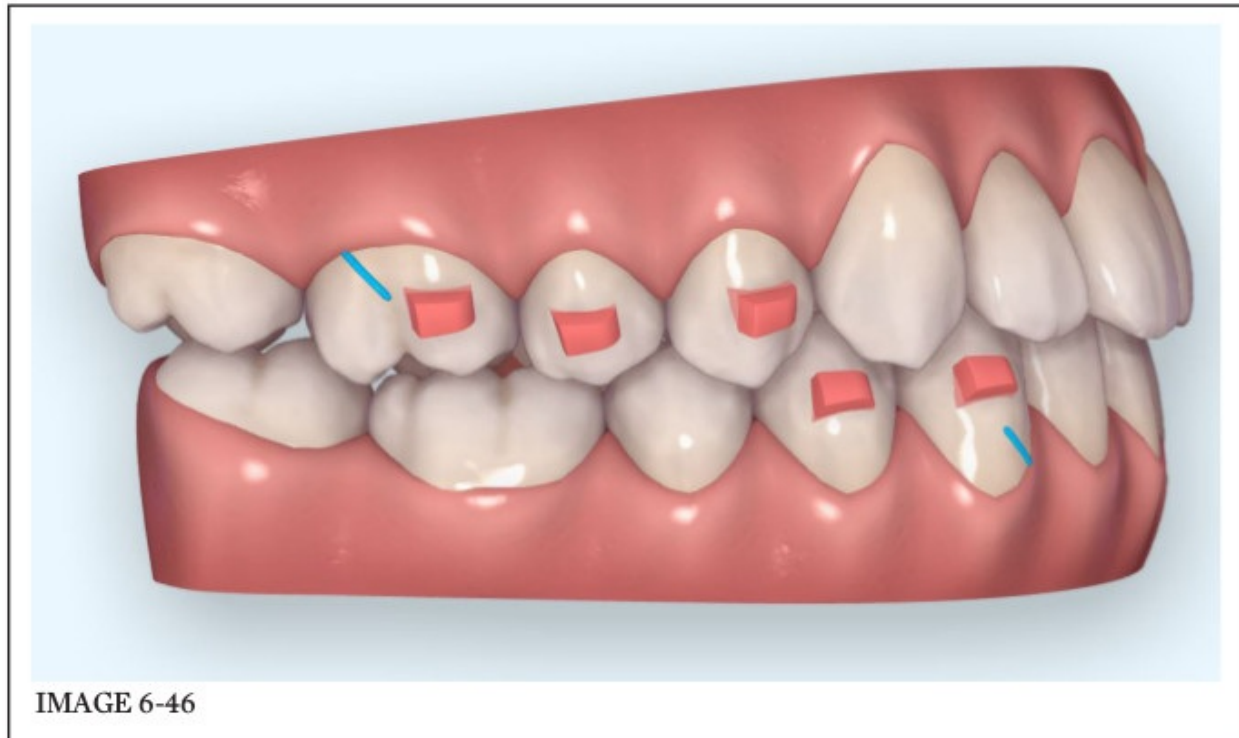
PROGRESS

After eight months of treatment, note all of the benefits of Invisalign Teen (image 6-45). Her occlusion has greatly improved, and there is significant improvement to her anterior relationship. However, at eight months, her upper incisors are still too upright and she is displaying a posterior open-bite because of heavy occlusal contact in the anterior. In this type of case, we do not want to

close the posterior open bite by running posterior vertical elastics — that is not the problem. The reason Gabriella is manifesting a posterior open bite is because of heavy *anterior* contact.



In refinement I ask for an additional 30-degrees of palatal root torque on U2112 to relieve the heavy occlusal contact, in addition to precision-cut elastic hooks for CL III elastics (image 6-46). These two ClinCheck moves eliminate the heavy anterior contact and eliminate the posterior open bite.



RESULTS

Study her final records (images 6-47-6-49). Note that her occlusal change comes from retraction of her lower incisors into the leeway space and proclination of her upper incisors. These movements are enhanced by light 2 oz. CL III elastics. The final occlusion is a solid Class I. She also has nice tissue response on the lower incisors by removing the traumatic inclusion. Her final panoramic radiograph is within normal limits. Her cephalometric superimposition shows proclination of the upper incisors and lingual tipping of the lower incisors, which is consistent with her CL III skeletal pattern and my treatment objectives. Three years into retention, there has been a small degree of asymmetrical mandibular growth to the left, nevertheless her occlusion is still holding up well (image 6-50).



IMAGE 6-47



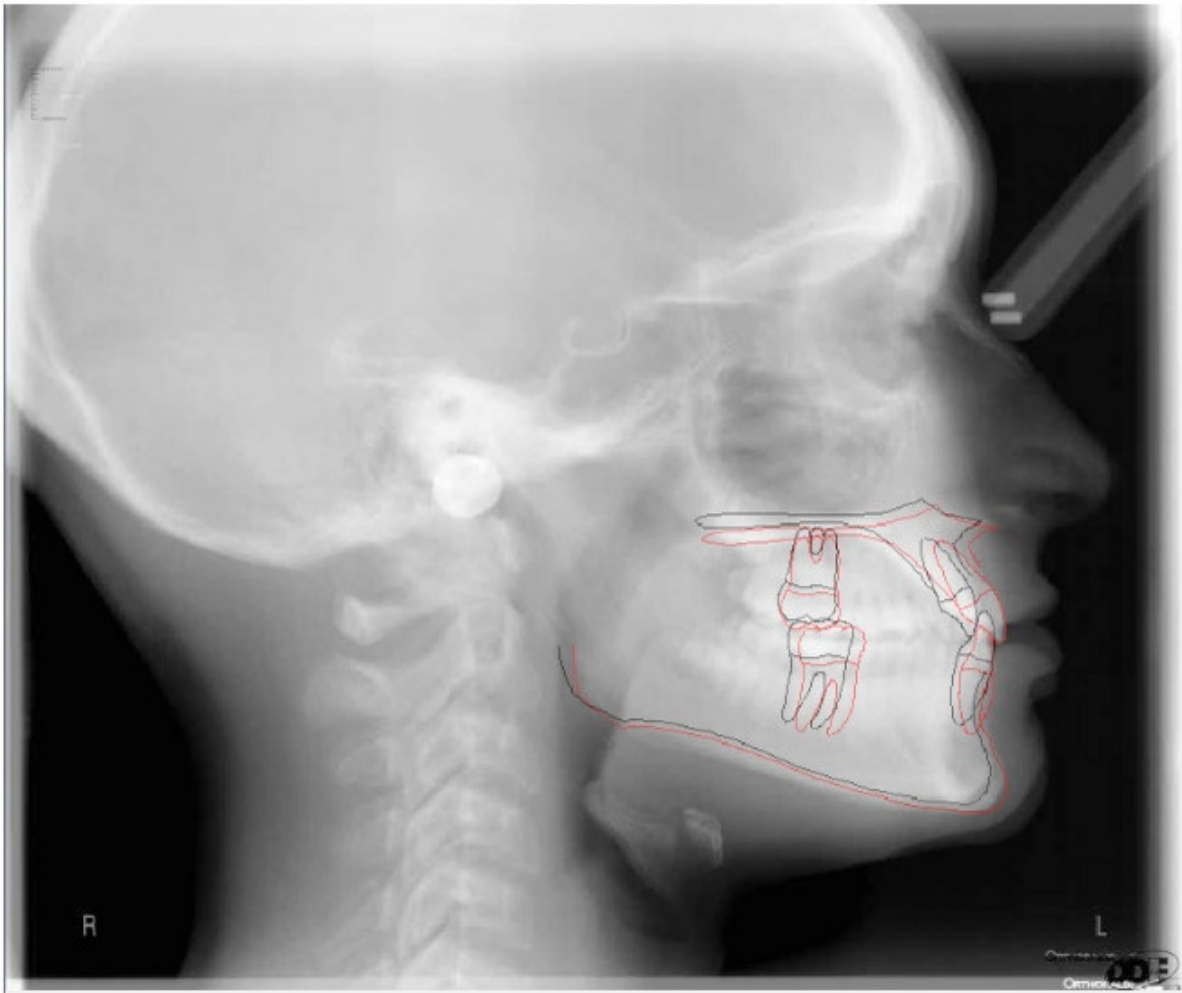


IMAGE 6-49



Summary: Total treatment time was 19 months, 1 refinement, and 2 oz. elastics.

CASE STUDY NO. 6 — ALFONSO

Alfonso is a young adult patient who presented with Class III Malocclusion with moderate upper and lower crowding (images 6-51- 6-53). My original treatment plan for Alfonso was orthodontics in conjunction with orthognathic surgery. However, Alfonso refused surgery so we began to explore nonsurgical options. Based on the magnitude of his sagittal discrepancy, the treatment plan was to use Invisalign clear aligners along with the extraction of the lower right and the lower left first premolars.

SAGITTAL

CL II:	Distalization	CL II Elastic Jump	Extraction	IPR
CL III:	CL III Elastic Jump	IPR	Premolar Ext	L Incisor Ext



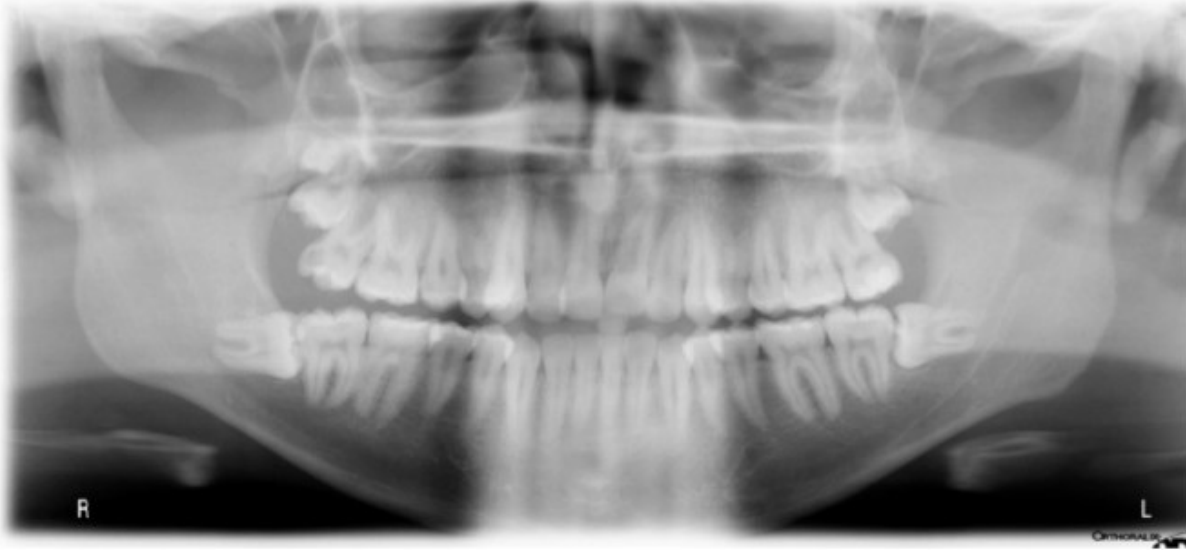
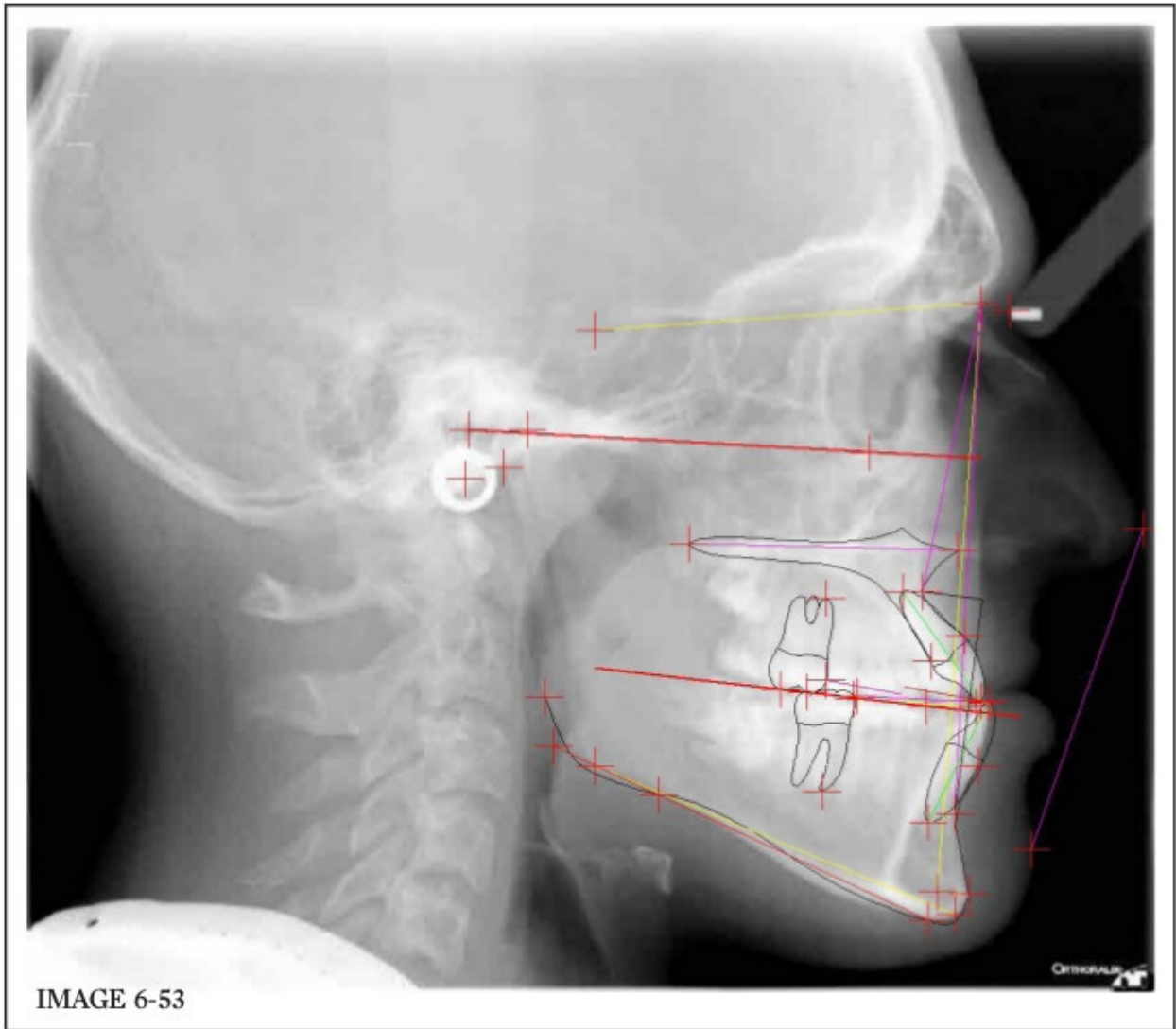
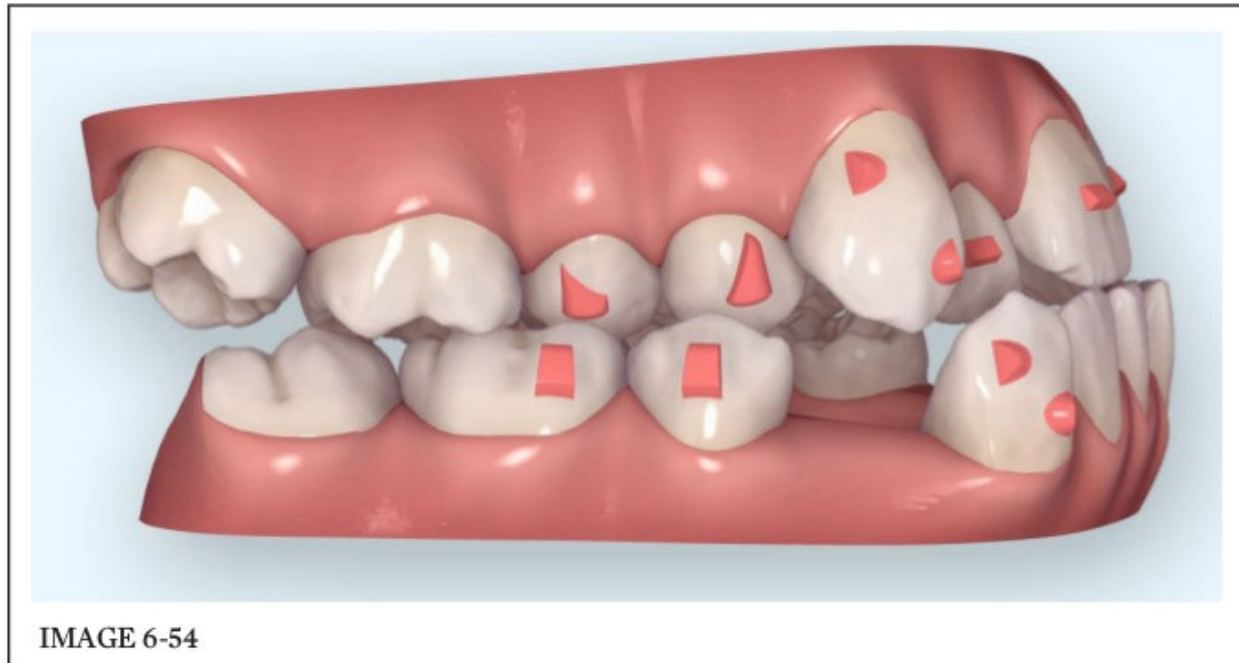


IMAGE 6-52





TREATMENT PLAN

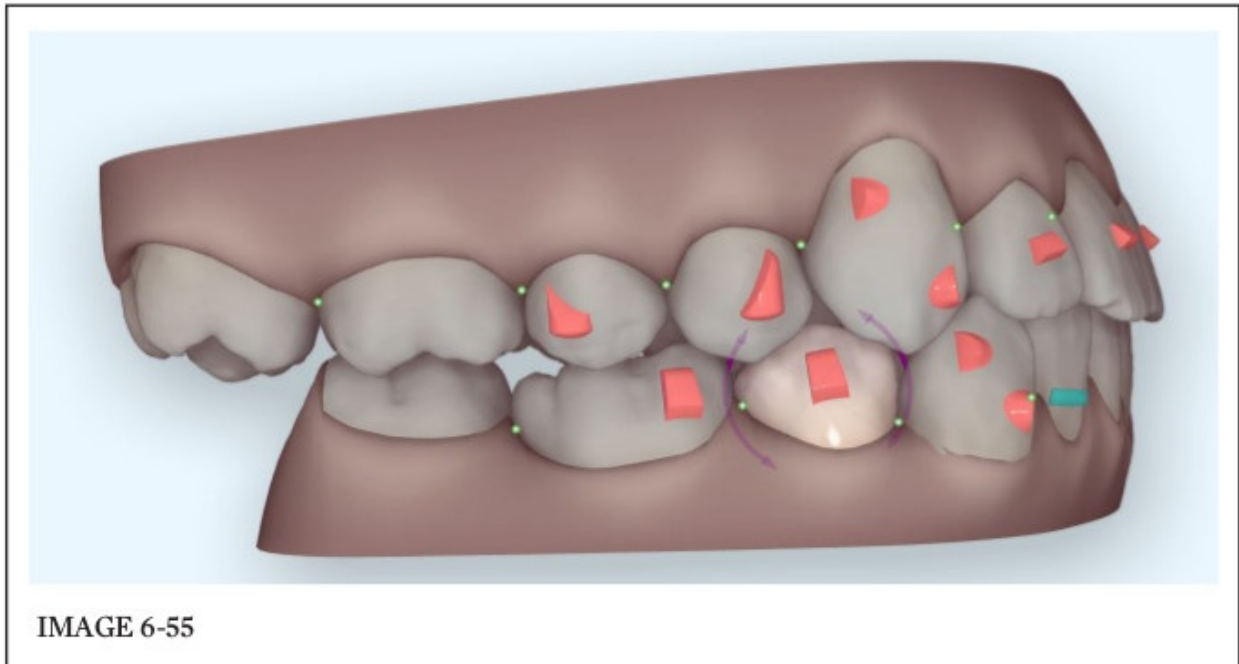
The treatment plan involves treating the upper arch non-extraction, utilizing posterior expansion and IPR to align the arch. In the lower arch, the lower right and left first premolars were extracted to create space for lower incisor retraction and ultimate coupling of the canines and incisors.

CLINCHECK TREATMENT PLAN

Alfonso's initial ClinCheck stage displays the magnitude of his Class III Malocclusion in addition to his extraction spaces where the lower right and lower left premolars were removed. At the final ClinCheck stage, movement of the lower teeth into the extraction spaces mirrors our discussion of bodily movement of closing spaces from the section on spacing in chapter 4. When we move teeth to close extraction spaces the aligners are placing forces on the crowns of the teeth, tending to tip them into the extraction spaces. Generally, that is not a desired movement. We want bodily movement so the roots finish parallel to each other at the end of treatment.

Just like in a case where we are closing a diastema, we want to place virtual

gable bends in addition to vertical rectangular attachments on the teeth being moved into those spaces as anti-tip and over-engineering to control the position of the roots. At the final stage you can appreciate there is a vertical attachment on the lower right and left premolar and first molars. You'll also appreciate that there is an optimized root control attachment on the lower canines. The software places the optimized root-control attachments automatically with the appropriate force systems on the canines to maintain root position. In my experience, optimized root-control attachments work very well. The software didn't recognize that type of movement on the lower second pre-molars, and I placed a lower conventional attachment to give the aligners grip to control positions of the roots (image 6-55).



PROGRESS

See the progress image 6-56 in treatment showing significant space closure. At this point, the lower second molars are being protracted forward.



Note: The height discrepancy of UR1 and UL1. We will discuss how we achieved absolute extrusion of UL1 using a bootstrap elastic in troubleshooting, chapter 11.

RESULTS

At the end of treatment (image 6-57) all spaces have been closed in the lower arch. We have achieved good coupling of the lower incisors and Class I canines. The molar relationship is Class III by design. Alfonso achieved an excellent result for a nonsurgical treatment plan. His final panoramic radiograph (image 6-58) reveals good parallelism of the lower roots demonstrating that over-engineering using virtual gable bends and appropriate attachments led to good control of the teeth.



IMAGE 6-57



IMAGE 6-58

CASE STUDY NO. 7 — LUCAS

Lucas presented with a skeletal Class III Malocclusion, prognathic mandible, deficient maxilla, and moderate upper and lower crowding. His cephalometric X-ray reveals a significant sagittal discrepancy and a significant Class III relationship (images 6-59-6-61).

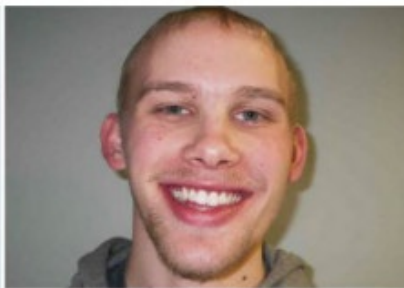
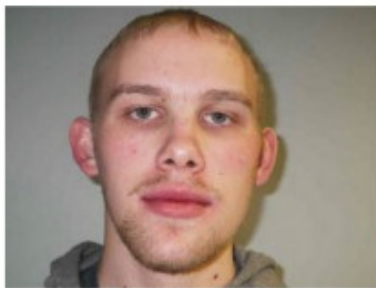
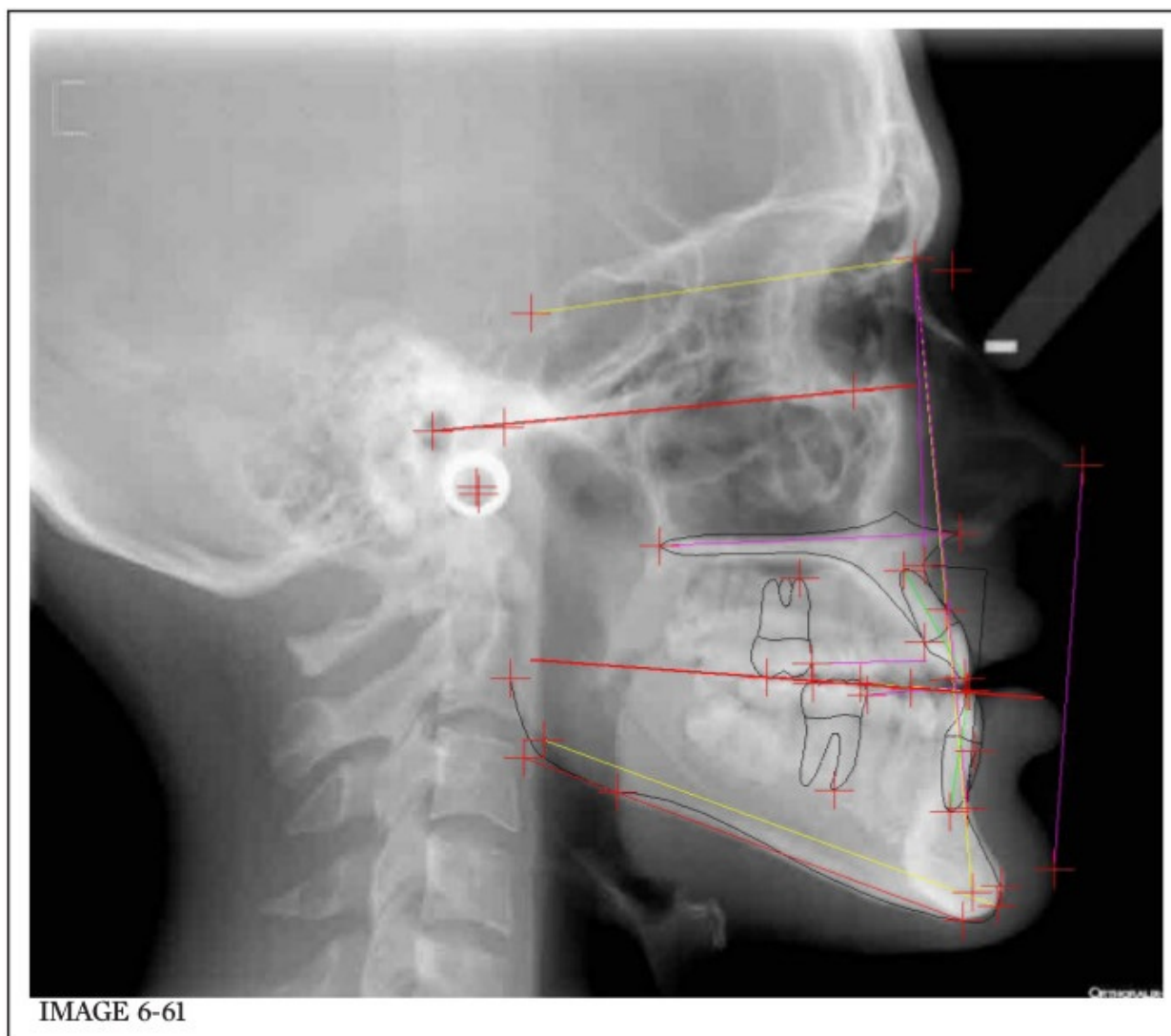


IMAGE 6-59



IMAGE 6-60



TREATMENT PLAN

The treatment plan involved leveling and aligning both arches to decompensate, followed by maxillary advancement and mandibular set-back surgery. Proclination of the lower incisors allowed for alignment of the lower arch as well as appropriate pre-surgical decompensation.

SAGITTAL

CL II:	Distalization	CL II Elastic Jump	Extraction	IPR
CL III:	CL III Elastic Jump	IPR	Premolar Ext	L Incisor Ext

CLINCHECK TREATMENT PLAN

The *CL III elastic-jump* is a useful pre-surgical planning tool to ensure good upper and lower arch coordination prior to surgery. Images 6-62 and 6-63 show before and after CL III elastic-jump ClinCheck images.

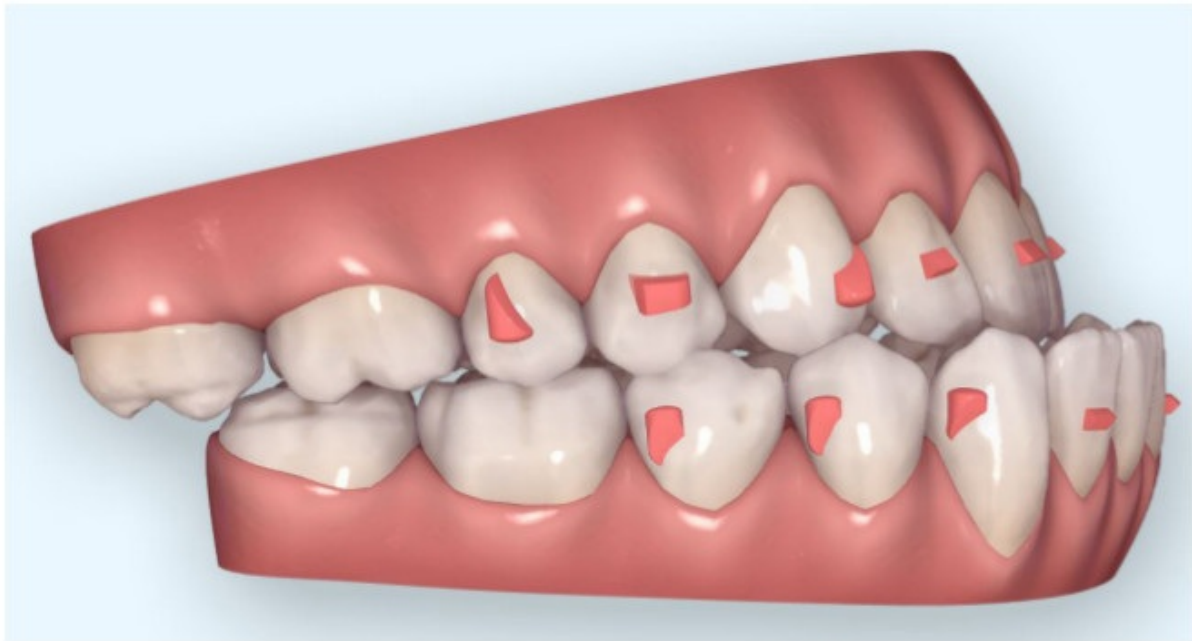


IMAGE 6-62

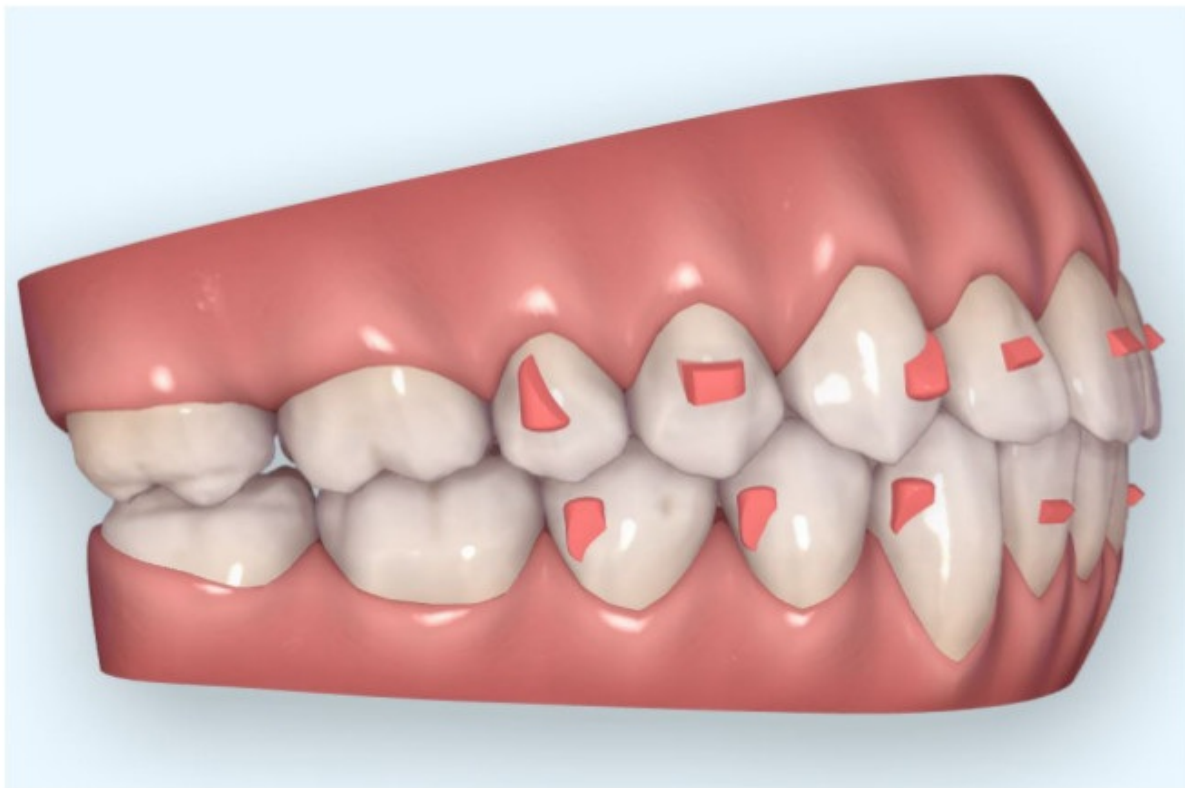


IMAGE 6-63

RESULTS

Image 6-64 shows Lucas 62 one week after surgery. In this case the surgeon, Dr. David A Behrman, Chief of the Division of Dentistry, Oral and Maxillofacial Surgery, Weill Cornell Medical College, placed TADs in the upper and lower arches for post-surgical stabilization. The placement of TADs meant there were no fixed appliances that needed to be placed on the teeth before or after surgery.

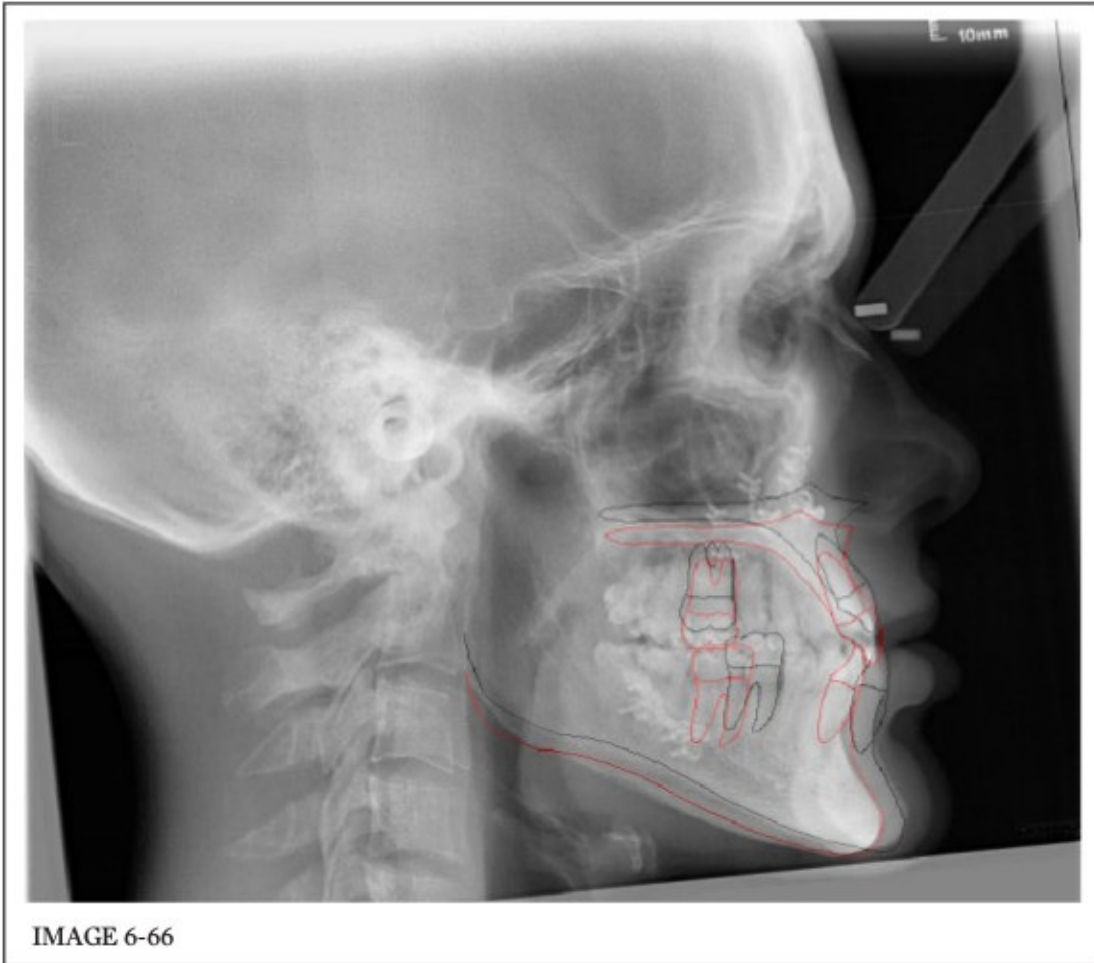
Once Lucas was released by the surgeon, he required one additional refinement series to refine the final occlusion. His final result is depicted in images 6-64-6-66.



IMAGE 6-64



IMAGE 6-65



CHAPTER SUMMARY

When I began treating patients with Invisalign aligners in 2006, I would never have dreamed that sagittal correction would be a routine part of my Invisalign treatment planning 10 years later. While each and every case is unique, I hope this chapter has outlined some of the most common treatment planning options for Class II and Class III cases. Using the ClinCheck list to help guide you through your Invisalign treatment decisions will lead to good treatment plans and great results!

CHAPTER 7

Transverse Dimension

In the previous two chapters, we have examined how to address orthodontic problems with Invisalign treatment in two planes of space: vertical and sagittal. The third plane of space is the transverse dimension. When we are correcting transverse conditions with Invisalign clear aligners, there are several considerations:

Expansion to resolve crowding — do we want to prescribe posterior expansion to resolve crowding? A very common scenario would be a case like Gilbert (see also in chapter 3 his original case study) who presented with a Class I Malocclusion and constricted dental arches. In this case, expansion of the transverse dimension using Invisalign to gain arch length helped to create space to resolve his crowding (images 7-1 and 7-2).



IMAGE 7-1



IMAGE 7-2

A case like Gilbert's would benefit from dental expansion. However, when you prescribe dental expansion you have to think about how the teeth are expanding. With Invisalign treatment, the default movement when prescribing posterior expansion is buccal tipping. In a case like Gilbert's, tipping works out well because his teeth begin palatally inclined. The palatally inclined teeth are being uprighted — and that is perfectly fine.

In Gilbert's case we don't need any posterior buccal root torque (BRT) because the teeth started out palatally inclined, but you have to watch for that condition. In other patients with upright posterior teeth with expansion using Invisalign, there can be a tendency to tip the teeth out toward the buccal, relatively extruding the palatal cusps and intruding the buccal cusps. Most of the time that is not something that we want. In cases where you see unwanted

tipping of the posterior teeth, ask your technician to give you posterior buccal root torque to maintain bodily movement.

Similarly, a patient like Emma (from chapter 6) who presents with constriction of the arches and palatal inclination may also benefit from transverse expansion to help resolve her crowding (images 7-3 and 7-4). She sets up well for expansion in the transverse dimension to gain arch length to resolve her crowding, without the need to program any posterior buccal root torque.





These movements are predictable tipping movements with Invisalign clear aligners. Tipping movements are predictable and typically don't require any ClinCheck modifications.

Posterior cross bite — what about patients who require posterior expansion to resolve a posterior cross bite? With patients who present with posterior cross bite, it is critically important to consider whether the patient presents with a **dental cross bite or skeletal cross bite**. For example, the patient in image 7-5, and his ClinCheck in image 7-6 presented with a dental cross bite on the upper-right side. His arch is constricted so we can set him up for dental expansion using Invisalign.



IMAGE 7-5

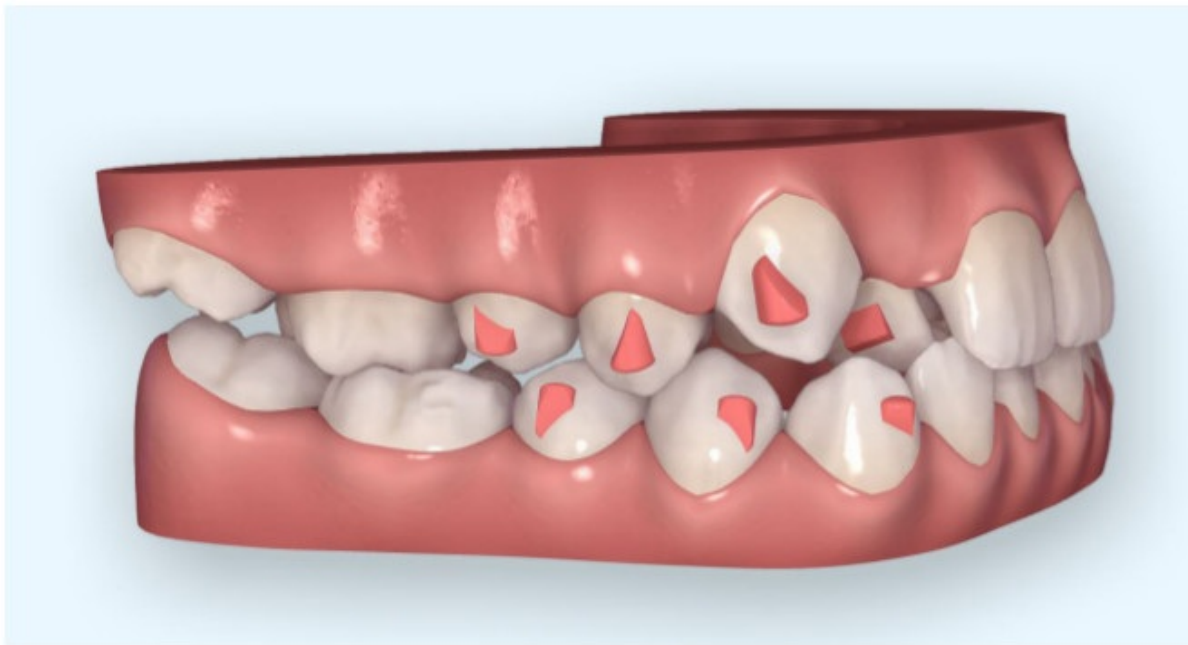


IMAGE 7-6

In cases where you have anchor teeth on either side of the cross bite that are not in cross bite for example, the UR7 and the UR3, those teeth provide anchorage to move the collapsed portion of the arch. Image 7-7 depicted his ClinCheck setup. The final result (image 7-8) shows very predictable movement and nice correction of the dental cross bite on the upper-right side.

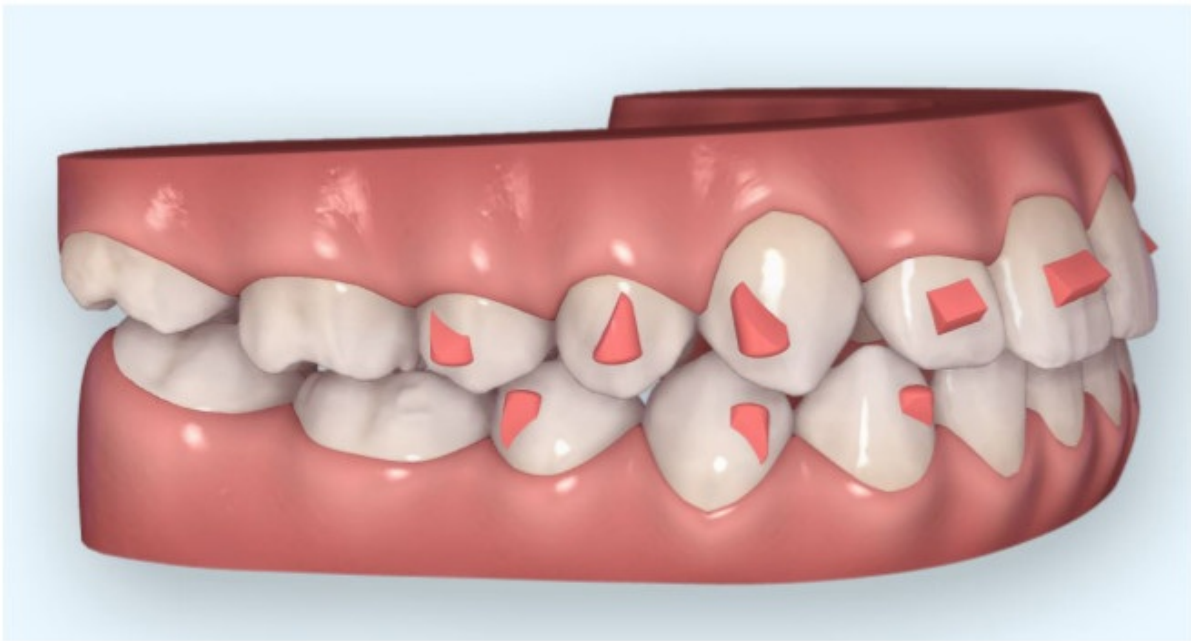


IMAGE 7-7



Note: Something to think about — one has to think through whether it's wise to treat a skeletal problem with a dental appliance — whether it be fixed appliances or aligners. It's also important when we're dealing with a patient who is a **child vs. adult** — and in particular, a prepubescent child vs. an adult patient.

RED FLAGS

Skeletal cross bites are a big red flag, particularly in adults — they are unpredictable to treat orthodontically non-surgically, regardless of the appliance used. I do not recommend attempting to correct a skeletal cross bite on an adult patient with Invisalign. However, in a prepubescent child pre-Invisalign rapid palatal expansion (RPE) is quite predictable. If we can capture the patient before the onset of the pubertal growth spurt, conventional phase I treatment with rapid

palatal expansion can set the patient up for a more predictable Invisalign experience later on. My good friend and colleague Gary Brigham DDS MSD refers to this as “developing an Invisalign Teen farm system.” In essence, the trans-verse discrepancy is corrected *before* the patient enters into Invisalign treatment.

Note: As I travel the world consulting with doctors on their Invisalign cases, it’s not uncommon to see ClinCheck plans for adult patients with skeletally constricted maxillae that show a tremendous amount of trans-verse expansion in the maxillary arch. In my opinion, one has to question whether or not this type of correction is attainable on a routine basis. This raises the question of whether it’s wise to treat a skeletal cross bite with a dental appliance.

What are my considerations for a patient like the one in image 7-9? I would treatment plan this patient for surgically assisted rapid palatal expansion (sRPE) prior to beginning Invisalign treatment. If the patient was not amenable to surgery, I would consider maintaining the posterior cross bite and treating the patient with Invisalign without cross-bite correction.



IMAGE 7-9

Other red flags are **unilateral cross bites** — they can be a challenge. In many cases where the patient is in braces or aligners, I will use cross elastics to help

with that movement. The ClinCheck plan depicted in images 7-10 and 7-11 might be a typical setup; here is a patient who has a posterior cross bite on the right side, and I've set them up with button cutouts on the lower surfaces of the LR6 and LR7, as well as on the pal-atal surfaces of the UR6 and UR7. I will bond buttons on those surfaces (see image) as well as the lower arch and have the patient run a 1/4-inch H6 elastic to help to correct the cross bite (image 7-12).

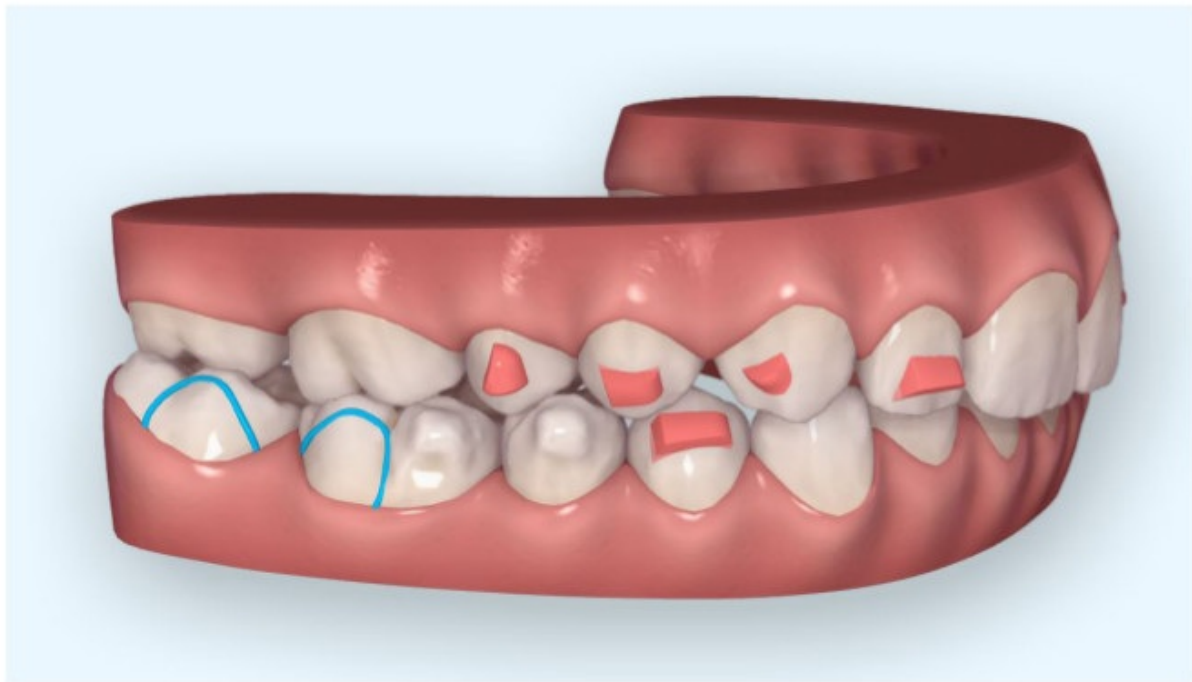


IMAGE 7-10

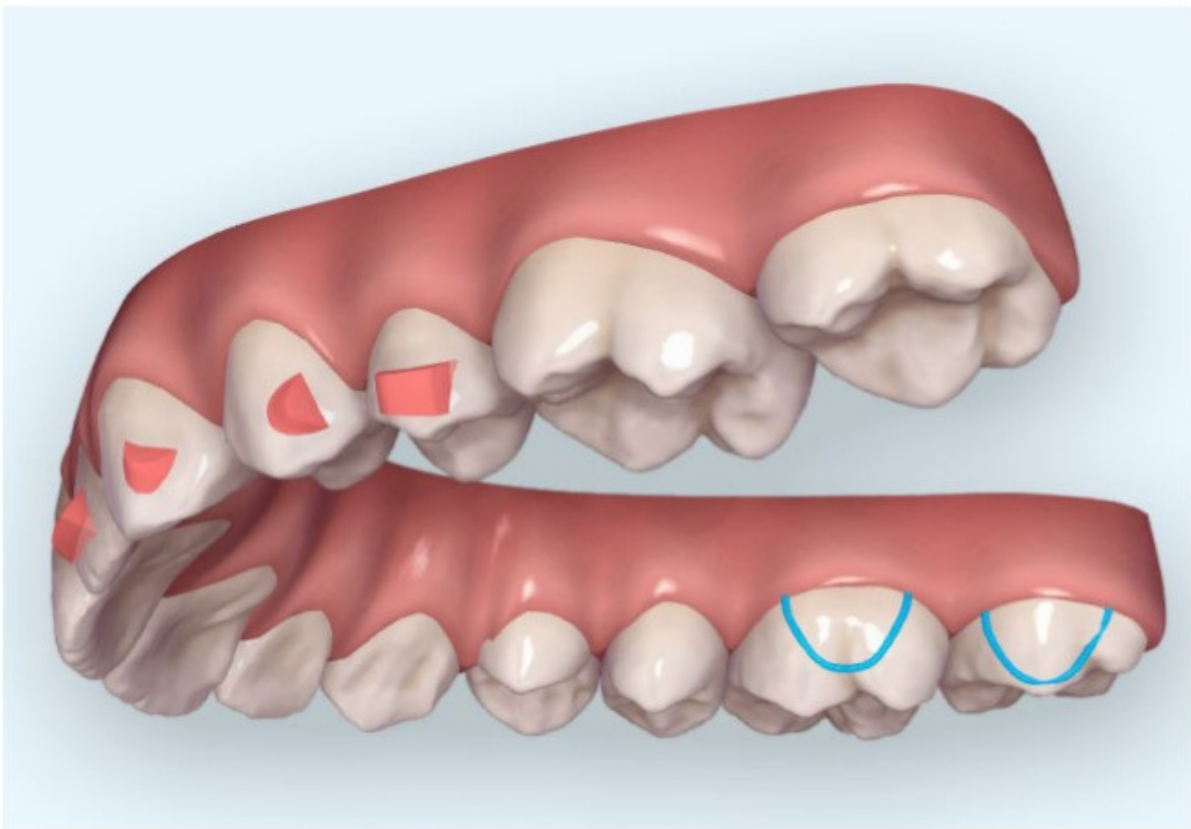


IMAGE 7-11

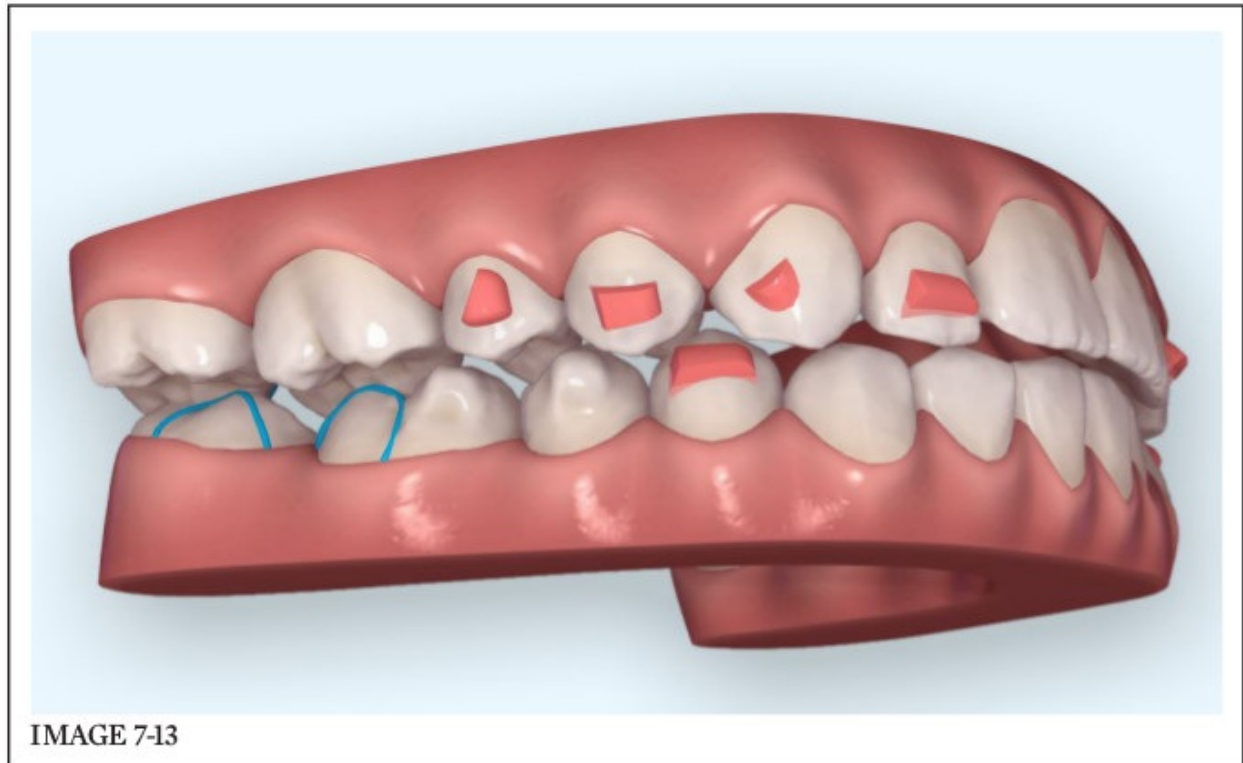


IMAGE 7-12

One final consideration for transverse dimension problems being treated with Invisalign clear aligners is over-treatment. For example, in the same patient we looked at in the last set of images, this is what the final ClinCheck stage looks like (image 7-13). Notice over-treatment of the expansion from mandibular constriction in the arch and additional expansion in the maxillary arch. A good rule of thumb in a case like this with a unilateral cross bite would be 3mm of additional expansion past ideal.

This patient is now set up for success for two reasons:

1. We use cross elastics to aid in the movement.
2. We have over-treated the ClinCheck plan to place additional forces on the teeth to achieve the desired result.



CHAPTER SUMMARY

When it comes to treating transverse problems with Invisalign clear aligners, it is important to remember that correction of dental cross bites is more predictable than skeletal cross bites. Carefully considering whether your ClinCheck treatment plan follows sound orthodontic principles that will help you achieve predictable cross-bite correction in the right cases, and avoid frustration in those patients where correction is less predictable. The use of cross elastics and 2mm of expansion over treatment will increase the predictability of correction of transverse dimension problems, reduce the number of case refinements, and help achieve excellent results on a consistent basis.

CHAPTER 8

Attachments

Attachments are integral to successful Invisalign treatment, and a good understanding of the different types and their applications will help to improve the outcomes of your cases. There are fundamentally two types of attachments. These can be categorized as either *optimized* or *conventional*.

OPTIMIZED ATTACHMENTS

Optimized attachments are automatically placed by the software and are one of many Smartforce® features that are engineered to place the required force systems on the teeth to get the desired movement. They are customized individually for each tooth using the concept of biomechanics. If we can develop the appropriate force systems to be placed on a tooth or group of teeth, we can then achieve the desired tooth movement.

Optimized attachments are engineered for a variety of tooth movements, and they are placed automatically by the software. It is important to note that they cannot be requested. You cannot write on your prescription, “Please give me an optimized rotation attachment.” The technician will write back and inform you that this is not possible.

TYPES OF OPTIMIZED ATTACHMENTS

Let’s look more closely at the various types of optimized attachments:

Rotation — there are optimized attachments for rotation of canines and premolars. For example, in the patient (image 8-1) who has a rotated maxillary canine, there is an optimized rotation attachment placed on the canine with the *active surface* of the attachment oriented to allow the aligner to place the correct force system to achieve correction of the rotation. The active surface is what I call the “business end” of the attachment. The active surface is oriented in the proper direction so the aligner can place the appropriate forces on this tooth to

achieve the desired movement, which in this case is distal-in rotation along with distal root tip.



The aligner shape is activated, which means it changes at each stage to maintain the force system at the appropriate levels — and they work quite well. This is the same patient, Jessica from chapter 3, clinically before treatment (image 8-2) and after one year of treatment with no refinements required (image 8-3). As you can see we achieved effective rotation with the use of optimized rotation attachments.



IMAGE 8-2



IMAGE 8-3

Extrusion — these are the second kind of optimized attachments. For example, with this patient, Michelle from chapter 5, (image 8-4) with an anterior

open bite, we are looking for absolute extrusion of the upper incisors. The active surface of this attachment is oriented in such a way as to allow the force system of that aligner to be perpendicular to the active surface of the attachment. We use this kind of force system to achieve extrusion of these teeth and closure of the open bite. Here is the same patient clinically (image 8-5) before treatment and after eight months of Invisalign treatment (image 8-6). Optimized extrusion attachments may be on single teeth or groups of teeth when multiple extrusions are required.

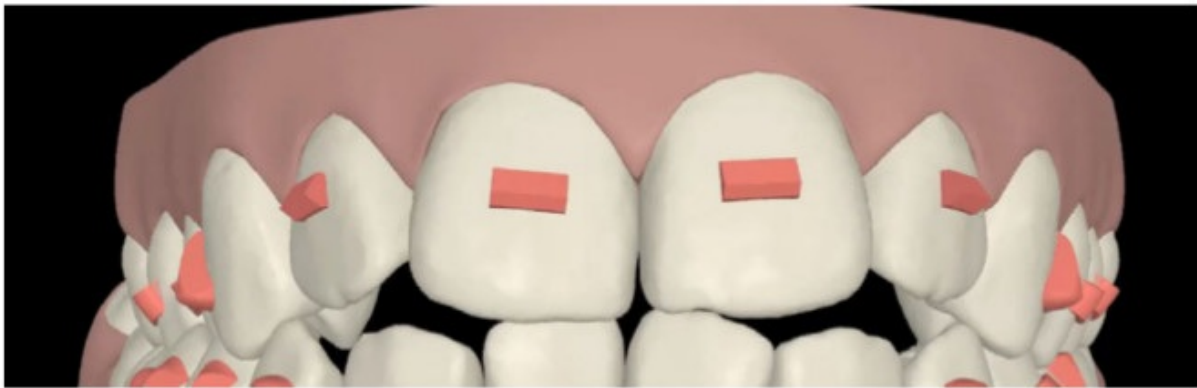


IMAGE 8-4



IMAGE 8-5



Root control — these attachments are the third type of optimized attachment. Let's take a look at the panoramic radiograph of a patient (image 8-7) who is congenitally missing the UL2. The treatment plan revolves around distalizing the upper canine to prepare a space for an implant. This movement is challenging, and we need to have crown and root movement at the same time. An optimized root control attachment (image 8-8) will help put the appropriate force system on the UL3 to achieve bodily movement to prepare a space for a future implant.



IMAGE 8-7

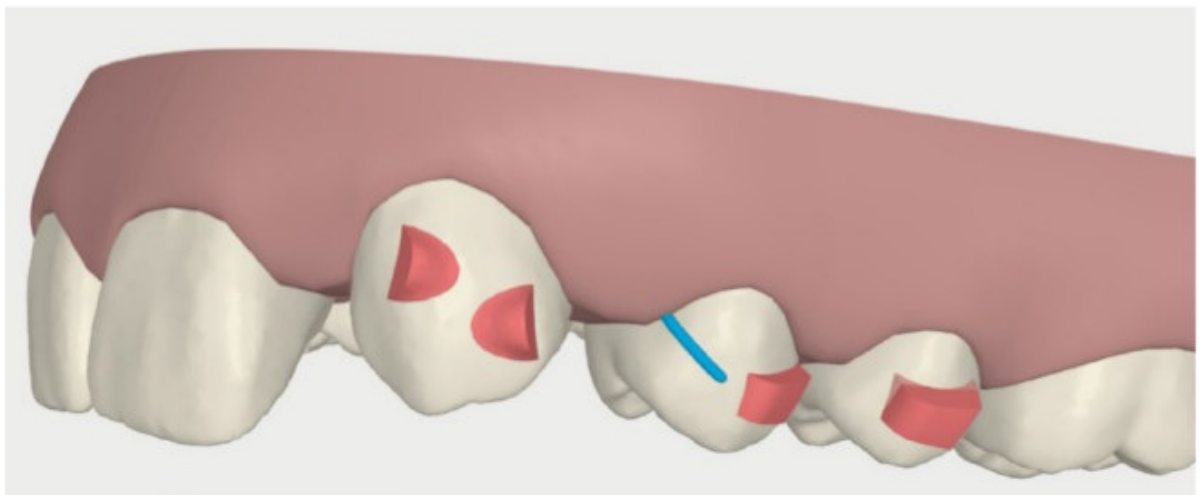
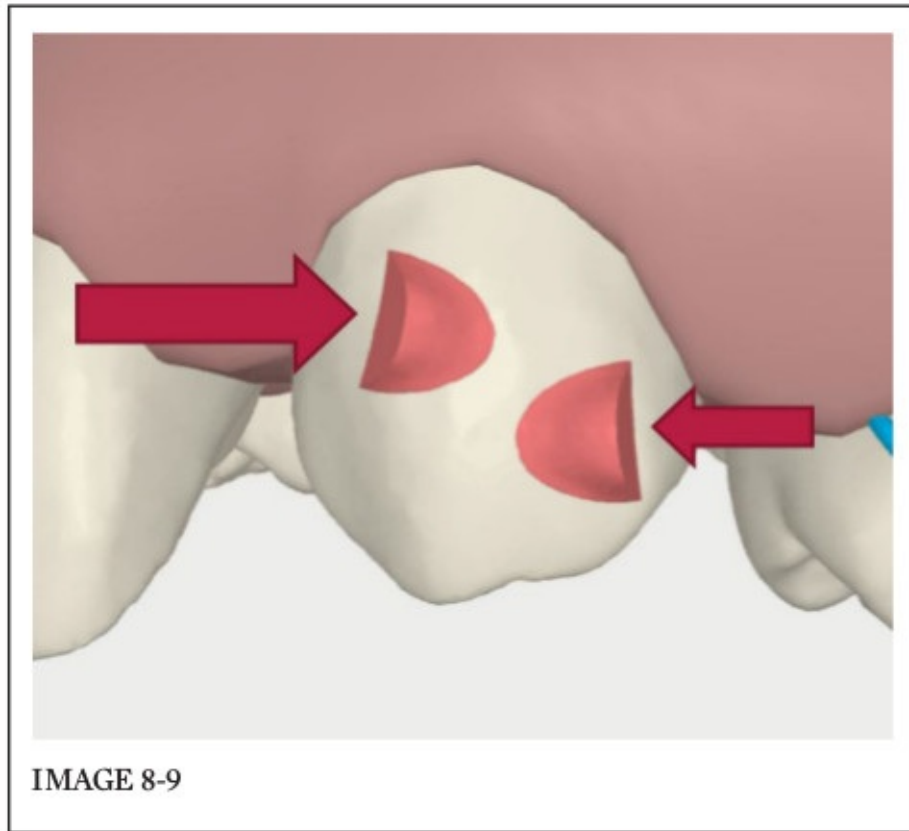


IMAGE 8-8

Note: The force systems being applied to the UL3 are not a couple, meaning that the aligner is not placing equal and opposite forces on this attachment. The forces are modulated to give you the desired tooth movement. In this case, the larger distal force is acting on the gingival attachment and a smaller mesial counter force is acting on the incisal attachment (image 8-9). These forces are

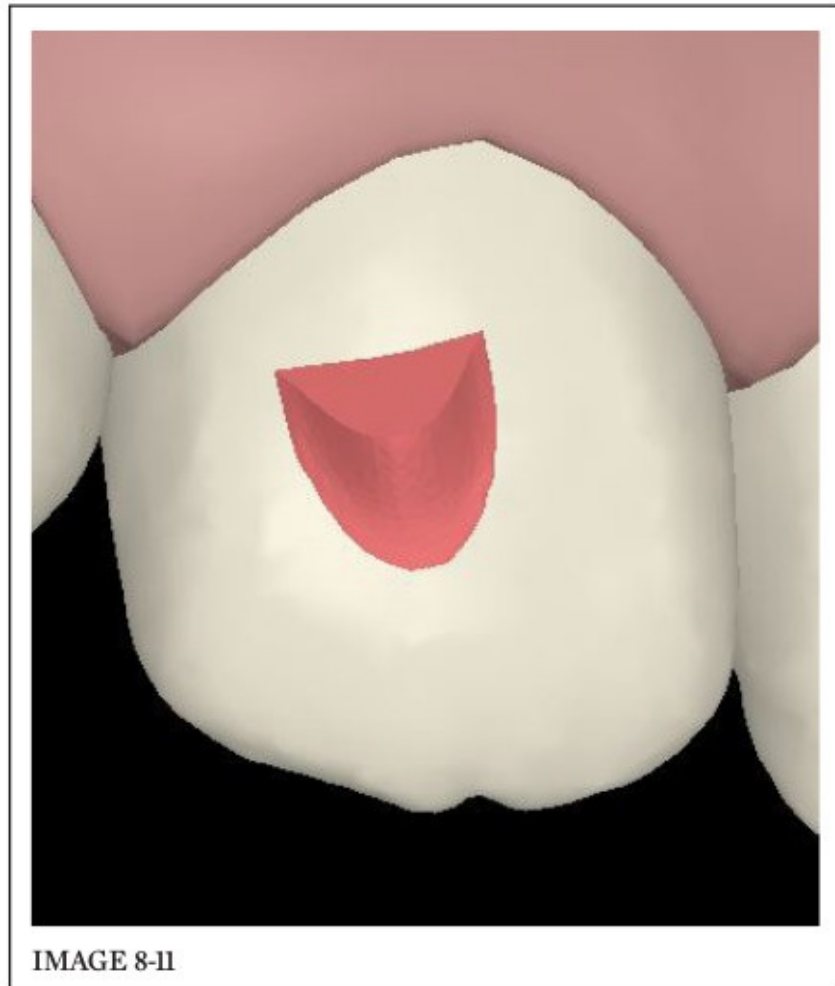
adjusted automatically to achieve bodily movement or root movement depending on the case.



Here is the panoramic radiograph of the same patient (image 8-10) after 20 months of treatment where appropriate root movement for im- plant-space preparation was achieved.



Multiplane — these attachments appear on maxillary lateral incisors when root movement and extrusion are simultaneously required (image 8-11).



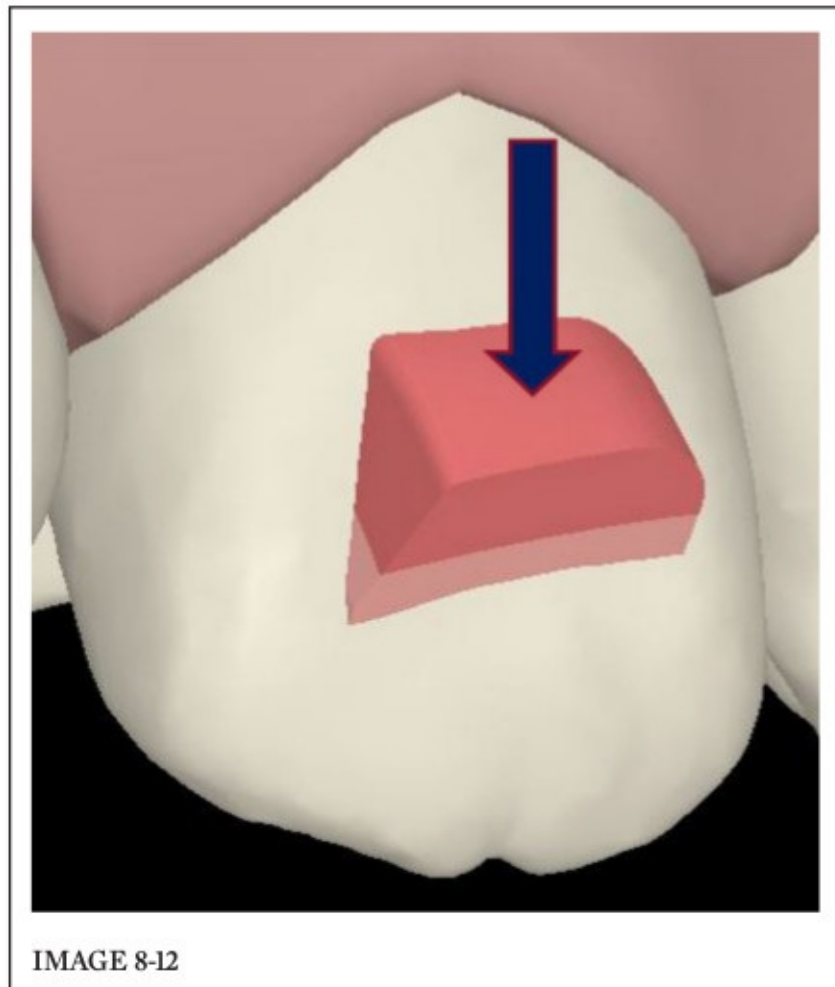
Support — Invisalign G5 introduced optimized deep-bite attachments for premolar teeth to support leveling of the lower Curve of Spee, and Invisalign G7 introduced optimized maxillary lateral support attachments when absolute intrusion of either the maxillary central incisors or maxillary canines is required.

CONVENTIONAL ATTACHMENTS

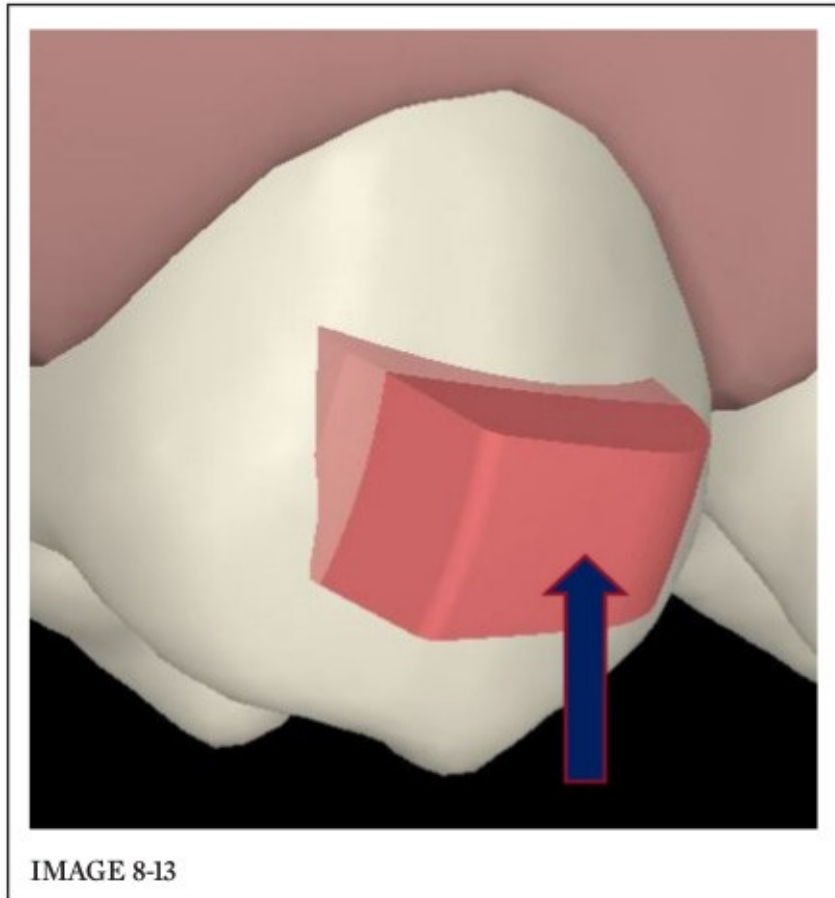
Conventional attachments are the second type of attachments. Conventional attachments can be ovoid, rectangular, beveled or non-beveled, and oriented horizontally or vertically. They are used for the following: aligner retention and anchorage, to support intrusion, extrusion or root control. Conventional attachments can be requested or you can place them yourself using 3D Controls in *ClinCheck Pro*.

Examples include:

Gingivally beveled rectangular attachments — (image 8-12) the direction of the bevel is how we use nomenclature. The bevel is sloping toward the gingival aspect of the tooth. Gingivally beveled attachments come in handy for many situations that we will explore in this chapter.



Occlusally beveled attachment — (image 8-13) the bevel is slanting toward the occlusal surface. This type of attachment is used for aligner retention to support leveling of the Curve of Spee, and to support absolute extrusion on posterior teeth.



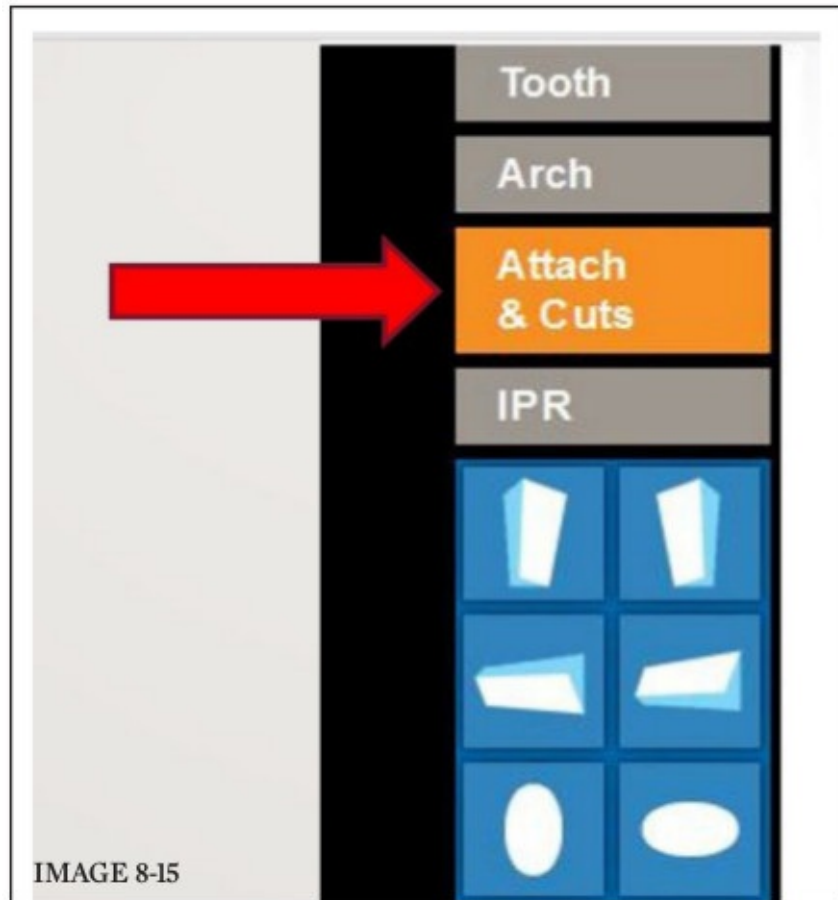
Vertical attachments — (image 8-14) this kind of attachment is used for root control. Vertical attachments may be beveled either mesially or distally.



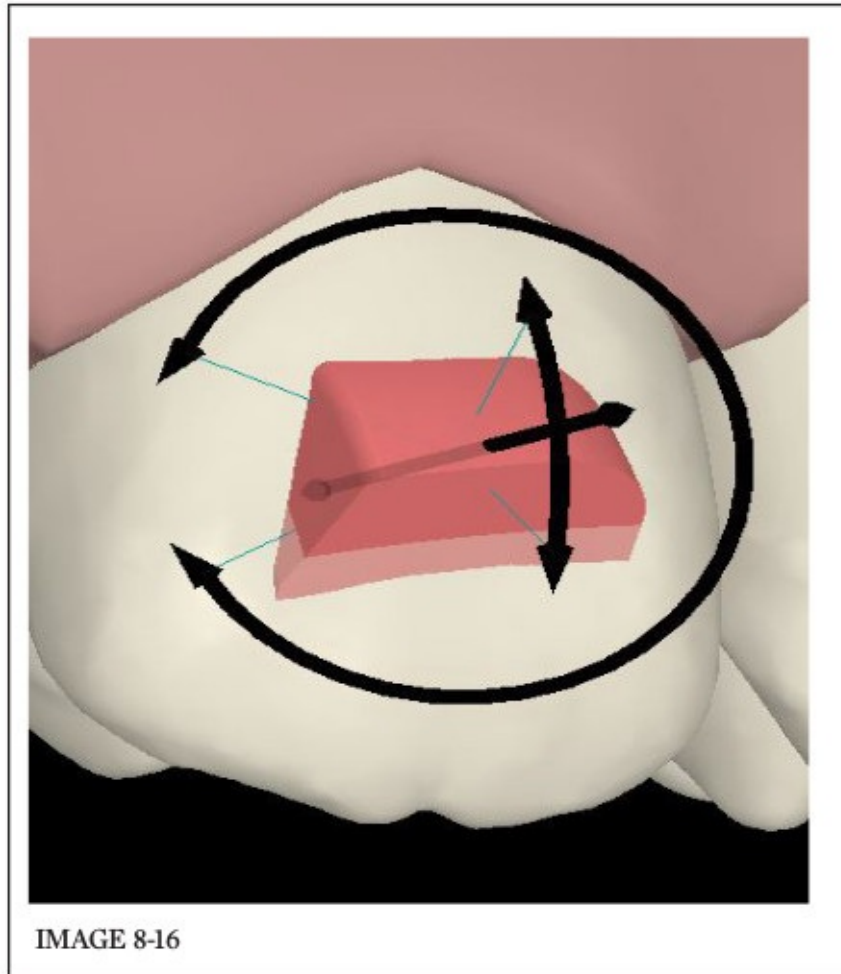
Ellipsoid attachments — (image 8-14) these attachments are not in my typical armamentarium

OPTIONS FOR ATTACHMENT PLACEMENT USING CLINCHECK PRO

ClinCheck Pro gives you options for the design and placement of conventional attachments under 3D Controls. Under “**Attachments and Cuts,**” (image 8-15) you can drag and drop a variety of conventional attachments into your ClinCheck treatment plan.



Conventional attachments may be customized. Options include (image 8-16):



- **Resizing the attachments** by clicking on the attachment already placed on the tooth and selecting either 3, 4 or 5mm in length.
- **Changing the orientation** of the attachment either by rotating the attachment in any direction you want. Push the attachment into the tooth by clicking on it and grabbing the black line to push the attachment in or out of the tooth to change the orientation of the attachment through rotation.

Finally, I want to encourage you to do some of these moves yourself using 3D Controls in *ClinCheck Pro*. It's easy and quick. You can put the attachments exactly where you want them. It's a time-saver once you get the hang of it and learn how to get the attachments exactly right.

Give 3D Controls in *ClinCheck Pro* a try. Simply drag and drop the desired attachment where you want it. If you make a mistake, you can click on the

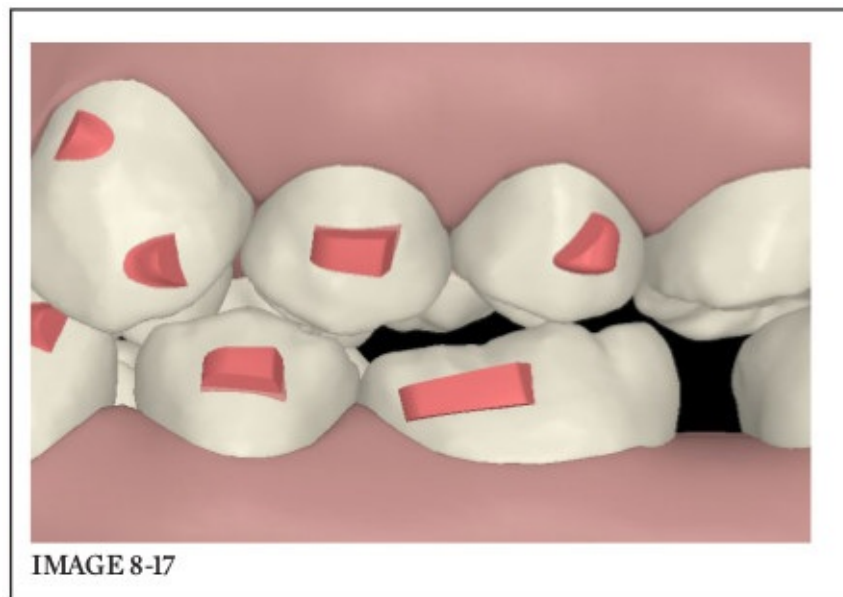
“Undo” button one move at a time. If you feel like you really messed up your ClinCheck do not panic! Go back to your “Reset” button and reset everything back to the way it was when you started.

Note: 3D Controls are not available in *ClinCheck Web*.

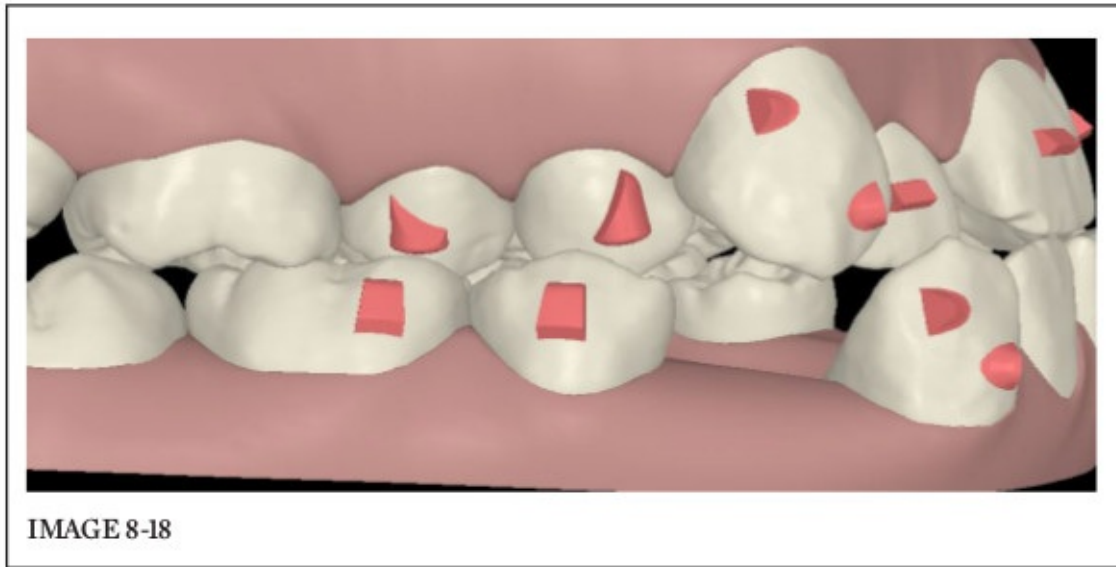
RULES OF THUMB

Here are two important rules of thumb when placing conventional attachments on teeth:

Horizontal attachments for vertical movements — use these attachments when placing attachments for vertical tooth movements. In this case (image 8-17) I am looking for vertical movement to erupt the mesial aspect of the LL6. Since it is a vertical movement, I have placed a horizontal rectangular attachment on that mesial aspect of the LL6 to give additional grip and push surface to get that movement. In this case, I used a horizontal attachment to achieve vertical movement.



Vertical attachments for horizontal movements — in this ClinCheck plan (image 8-18) a vertical attachment will effect horizontal movement of the LR5 and the LR6. These attachments will support the horizontal translation of the teeth. When horizontal movement is desired, think vertical attachments.



HOW TO DECIDE WHAT ATTACHMENTS TO USE?

In deciding on what attachments to use on a particular case, this is where the ClinCheck list comes in handy. You have choices: optimized, retentive and substitutions. You will have cases where you want to accept optimized attachments just the way they come from your technician.

ATTACHMENTS

Optimized

Optimized attachments — these work well for cases that don't have significant vertical, sagittal or transverse problems. For example, simple Class I Crowded cases where the optimized attachments work great just the way they are without any major modification.

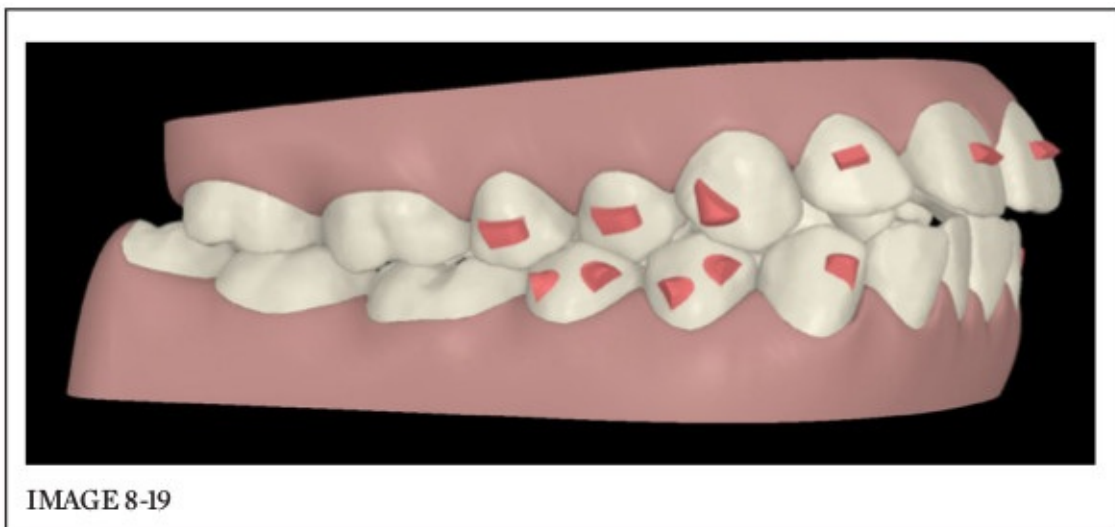
Retentive

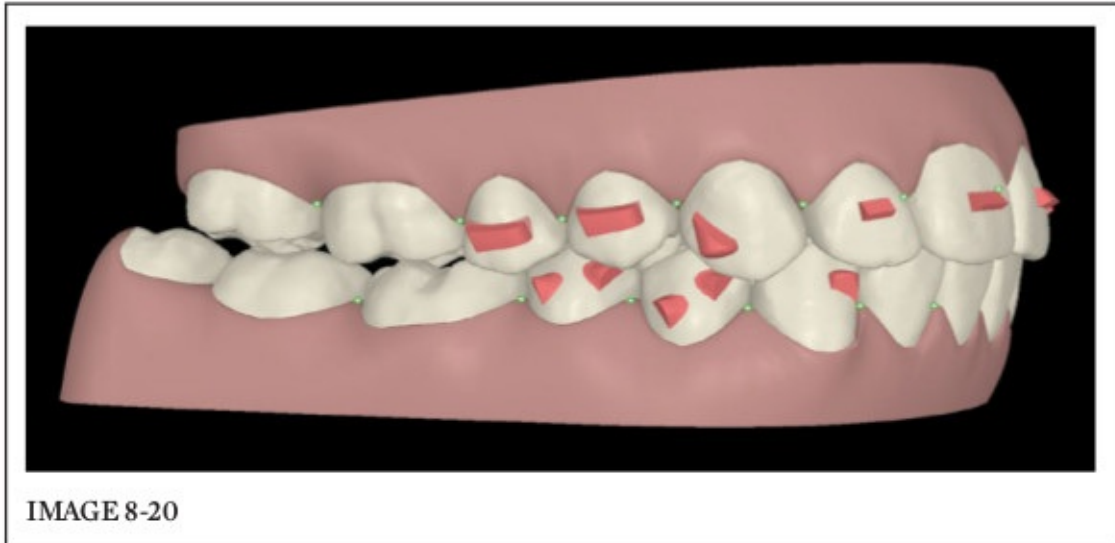
Retentive attachments come in handy in situations where you are looking for additional aligner retention, for example, when you are running Class II elastics off precision-cut elastic hooks on the lower first molars as described in chapter 6. Placement of an occlusally beveled rectangular attachment on the mesial surface of the molar provides additional retention to prevent the aligner from dislodging as a result of the vertical vector of force from the CL II elastic.

Substitutions

Substitutions — there are times when I will substitute one attachment for another. An example would be in cases where I am looking for additional aligner retention in a case with a teen patient with short clinical crowns. It may be a case where there is a conflict with a precision cut, where I will take the optimized attachment off and place a conventional attachment so I can have an attachment and a precision cut on the same tooth.

Additional anchorage attachments — there are times when I will substitute additional anchorage attachments to support either absolute intrusion or absolute extrusion. An example would be in cases where I want to close an anterior open bite through the use of absolute intrusion of the upper molars (images 8-19, 8-20). We do not need attachments on molars since there are plenty of push surfaces. I do need anchorage, however, on the adjacent premolars to support the intrusion. Think again of Newton’s third law. The “action” is intrusion of the molars, while the “reaction” will tend to make the aligners slip off from the adjacent premolars, which I do not want to have happen. This case is where I will go into 3D Controls in *ClinCheck Pro* and select attachments and cuts. I am going to increase the size of the retentive attachment on upper 4’s and 5’s to give me additional aligner grip to support absolute intrusion of the molars.





Another example of attachment substitution would be in Ava's case (from chapter 6). Toward the end of her treatment, the UR1 and UL1 required absolute intrusion to complete her case. Today, Invisalign G7 optimized support attachments would be placed by the software, but these attachments were not available when Ava was treated. I therefore substituted 4mm-long, gingivally beveled rectangular attachments on the UR2 and UL2 to provide additional aligner grip to support the intrusion of UR1 UL1 (images 8-21-8-23).

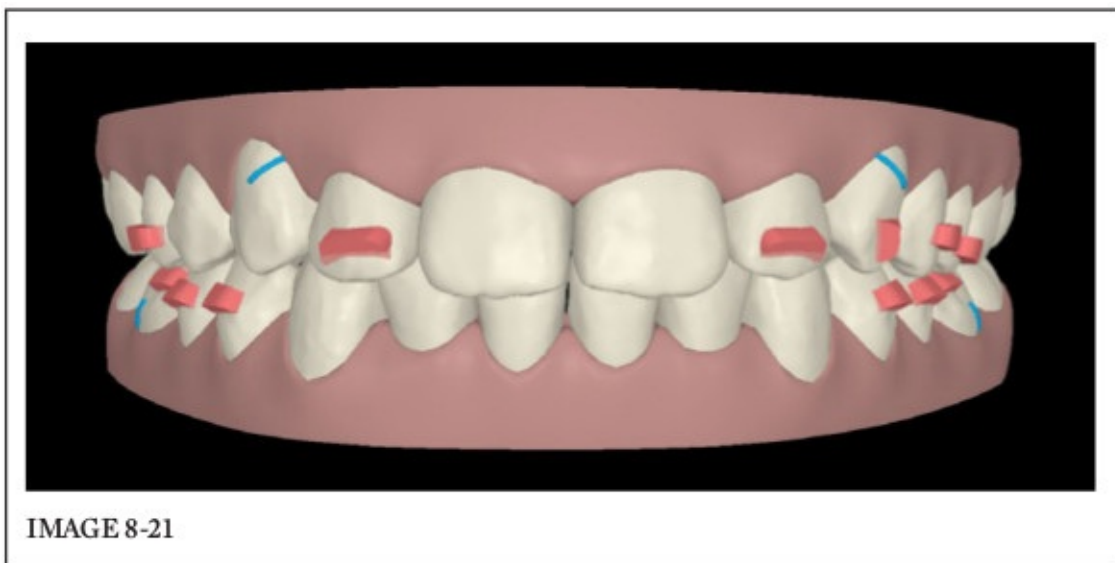




IMAGE 8-22



Note the size and placement of these attachments in image 8-21. For cases like Ava's requiring absolute intrusion of the upper central incisors or for cases requiring absolute extrusion of the upper laterals, I make two modifications that help make these attachments perform very well. First, I use *3D Controls in ClinCheck Pro* to rotate the bevel completely to the gingival. This provides for a long, forgiving gingival bevel that has a broad, flat surface for additional aligner grip. The second move is to move the attachment 2mm from the incisal edge of the tooth, where the aligner plastic is stiffer and grip is at its greatest. I use these modified attachments frequently and find them to work very well.

The third common attachment substitution occurs when a deep over- bite requires correction, as in Haley's case from chapter 5 (images 8-24- 8-26). To support the leveling of the lower Curve of Spee, 4mm-long, occlusally beveled

rectangular attachments are added to the lower 4's and 5's to support the lower incisor intrusion.

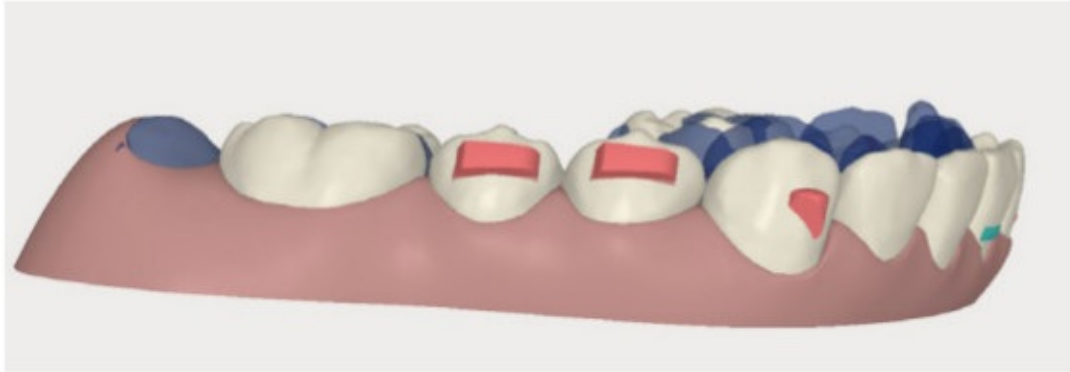
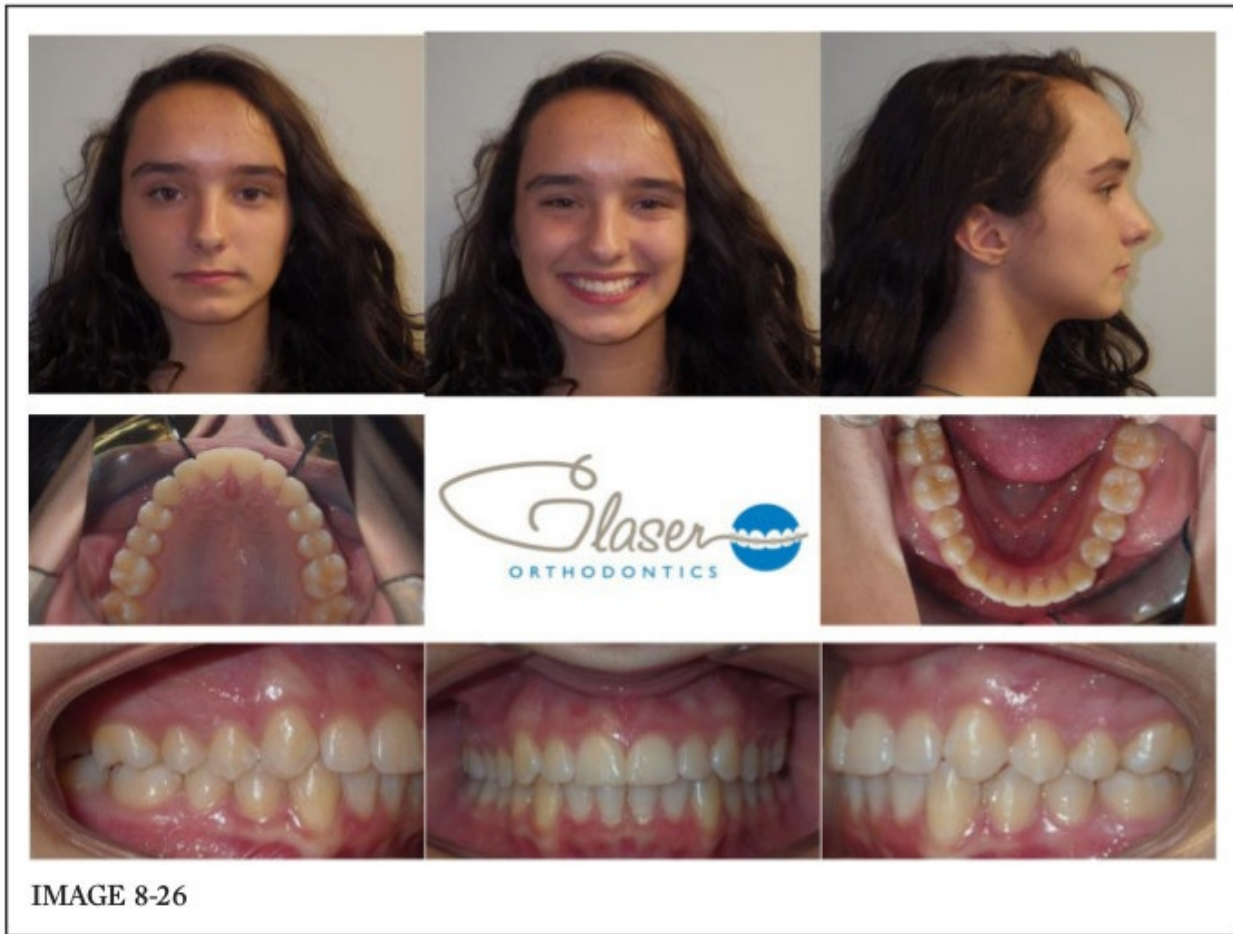


IMAGE 8-24



IMAGE 8-25



Note to the reader: It may seem contradictory to bevel the retentive attachments on the lower 4's and 5's *occlusally*, while the retentive attachments on the upper 2's are beveled *gingivally*. Here is why it works — in the buccal segments, the forces of occlusion work to keep the aligners engaged, and the 90-degree gingivally oriented “ledge” provides maximum aligner grip to support the lower incisor intrusion. On the upper lateral incisors, however, there are weaker occlusal forces and “failure mode” is a greater possibility. The long gingival bevel on the upper 2's, while somewhat less retentive, are more forgiving if there is a small degree of non-tracking.

CHAPTER SUMMARY

Understanding the different types of attachments and how to handle them are critical to achieving excellent treatment results. This chapter deals with the

most common situations that arise during Invisalign treatment. If you do not find the information you need in this chapter, go to your Invisalign Doctor Site (IDS), click on the “Education” tab, and in the “Search” box type “attachments”. You’ll find pages of videos and papers written to help guide you through any specific clinical problem that is not covered in this chapter.

CHAPTER 9

IPR and Staging

Inter-Proximal Reduction (IPR), removal of enamel in-between the teeth, is indicated for specific issues. The number one reason is to **alleviate crowding**. From chapter 1, a basic Invisalign principle is that *teeth need space to move*. In a patient that presents like Jessica, from chapter 3 (image 9-1) IPR can be a useful to gain arch length to resolve the patient's crowding. The ClinCheck list will help guide you through the important IPR decisions:

IPR

Round Trip to Stage _____ Amount: U Ant _____ L Ant _____ U Post _____ L Post _____



IMAGE 9-1

To explain:

Round Trip to Stage — *round tripping*, temporary proclination of the upper or lower incisors is a useful technique to improve access for IPR. In many cases, it is not necessary to procline the anterior teeth so far forward to perfectly align the interproximal contacts before performing IPR. I will “read” my ClinCheck plan and determine the stage at which the contacts are sufficiently aligned to gain safe access to perform IPR. “Round trip to Stage” indicates at which ClinCheck stage the proclination ends and the IPR begins. This can both significantly shorten treatment time by reducing the number of stages, as well as prevent excessive proclination, which may lead to gingival recession and/or bone loss.

Amount: U Ant/L Ant/U Post/L Post — fill in the amount and location of the IPR you would like to perform in these fields.

JESSICA’S CLINCHECK LIST

To explain, in Jessica’s lower arch, 0.3mm of IPR will be performed after the lower anterior teeth have been round tripped to stage 13. The lower incisors are not perfectly aligned at stage 13, however the contacts are comfortably accessible.

CLINCHECK TREATMENT PLAN

The patient’s ClinCheck plan (see Image 9-2) indicates the use of 0.3mm of IPR from lower canine to lower canine to create room to resolve the lower incisor crowding. At the end of treatment, the lower arch is well aligned (see Image 9-3).

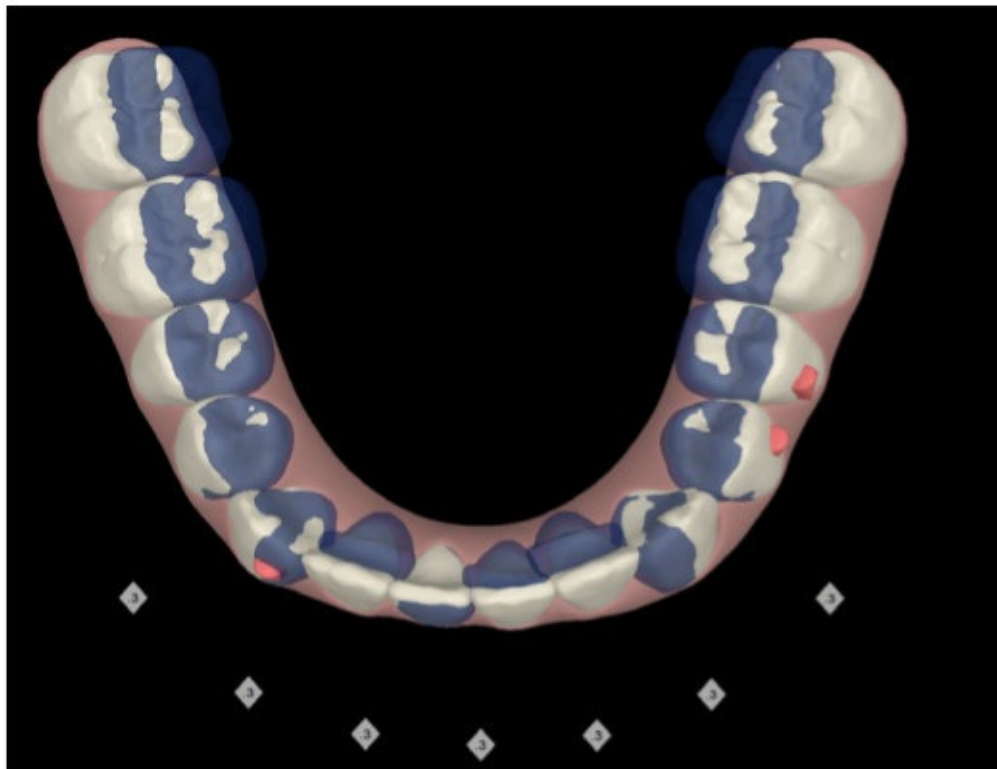


IMAGE 9-2



IMAGE 9-3

Instructions to the technician: *Round-trip to improve access for IPR.*

THE SECOND USE OF IPR — BOLTON DISCREPANCY

The second indication for IPR is to adjust for a Bolton Discrepancy, also known as a tooth-size discrepancy. When a patient has a tooth-size discrepancy as a result of narrow maxillary lateral incisors, the choices for managing a Bolton Discrepancy are:

- IPR in the lower arch
- Leave space for esthetic build-ups of the narrow maxillary laterals
- Leave space somewhere else in the maxillary arch

In cases where the maxillary lateral incisors are not esthetically too narrow, lower arch IPR is an effective way to normalize the Bolton ratio and help finish with a normal occlusion.

THE THIRD USE OF IPR — REDUCTION OF OVERJET (OR UNDER BITE)

The third use of IPR is to reduce overjet in Class II cases or under bite if the

patient is Class III. For example, in a case like the one depicted in image 9-4, the patient presents with a Class III malocclusion. In this case, IPR has been added in the lower arch to create additional space to aid in the retraction of the lower canines and couple them into Class I. This case in particular also has the use of Class III elastics to enhance the correction of the Class III malocclusion. Posterior IPR is being applied to both sides to help couple the canines.



IMAGE 9-4

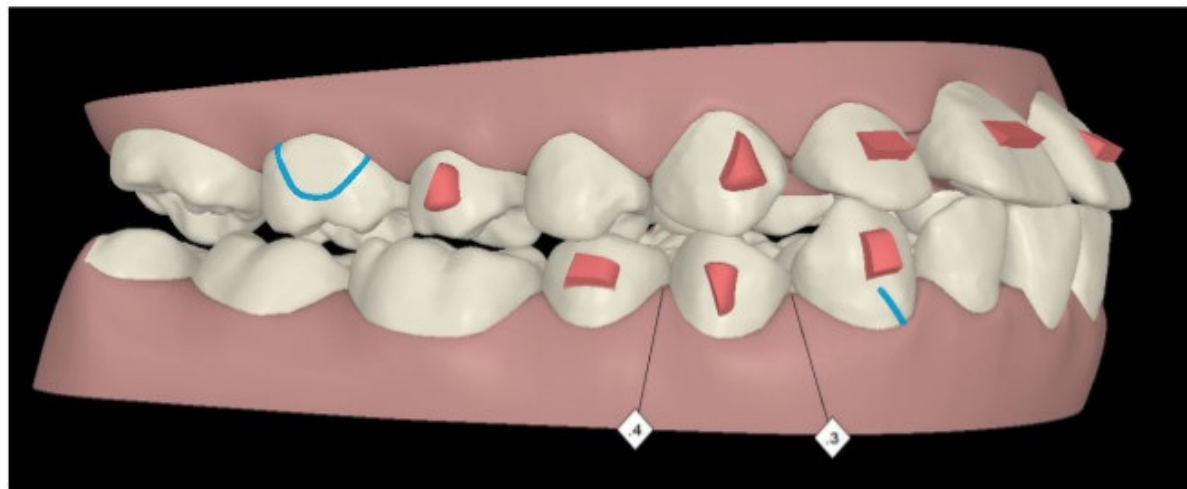


IMAGE 9-5

This ClinCheck view (see Image 9-5) is of the patient set up for Class III elastics and lower posterior IPR to retract the lower interior teeth to improve the coupling of the incisors and canines. The final result can be seen in image 9-6.



IMAGE 9-6

FOURTH USE OF IPR — REDUCE HEAVY ANTERIOR OCCLUSAL CONTACT

The fourth use of IPR is to reduce the heavy anterior occlusal contact. If you have treated enough patients with Invisalign clear aligners this image (see image 9-7) probably doesn't look all that unfamiliar. There are cases where we have to manage posterior open bites. In my experience the vast majority of post-anterior open bites are due to heavy anterior contact. In this case IPR was added to the lower arch in order to retract the lower incisors to relieve the heavy anterior occlusal contacts and settle the posterior open bite (image 9-8).



IMAGE 9-7



IMAGE 9-8

CLINCHECK TREATMENT PLAN

This ClinCheck set-up (see Image 9-9) is how the posterior open bite was resolved. You can see the IPR is creating space to retract the lower anterior teeth supported with Class III elastics to allow for auto-rotation of the mandible and closure of the posterior open bite. The final ClinCheck stage depicts the expected resolution of the problem (image 9-10).

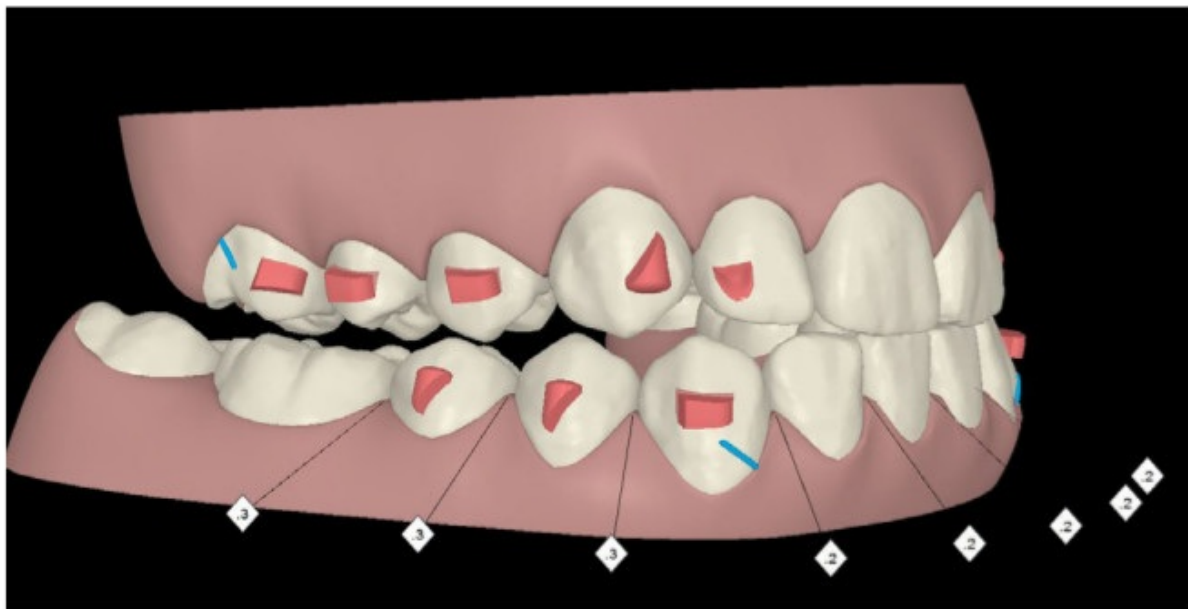


IMAGE 9-9

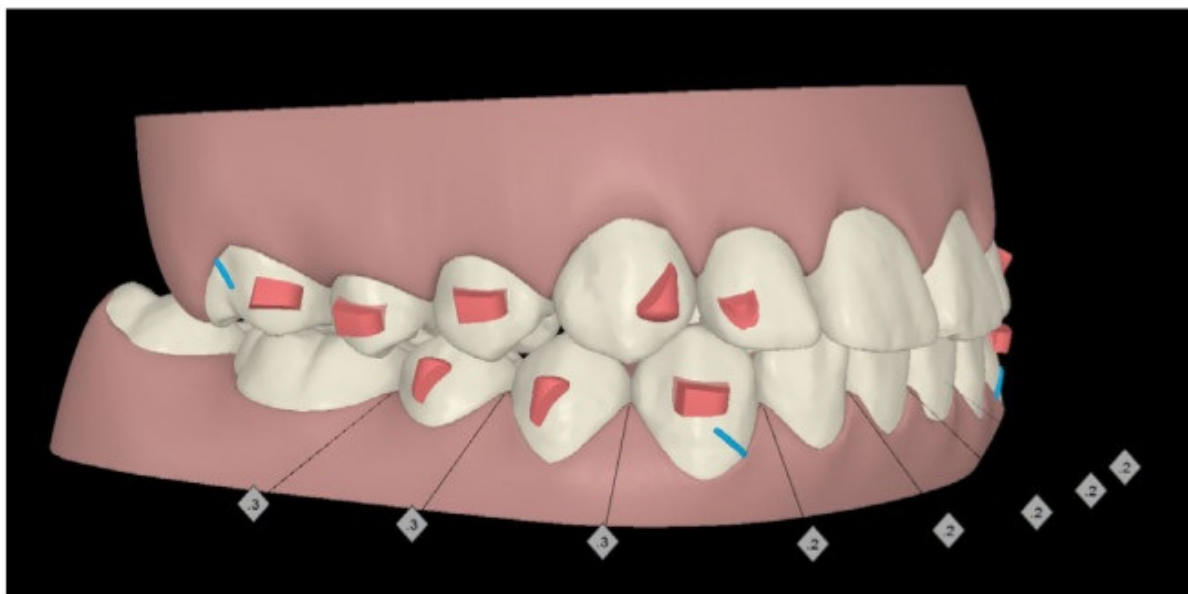


IMAGE 9-10

FIFTH USE OF IPR — MANAGEMENT OF DARK TRIANGLES

IPR to reduce the appearance of dark interproximal triangles is common in

some adult patients who have lost some papilla. This patient (see image 9-11) was unhappy with the dark triangle between the UR1 and UL1.



IMAGE 9-11

CLINCHECK TREATMENT PLAN

The ClinCheck plan (image 9-12) was set up with IPR in the maxillary arch in order to create space for the retraction of the upper incisors and improvement of the dark triangle. The final results show improvement of the dark triangles through the use of IPR (see image 9-13).

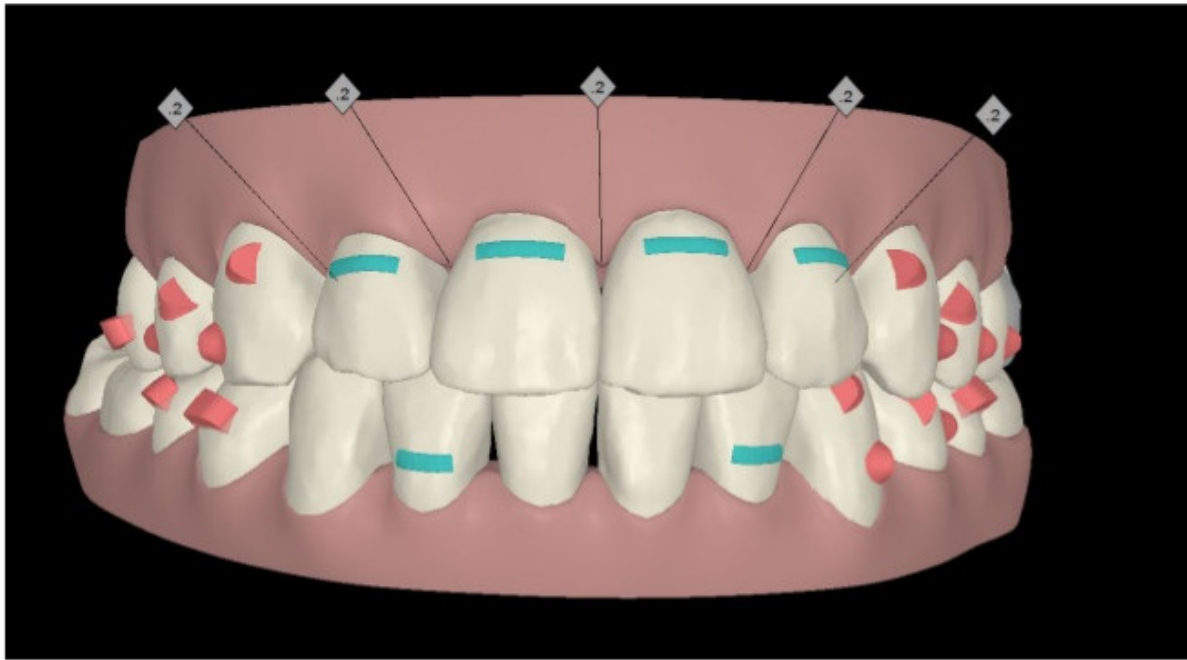


IMAGE 9-12



IMAGE 9-13

IPR TECHNIQUE

There are several techniques for IPR including the use of **manual diamond/polishing strips**. If you prefer this technique you would start off with

the thinnest strip possible to open interproximal contact. Use a gentle back-and-forth motion until the strip is passive. Then migrate to a thicker strip to widen the contact. Work to the thickest strip needed.

The second option is the **use of slow-speed diamond**. Start on the facial using slow RPMs and engage the disk against the tooth surface. Start on the facial and then gradually work through the contact. Starting on the facial will greatly reduce the chances of ledging.

The third technique is the use of a high-speed bur where you break interproximal contact with light, even, brush-like movements. Water spray is used to help reduce clogging and overheating of the bur.

PROCEDURE

As far as the procedure goes you will get a treatment overview sheet in every box that indicates the amount of IPR that needs to be done and what stage by which it needs to be performed. Review the IPR amounts on the form included in the aligner box and determine the appropriate IPR method. Confirm the amount of interproximal enamel removed with thickness gauges. Feel for tactile resistance when the proper amount has been removed and the reason you do it that way is that you would then want to go in and polish the interproximal surface with polishing strips, until adjacent surface is rounded and smooth. Then verify the final gap dimension with thickness gauges and record the date and amount of IPR in the patient record.

INSIDER TIPS FOR IPR

Tip 1: When working with teen patients makes sure you discuss IPR with the parents three different times. A nice brochure is available from the AAO that you can review IPR in detail — and we give that to the patients and their parents on the first visit. The second time we discuss IPR is at the scan or impression appointment. The third time to discuss the IPR procedure is right before we begin — and to discuss it in particular with the child. Sometimes the kids come back to the treatment area and the parents stay in the waiting room.

The last thing I want to have happen is for the kid to walk out into the waiting room with possibly bloody aligners. With the papilla high up in teen patients it is possible to cause gingival bleeding. I don't want the parents to be upset. Parents often forget the first two discussions about IPR. We discuss it one more time right before we're going to do it and that way everyone is on the same page and understands.

Tip 2: Slightly under do it. For example, in the previous case that called for 0.3mm of IPR, I'll start off and perform 0.2mm and then monitor contacts. If contacts are not tight we'll continue on the aligners and monitor any areas where we might go back with a strip and lighten the contacts. I have found by slightly under doing the IPR initially it helps to reduce the chances of open contacts at the end of treatment.

STAGING

In discussing staging, we look at two areas of importance: attachment placement and timing of IPR. What is the big deal about staging? Staging your procedures will increase the efficiency of your practice. We want to be profitable with our Invisalign patients and we don't want to have unnecessary appointments. Staging helps reduce office visits and patients appreciate not having to come to your office more than necessary. Let's look at the ClinCheck list:

For example, with our patient Jessica (see image 9-14), we gave her six sets of aligners at the beginning of treatment (note that this protocol was used for two week aligner changes). At the start of her treatment we insert aligner number one and then give her aligners two through six, and each set is worn for two weeks. This approach means Jessica is going to return in twelve weeks to have aligner number seven inserted, which means I want to stage important events at the time she will be returning for her regular appointments. Specifically, the events are *performance of IPR* and *placement of new attachments*. In my office, since we dispense six sets of aligners per visit that would be for stages seven, 13 and 19.



IMAGE 9-14

It may seem trivial, but if Jessica comes back to the office for her regular appointment and she's ready to insert stage seven and my staff says, "Dr. Glaser, she has to come back in at stage 8 to have an attachment put on," that is a visit we really didn't need to have. Whatever your normal interval of seeing patients, for example, at every eight weeks then you would adjust your procedures accordingly. On your ClinCheck you want to plan for IPR and new attachments at regular intervals, which will help to reduce maybe two, three or maybe four visits per treatment — and that time adds up.

Why in the middle of treatment would a new attachment appear? Sometimes there are incompatible features such as the example where you can't have a power ridge on a tooth at the same time you have an attachment. So for patients that need root torque first, then extrusion you may have multiple stages where a power ridge exists on a tooth and at some point on your ClinCheck you may

need extrusion and that is when you'll see an attachment appear.

Staging allows you to:

- Reduce the total number of appointments
- Increase office efficiency
- Reduce chair time
- Please your patients at the same time

Note: A new development in Invisalign aligner treatment is seven day aligner changes. For those patients that I deem acceptable to change their aligners every seven days,, at the start of treatment the patient inserts the initial aligner on day number one, and we give the patient aligners numbered two through eleven. This corresponds perfectly with the new, smaller aligner boxes. The patient leaves with the entire box, which both keeps the aligners organized for the patient and greatly reduces our box-storage needs!

CHAPTER SUMMARY

IPR and staging are important items to manage on each and every patient. Proper IPR technique and staging of events such as new attachment placement can help ensure treatment proceeds smoothly and appropriately.

CHAPTER 10

Over Treatment and Over correction

Why do we consider over treatment in our Invisalign ClinCheck plans? In Chapter 1, we explored the similarities between pre-adjusted “straightwire” appliances and Invisalign clear aligners.

Let’s look again at pre-adjusted edgewise appliances. In straightwire appliances the braces are pre-adjusted, meaning the tip, torque, ins and outs, and rotation are pre-built into the brackets, the concept being that a *straight wire* placed into this system should align all of the teeth. As we know “straightwire” really isn’t straightwire. What I mean by that is as orthodontists we don’t routinely “throw in a wire” and the case somehow magically treats itself.

A short list of reasons why braces are not “self-treating” are:

- Anatomical differences between patients
- Variations in tooth size, shape and anatomy
- Skeletal variations
- Differences in bone density
- Play between wire and slot
- Genetic differences between patients

Because of those differences we’re not “doing” straightwire; we’re practicing orthodontics. It’s the same approach with Invisalign treatment. We are not “doing Invisalign”. Instead we are performing orthodontics with the Invisalign appliance. Despite there being a tremendous amount of science and engineering built into every aligner, these genetic and anatomical differences from one patient to another means we are the doctor, adjusting along the way for the individual needs of each patient. Adjustments we do make up for these differences.

Based on that premise, these are the four areas to consider over treatment in

the ClinCheck list:

- Deep/Open Bites
- Tip
- Torque
- Expansion

DEEP BITES

In chapter 5 we discussed the treatment of problems in the vertical dimension. In this chapter, we explored over-engineering moves to successfully manage deep bites. Just like with the patient (see Images 10-1, 10-2) who presents with a deep bite, if this patient were being treated with fixed appliances it would be quite reasonable to place a reverse-curve arch wire to help level the lower Curve of Spee (see Image 10-3).



IMAGE 10-1

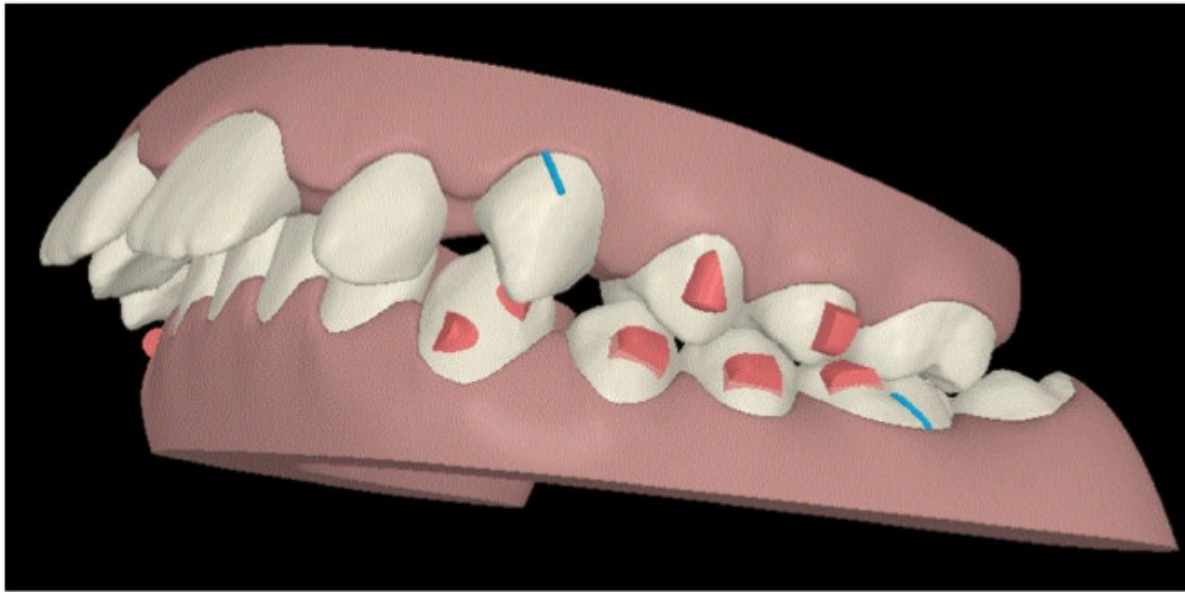


IMAGE 10-2

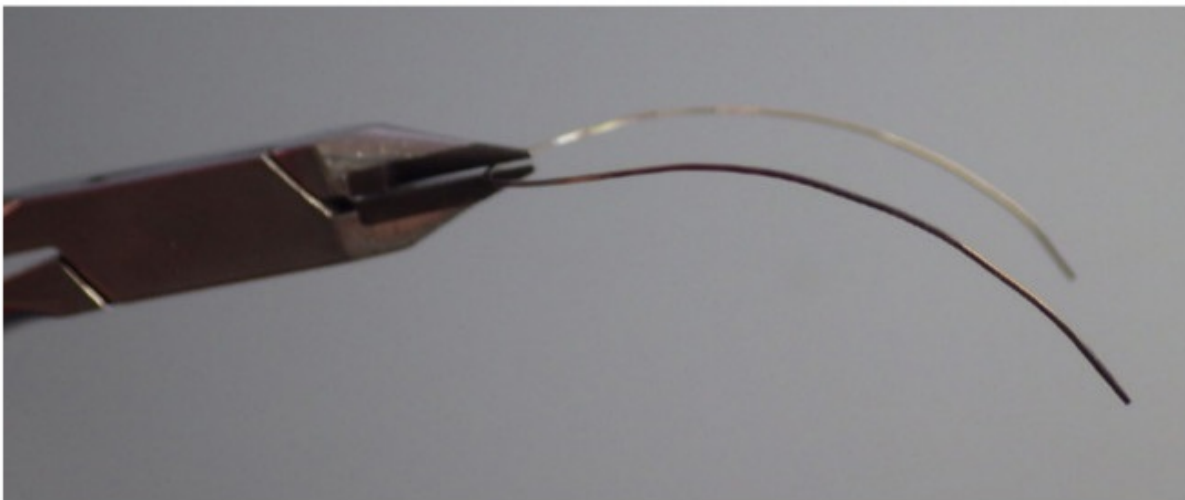


IMAGE 10-3

The question is: If the patient were wearing straight-wire appliances, why would we need to over-engineer the arch wire? We all learn as orthodontists that this arch-wire shape produces a force system, which will help to level the lower arch and flatten the Curve of Spee. We place extra into our arch wire knowing that it will produce force systems to give us a flat arch.

The same ideas apply with Invisalign treatment. How would we ask for a

reverse Curve of Spee arch wire with Invisalign? Simply write in your prescription: **“Please set the final over bite at 0mm.”**

Those instructions will over-engineer the ClinCheck plan so that the final stage for a patient like the one depicted in image 10-2, the final over bite is set at 0mm. As we have discussed many times throughout this book when we’re looking at a ClinCheck plan we’re not looking at a pre- diction of the final occlusion. We are looking at a graphic representation of the force systems made by the aligners to the teeth. Force systems, not teeth. Just like the Reverse Curve of Spee arch wire, we add Reverse Curve of Spee to our lower arch in the ClinCheck treatment plan. As you can see in this patient (see Image 10-4), he didn’t end up with a Reverse Curve of Spee, but rather he ended up with a flat arch and appropriate bite opening. This ClinCheck plan was over-engineered to produce a normal final result.



Here again is Haley from chapter 5 (see Image 10-5). Similar to the previous patient, Haley presents with a deep over bite. Look at the final ClinCheck stage (see Image 10-6) where an additional 2mm of intrusion was added to the upper and lower incisors so her final over bite is 0mm. The ClinCheck plan is over-engineered but in reality she doesn't not wind up with the over engineered results (see Image 10-7). She has upper and lower arches that are flat and coordinated and an excellent functional and esthetic final result.



IMAGE 10-5

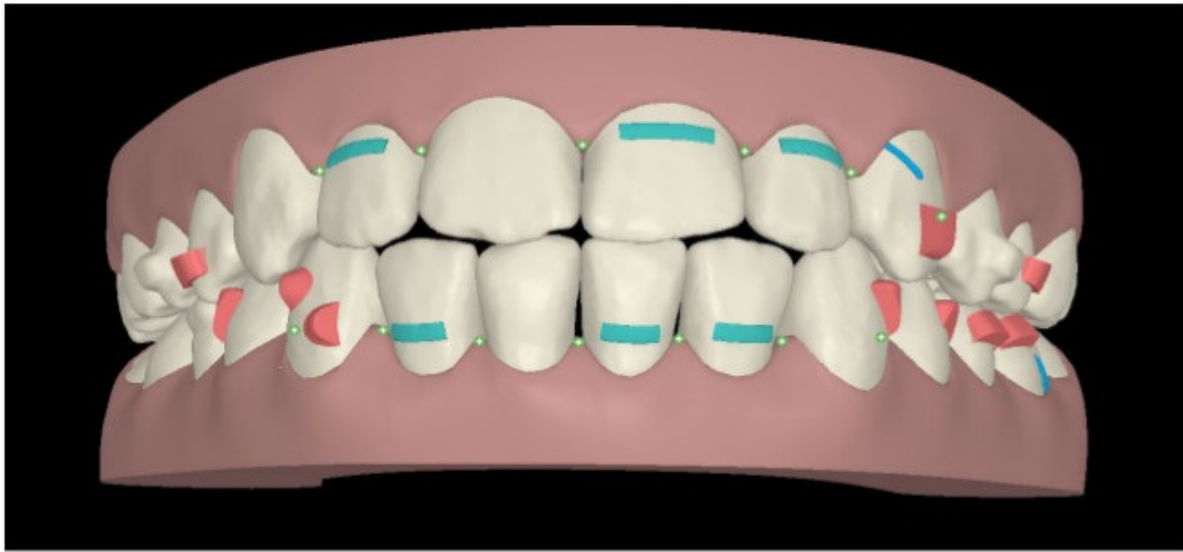


IMAGE 10-6



IMAGE 10-7

To the reader: This concept of deep bite over treatment is one that I have

built right into my clinical preferences: “For all deep-bite cases, please finish with the final overbite at 0mm.” My technician builds in over treatment — my prescription — for all my deep-bite cases.

OPEN BITES

The over-engineering principle also applies to open bites. Let’s revisit Michelle’s case, from chapter 5 (see image 10-8). If you recall from this chapter dealing with problems in the vertical dimension, Michelle presented with an anterior open bite. Her treatment plan is to over-engineer her ClinCheck plan with 2mm of *additional* intrusion on the upper molars to create a 2mm posterior open bite. Why do we do it this way? The ClinCheck plan is not a prediction of the final occlusion, but rather a prediction of the force systems acting on the teeth. *Force systems, not teeth*. I want to place an additional intrusion force on the upper molars. Intrusion is a difficult movement. I am not expecting the full expression of the aligners. I am not expecting the patient to develop a posterior open bite, but I want to place additional forces on the upper molars to ensure we gain additional intrusion to allow for auto-rotation of the mandible and closure of the bite. Here in this image (see image 10-9) is the area of over treatment on the upper molars.



IMAGE 10-8

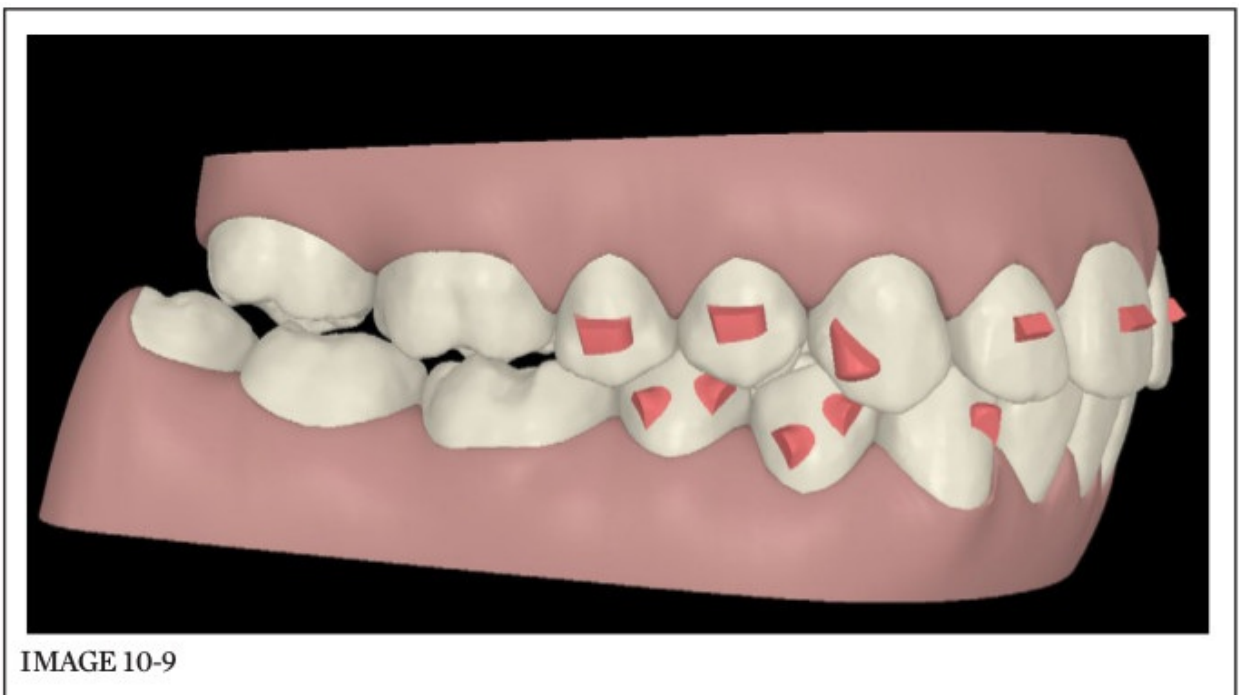
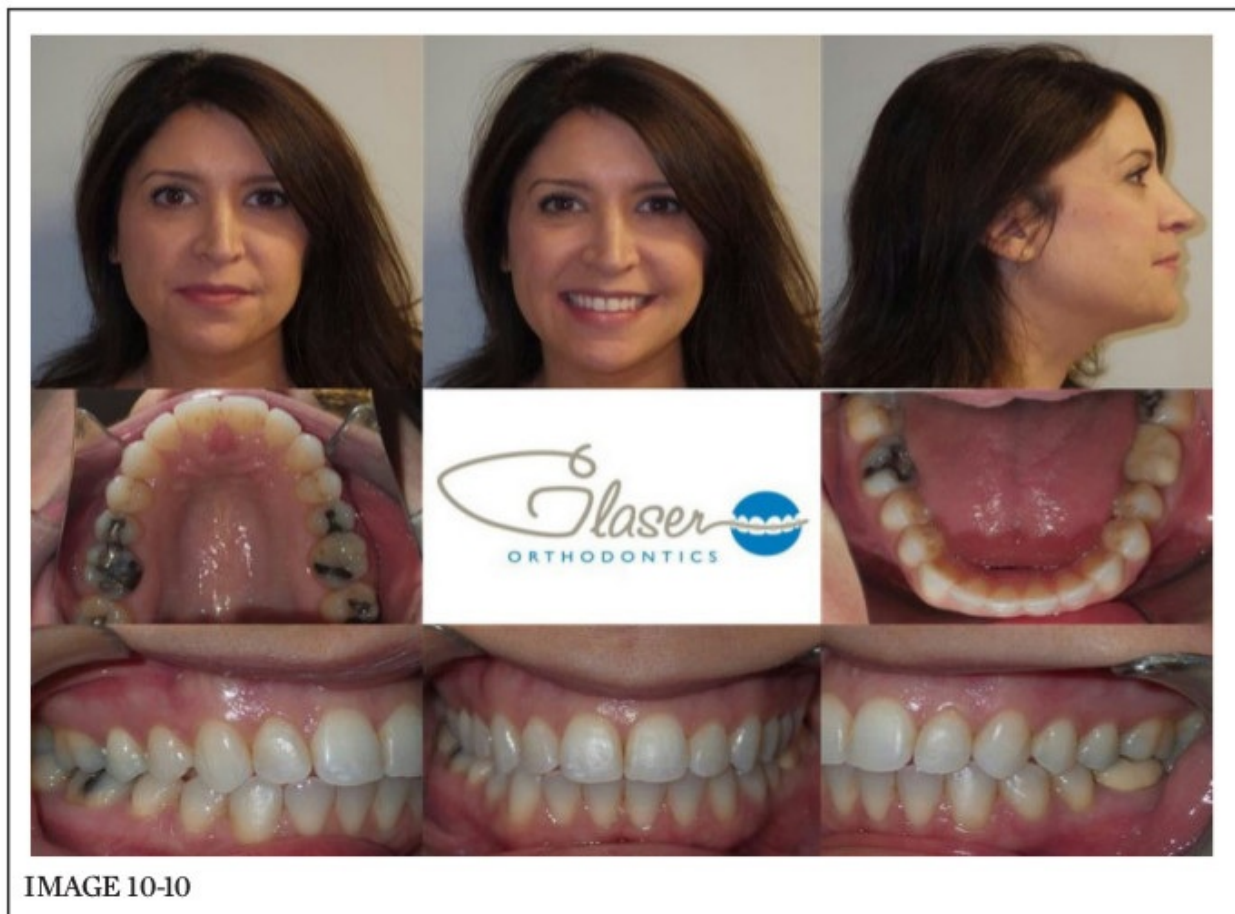


IMAGE 10-9

If you compare this posterior open bite we created on the ClinCheck plan and Michelle's final result (see image 10-10) you will note that she does not clinically have a posterior open bite at the end of treatment. This is the best illustration regarding the difference between the graphic representation of the force systems acting on the teeth in the ClinCheck plan and why it's not a prediction of the final occlusion. We asked for additional intrusion that we know is not going to fully express to get the desired amount of intrusion that we need for an excellent final occlusion. A good rule of thumb that we need for a case like Michelle's would be **2mm of additional intrusion of the posterior teeth**.



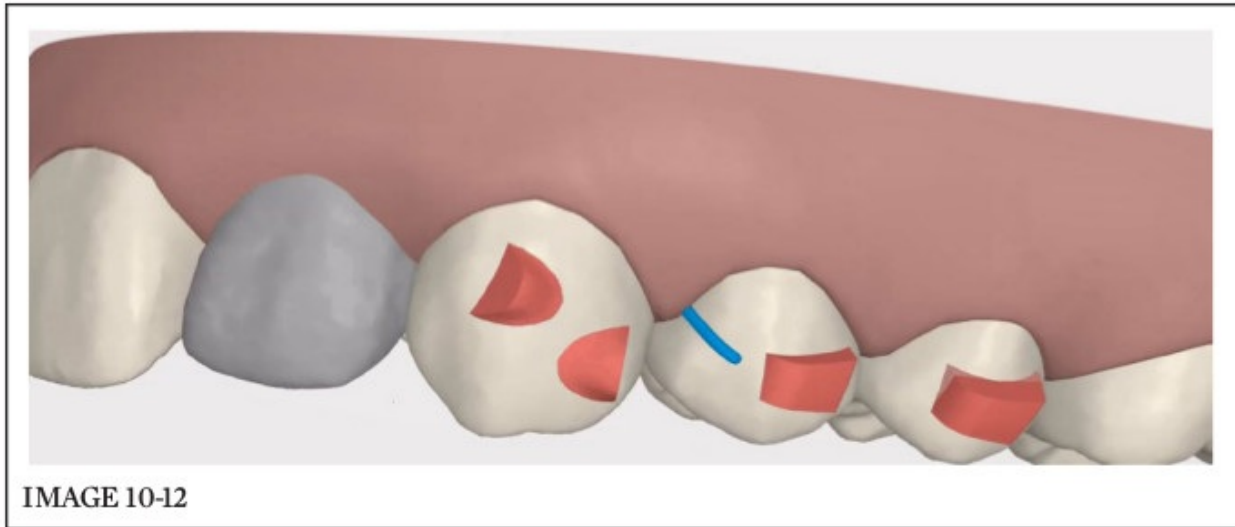
Another possible move (not performed in Michelle's case) is to ask the technician to extrude the upper and lower anterior teeth into a hard contact, which is also an over-engineering move. We don't expect the teeth to come into hard contact, but knowing there may be a slight under-performing of the

aligners we ask for over treatment to gain our desired results.

TIP AND EXPANSION

The third over-treatment movement is tip. A good rule of thumb for tip of individual teeth is 10 degrees of over treatment of tip when there's no space present in the arch; and 30 degrees of over treatment of tip to close space. For example, this patient (see Image 10-11) with missing tooth number 10, our treatment plan is to distalize the UL3 back into Class I to create space for an implant. Look at the ClinCheck plan (see image 10-12) and the instructions to the technician: *Please over treat the distal root tip of the UL3 by 30 degrees.* Since orthodontic treatment is applied at the crown, which is some distance away from the center of rotation of the teeth, orthodontic treatment has a tendency to make some teeth tip. In this case, if we move the UL3 distal crown tips distal even more and will result in an un-esthetic situation. In addition it won't position the root of the UL3 in a place where the implant will be able to be placed between the UL3 and UL1.





We ask for additional 30 degrees of distal root tip of the UL3 not expecting it to express. We want to place the appropriate force systems on the UL3 to obtain movement of the root. Image 10-13 shows the patient one year into treatment. As you can see from the panoramic X-ray we did achieve bodily movement of the UL canine; in fact, at this point one year into treatment, there is still a slight mesial root inclination. At case refinement, we asked for an additional 30 degrees of distal root tip. Twenty months into treatment the appropriate implant space has been created (see image 10-14).



TORQUE

The rule of thumb for torque is 10-30 degrees depending upon the case. For example, in this patient (see Image 10-15) the clinical challenge was moving the UL and UR lateral incisors labial out of cross-bite. Orthodontic treatment is

applied at the crowns with Invisalign clear aligners or fixed appliances, the upper lateral incisors have a tendency to tip out labially, and we don't want that to happen. We want these teeth to move bodily. This patient's ClinCheck plan was set up with 30 degrees of additional labial root torque of the UR2 and UL2 as anti-tip (see image 10-16).





IMAGE 10-16

After 22 months of treatment time, see the patient's results (see image 10-17), and as you can see the UL laterals are positioned well and the root position looks appropriate. The teeth are not over-torqued even though we asked for 30 degrees of additional root torque, but we didn't get expression of it in the final results. The 30 degrees of labial root torque prevented the crowns from tipping labially to control the positions of the roots appropriately.



EXPANSION

Turn back to chapter 7, where we examined the over treatment moves for patients with posterior cross bites. The rule of thumb to follow is an additional 3mm of expansion past ideal.

OVER CORRECTION

Let's explore the difference between over correction and over treatment.

OVER TREATMENT

Up until this point in the chapter, we have explored the four areas where over treatment should be considered: deep/open bite, tip, torque and expansion. Over treatment occurs gradually throughout the ClinCheck plan from the first stage to the last, and can be thought of as over-engineering the ClinCheck plan to

place additional forces on the teeth to achieve the desired result.

OVER CORRECTION

Over correction, on the other hand, is designed to build in “extra” correction in two specific areas: rotations and ins/outs. Always represented by three final aligner stages designated with a “+”, over correction is the tenth parameter on the ClinCheck list.

The over treatment and over correction techniques I employ in my practice were taught to me by my friend and colleague William Kottemann, DDS, MS. Dr. Kottemann cites the August 1986 *Journal of Clinical Orthodontics* interview with Dr. Bjorn Zachrisson. In this interview, Dr. Zachrisson discusses his concept of “11/10” orthodontics for rotations and ins and outs. Dr. Zachrisson stated, *“To me, 11/10 orthodontics means slight overcorrection of those most important sites of relapse. I want relapse to work in my favor and not against me. Therefore, it makes more sense to have slight overcorrection. Then if there is any relapse, it will relapse toward an ideal position rather than away from an ideal position.”*

Based on Dr. Kottemann’s interpretation, anterior rotations are routinely over corrected five degrees, and anterior in/outs are over corrected by 0.2mm.

Do I always use all three over correction aligners? No! I make the decision to use over correction aligners on a cases-by-case basis. In those cases where gaining final alignment has been a challenge, I am more inclined to use all three stages. If, however, the final alignment at the last non-over-corrected stage looks ideal, I may choose to stop at that point.

Building over correction of anterior rotations as well as ins/outs is a great way to reduce the number of refinements on your patients. In Dr. Kottemann’s practice his refinement rate is a low 10 percent. If it’s good for Bill, it will be good for you too!

Here’s a tip: In any case where you choose not to use your three over-correction aligners, don’t throw them away. Why? They’re great emergency retainers! Give them to the patient in case their final retainers are lost.

CHAPTER SUMMARY

Over-engineering your ClinCheck treatment plans is an important concept to master. If you follow the guidelines in this chapter, you will be well on your way to achieving excellence with Invisalign!

CHAPTER 11

Troubleshooting

I was blessed to study under the legendary Dr. Anthony A. Gianelly at the Boston University Goldman School of Graduate Dentistry. As I was winding down my final year of orthodontic residency, I asked “Dr. G,” as his students fondly called him, why he didn’t talk about using elastics and other auxiliaries to “sock in” cases at the end of treatment.

“Barry,” he said, “If you control your mechanics from the beginning of treatment, you won’t have to worry about socking in your occlusion at the end.”

Indeed, Dr. G instilled into his students the importance of thoughtful and meticulous treatment mechanics from beginning to end, carefully anticipating and adjusting for side effects at every patient visit. By doing so, treatment progressed in a controlled fashion, leaving little to no “clean-up” necessary at the end of treatment.

It’s the same with Invisalign treatment. By using the ClinCheck list to guide you in employing the concepts we have explored in this book, your Invisalign cases will track better, with fewer refinements and less side effects. Non-tracking will be greatly diminished, and dealing with problems such as posterior open bites will become a rarity in your practice.

Nevertheless, despite the most thoughtful ClinCheck setups, there are at times issues that can arise during treatment. Let’s take a look at the most common troubleshooting issues and their remedies in the following descriptions.

LOSS OF ANTERIOR TOOTH TRACKING DURING ROTATION

The most common problem encountered when an anterior tooth loses tracking is *lack of space*. At the first sign of non-tracking during anterior rotation, interproximal contacts should be checked with floss, and any tight contacts

should be “eased” with an interproximal strip. A common error is to ignore minor non-tracking issues, hoping they will go away on their own. Unfortunately, this approach rarely works and the problem gets progressively worse over time. Monitoring and adjusting tight contacts at each visit will help to improve tracking, reduce the number of case refinements, and reduce overall treatment time.

STUBBORN ROTATIONS 1 — DIMPLE PLIERS

Have you ever had a case where you just can’t get the last few degrees of rotation on an upper or lower anterior tooth? Here’s a time-saver — instead of refining the entire case, use a dimpling plier to place a small “divot” into the aligner, thus increasing the force to the desired tooth. I used this technique all the time in my pre-Invisalign days when treating patients with Essix® appliances, and it can be equally effective for minor rotational correction with aligners.

STUBBORN ROTATIONS 2 — BOND BUMPS

There are some anterior teeth rotations that won’t respond to dimpling of the aligners. If you are certain that tight interproximal contacts are not to blame, it may be that the dimple created in the aligner does not create sufficient force to achieve the desired rotation. In these cases, instead of doing a case refinement, try bonding a “bump”. A bump is a small 1/2mm- thick dome of attachment material on the surface of the tooth requiring additional force. For example, if the UR2 requires additional mesial-in rotation, bond a small composite bump on the mesial aspect of the labial surface of the tooth. Have the patient seat the aligner, and adjust the height of the bump so the patient feels pressure on the tooth. Have the patient return in 1-2 weeks and check for progress. This technique is very effective to achieve the last few degrees of rotation and helps reduce the number of case refinements and overall treatment time.

STUBBORN ROTATIONS 3 — VIVERA® RETAINERS

In cases where there is just the slightest suggestion of a rotation on an anterior tooth, the thicker, stiffer plastic of Vivera® retainers can be just what the doctor

ordered. Here's the trick — check for tight contacts, ease as necessary and have your patient wear their Vivera[®] retainers full time for a month. Very often, the stiffer, thicker plastic will help achieve the last few degrees of rotation. If, after a month of full-time wear, the tooth in question is not fully corrected, consider bonding a small bump as noted in the previous section of this chapter.

NON-TRACKING IN ABSOLUTE EXTRUSION 1 — IPR

We discussed the differences between absolute and relative extrusion in chapter 5. Absolute extrusion of anterior teeth is by far the more challenging movement with aligners. The software is very good at recognizing absolute extrusion and placing the appropriate optimized extrusion attachments to help gain the desired tooth movement. If an anterior tooth extrusion is not tracking, the first things to look at are the *adjacent contacts*. To reiterate, one of the basic aligner concepts outlined at the beginning of this book is that *teeth need space to move*. Check for tight interproximal contacts with floss and employ IPR to ease the tight contacts to allow the tooth in question to extrude.

NON-TRACKING IN ABSOLUTE EXTRUSION 2 — LARGER ATTACHMENTS

If the adjacent contacts are not tight, you may consider placing larger attachments on the tooth requiring extrusion to gain additional “aligner grip”. For non-tracking maxillary lateral incisors, I will place a modified 4mm-long, gingivally beveled rectangular attachment. I orient the bevel of this attachment similarly to that of an optimized extrusion attachment. While not “optimized,” the long gingival bevel provides greater surface area and is quite effective in those “stubborn” cases where the maxillary lateral incisor is not extruding properly. For more specific details on how to design and place this and other conventional attachments, please refer to chapter 5, where we review the considerations such as “failure mode” when placing conventional attachments.

NON-TRACKING IN ABSOLUTE EXTRUSION 3 — BOOTSTRAP ELASTICS

Have a case where everything is tracking well except for one anterior tooth? A bootstrap elastic is a handy tool to use in those cases where you don't want to stop and order additional aligners, since the remaining teeth are tracking well. A window is cut into the labio-gingival aspect of the aligner, and a V-shaped cut is made on the linguo-gingival aspect of the same tooth to form a small elastic hook. Bond a clear ceramic button on the labio-gingival aspect of the non-tracking tooth and have the patient attach a 3/8" elastic from the button — over the incisal edge — to the V-shaped hook. The elastic places a force to the tooth, which extrudes it back into the aligner. If it sounds complicated, it's not. Please refer images 11-1 through 11-3. Bootstrap elastics can be very effective in getting the tooth back on track!



IMAGE 11-1



IMAGE 11-2



IMAGE 11-3

NON-TRACKING IN ABSOLUTE EXTRUSION 4 — TRIANGLE ELASTICS

Extruding high canines with aligners can be unpredictable. A technique I frequently use is elastic-assisted extrusion. A button cutout is placed on the canine requiring extrusion, and two precision-cut elastic hooks are placed on the

lower canine and first premolar. A ceramic button is bonded to the labial surface of the canine requiring extrusion, and the patient is instructed to wear a 1/4" heavy elastic from the button to the elastic hooks in a triangle configuration (see images 11-4, 11-5). The elastic provides an additional eruptive force to keep the canine extrusion on track.



IMAGE 11-4



IMAGE 11-5

PREMOLAR ROTATIONS — BUTTONS/ELASTICS

Premolars, being more rounded, present fewer “push surfaces” than anterior teeth. As a result, rotating them with aligners can be a challenge. There are several ways to deal with this, pre-Invisalign buttons and elastics being one method. In this scenario, buttons or brackets are bonded and elastic chain used to rotate the teeth prior to beginning Invisalign treatment. Generally, I prefer to employ buttons and elastics *during* Invisalign treatment. In your ClinCheck setup, place cut outs on the tooth requiring rotation as well as the adjacent tooth, since buttons bonded in these areas will not affect aligner fit. Light elastic chain can then be placed on the buttons to aid in rotation (see images 11-6, 11-7).

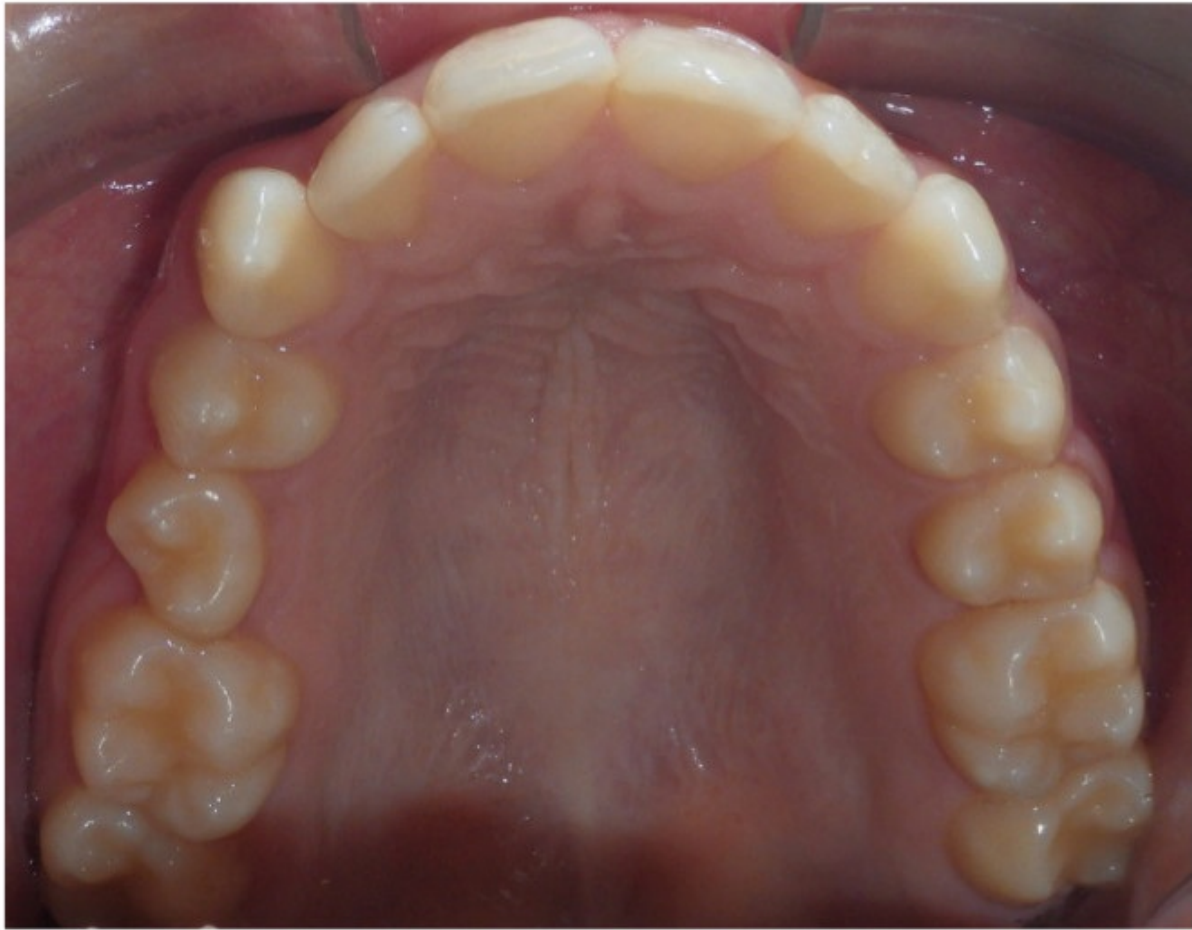


IMAGE 11-6



IMAGE 11-7

POSTERIOR OPEN BITE

A common assertion with Invisalign treatment is that the interoc- clusal plastic can lead to inadvertent posterior intrusion, with a resul- tant posterior open bite (POB). In my experience, this is often NOT the case. In my estimation, the leading cause of a vast majority of the POB's during Invisalign treatment are *heavy anterior occlusal contacts*. It is my contention that if these conditions are recognized and managed during the initial ClinCheck setup, it greatly reduces the chances that a POB will develop later on. I direct you back to Dr. Gianelly's wise words: "*If you control your mechanics from the beginning of treatment, you won't have to worry about socking in your occlusion at the end.*" Control the ClinCheck plan, control the case.

HEAVY ANTERIOR OCCLUSAL CONTACTS

Heavy, premature anterior occlusal contacts will prevent the posterior teeth from occluding, and is the leading cause of POB during Invisalign treatment. Heavy anterior occlusal contact may result from the following circumstances:

UNMANAGED BOLTON DISCREPANCIES

In chapter 4, we explored the relationship of tooth size (Bolton) discrepancies to posterior open bite. In cases where there is a relative deficiency of tooth structure in the maxillary arch, the upper anterior teeth may wind up in heavy occlusal contact with the lower anterior teeth. It is important to recognize Bolton discrepancies on the initial ClinCheck plan and decide on the appropriate remedy, such as lower IPR and or leaving spaces in the upper arch before beginning treatment. Please refer to chapter 4 for detailed information on the options to manage Bolton discrepancies to prevent the development of POB.

- **LOSS OF UPPER ANTERIOR TORQUE**

Orthodontics, whether with fixed appliances or aligners, tends to tip teeth. In cases where palatal tipping of the upper anterior teeth is not desired, during upper incisor retraction for example, make sure to build palatal root torque overtreatment into the ClinCheck plan. Overtreatment of palatal root torque by 10-20 degrees provides *anti-tip forces*, similar to the use of high-torque brackets in fixed appliance cases.

- **CL III GROWTH**

In teen patients with a mild CL III growth pattern, it is important to manage the growing face with the use of CL III elastics and/or lower IPR to prevent heavy anterior occlusal contact. It's a good idea to add CL III hooks to the initial ClinCheck plan in case they are needed as treatment progresses.

POSTERIOR OPEN BIT 2 — SECTIONING ALIGNERS

There are some cases, in patients who are heavy bruxers for example, where a small posterior open bite of 1mm or less may be induced from slight inadvertent posterior intrusion. Some patients may report that they don't feel their back teeth

touch, or you may detect lack of posterior contact using articulating paper. These cases respond very well to *aligner sectioning*. In the final three aligner stages, snip the aligners distal to either the canines or first premolars and have the patient wear the sectioned aligners full time as usual. In most cases, the posterior occlusion will settle in over the final six weeks of full-time aligner wear.

POSTERIOR OPEN BITE 3 — BUTTONS/ELASTICS

If the aforementioned aligner sectioning procedure fails to gain solid posterior contact, bonding small buttons on the posterior teeth along with the use of vertical elastics worn full time can be effective in establishing the final posterior occlusion (see images 11-8, 11-9).



IMAGE 11-8



IMAGE 11-9

I want to reemphasize that thoughtful ClinCheck treatment planning using the principles in this book greatly reduces the incidence of POB. In my practice, I find myself using buttons and elastics in very rare cases. Managing heavy anterior occlusal contacts from the first ClinCheck plan and throughout treatment is the key!

Conclusion

I hope this book has been educational and maybe even enlightening when it comes to your Invisalign treatment plans and techniques. In writing this guide, I wanted to discuss and demonstrate effective ways to set up your ClinCheck treatment plans and give you fresh ideas to accomplish more than you might have ever considered Invisalign treatment could do. I also intended to share my own lessons learned and best practices as I had discovered the most effective ways to help patients achieve a healthy occlusion and esthetic smile.

As I demonstrated in the various case studies and successes, Invisalign treatment offers orthodontists a tool to attract new patients. These patients may be the people who might not otherwise have sought orthodontic treatment because they wanted to avoid the appearance of metal in their mouths. In the past, this opportunity to help these patients achieve a functional, esthetic occlusion might have seemed impossible without the use of traditional braces. Yet as my book has revealed, Invisalign treatment can correct a wide variety of complex malocclusions — certainly much more than many of you might have thought possible.

In addition, I hope I opened your mind to the possibilities of successfully treating teens with Invisalign clear aligners. This widely untapped market — only 6 percent of teenage orthodontic patients in the United States are being treated with Invisalign — is another potential growth center for your practice. I treat 75 percent of my teenage patients with Invisalign clear aligners and so can you!

I also wanted to show you through the principles of sound ClinCheck design ways to maximize efficiency with Invisalign treatment by reducing tracking problems, posterior open bites, and excessive refinements. These efficiencies are truly a win-win proposition. The patient benefits from all of the esthetic and lifestyle conveniences of Invisalign clear aligners, while the orthodontist benefits

by treating their Invisalign patients with fewer appointments, less chair time, less stress, and almost no disruptive emergency appointments. These efficiencies can help keep a practice competitive in times like these where the dental landscape is rapidly evolving.

Maybe in the past you did a break-even analysis with your Invisalign costs and realized things like mistakes in the correction process were often not getting the desired results and requiring longer and more costly treatments. Unexpected costs due to mistakes and miscalculations could extend the need for longer treatment time and more unanticipated appointments. Maybe you even tried basic Invisalign treatment and soon discovered that you were less profitable and not gaining real market value. You might have thought to abandon the practice because it made no economic sense to your practice.

Now that you've read about my best practices and principles I hope you are inspired and feel confident that offering Invisalign as a treatment option for a wider variety of malocclusions and dental issues can open the door to greater opportunities. You don't necessarily have to worry that you will face costly treatment overruns. You feel greater confidence in the aligner technology and *ClinCheck Pro* software. Maybe you've avoided Invisalign treatment completely out of fear that you can't make it work. Yet now you've read all of my techniques and tricks to ensure reliable results. Now you do feel like you want to expand your Invisalign clientele and know it will be a success if you follow my suggestions and ideas.

If nothing else, I hope this book has opened the door either wider in your practice to use Invisalign treatment in more patients or has opened a completely new revenue opportunity. You now have an entirely new perspective on what is Invisalign, how you can use it, and how you can even improve upon it with your own skills. Maybe you didn't use Invisalign clear aligners at all in your practice and this book enabled you to see effective ways to apply it to almost any malocclusion. You feel certain you will be able to leverage this technology to expand your market opportunities and successfully capitalize on these potential revenue streams. Ultimately, you might see a great (and as demonstrated)

reliable opportunity to grow your practice.

Moreover, you can feel confident that you can achieve the very best clinical results treating a wide variety of patients with Invisalign clear aligners. The principles outlined in this book are sound orthodontic principles that will help open your mind to looking at your ClinCheck setups in an entirely new way — as “force systems, not teeth”. Through a comprehensive understanding of how an aligner interacts with the dentition as well as a common-sense approach to biomechanics, you will be able to “read” your ClinCheck setups more accurately and customize them to achieve the results you want. You will feel completely in control of the process and will be able to translate a virtual treatment plan you view on your computer to a successful clinical outcome for the patient.

In my experience, I know Invisalign clear aligner treatment is the future of this industry. I honestly feel that today’s orthodontists who don’t capitalize on its value and benefits will be left behind. More and more patients are going to be expecting the Invisalign option. As market demand increases, you cannot afford to be the one practice on the block that doesn’t offer it. Rest assured, the office up the street — the competitors going for your same market share will be using it. The real question, will they use it in the innovative ways I’ve just explained? If you’re using my tips and tricks chances are competitor’s practices are not. So not only do you offer Invisalign treatment like the next orthodontist, but also you’ve figured out how to get the most opportunity out of the technology. Looking at it from this perspective might turn on a light bulb. A-ha! I can be competitive and stay up with the latest technology — and even better, I can leverage that technology to get better results.

In my opinion, this approach is a win-win. You are more competitive because you offer the most up-to-date techniques and best practices, and the patient benefits from an excellent clinical outcome, a pleasant orthodontic experience, as well as the confidence that comes with a fantastic smile. If this argument doesn’t convince you to try out the ideas I’ve shared with you in the book than I don’t know what else will.

In short, Invisalign treatment is the future of this industry. If you want to stay

ahead of the curve and be profitable in the interim, then don't hesitate to try my tried-and-true techniques. I wish you much success in your endeavors.

Resources

Please download a free copy of the ClinCheck list at Dr. Glaser's innovative educational site:

AlignerInsider.com

Need more help? Dr. Glaser is available for personalized, one-on-one Invisalign® coaching at yourorthocoach.com

About Dr. Glaser

Dr. Barry J. Glaser received his BA in Psychology from Binghamton University, was awarded his DMD degree from The University of Pennsylvania School of Dental Medicine and earned his Certificate of Advanced Graduate Studies in Orthodontics from Boston University. He served as Associate Director of Orthodontics at Montefiore Medical Center in New York City from 1992 to 1995. He has been in private practice in Cortlandt Manor, NY, USA since 1994.

Dr Glaser's feature article "From Skeptic to Elite" can be found in the June 2014 edition of *Orthodontic Products magazine*, and he has contributed several additional articles published in Orthodontic Products. Dr Glaser is featured in the book, "*Your Smile, Your Health, Your Success*" published by 3L Publishing in 2015.

Dr. Glaser is an Align faculty member, an Invisalign Elite Preferred Provider and has given hundreds of Invisalign lectures throughout the world. He has spoken at numerous Invisalign Summits, and has an active schedule travelling around the world teaching doctors about excellence in orthodontics using Invisalign. He is the founder of the innovative educational website AlignerInsider.com, and is available for one-on-one virtual Invisalign coaching at yourorthocoach.com.

Dr. Glaser resides in Cortlandt Manor, NY with his wife Tracy and sons Scott and Jake, along with boxers Roxy and Dempsey.

"A must-read for all doctors looking to up their Invisalign game."

DR. WILLY DAYAN

"... a true 'how to' textbook when it comes to treatment planning using the ClinCheck® software."

DR. JONATHAN L. NICOZISIS

"Dr. Barry Glaser is a consummate professional, educator, and clinician. His years of mentoring and lecturing to orthodontic practitioners worldwide has given him a unique insight into approaching Invisalign in a rational, concise, and systematic approach. This book will benefit any clinician who recognizes the critical importance of Invisalign in orthodontic treatment, and who endeavor to embrace it as an integral part of their orthodontic practice. Dr. Glaser's work will be the yardstick by which all future texts on Invisalign will be judged, and is a must read for all orthodontists that strive for practice growth, efficiency, profitability, and remarkable clinical results."

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Do you really know what to look for in your Invisalign® treatment plans? After reading this book, you will never look at a ClinCheck® plan the same! **Unleash the power of virtual treatment planning using the ClinCheck® software** by using Dr. Glaser's revolutionary methods to re-train your eyes and mind to look at your ClinCheck® treatment plans in an entirely new way – as force systems, not teeth.

THIS STEP-BY-STEP GUIDE TEACHES:

- A simple-to-follow, 10-step method to ClinCheck® design
- How to "over-engineer" your ClinCheck® plans to achieve excellent results
- How to recognize potential treatment pitfalls before they occur
- How to save valuable time with efficient, comprehensive virtual treatment planning
- How to troubleshoot common problems encountered during Invisalign® treatment
- How to achieve consistently excellent results in a wide variety of malocclusions

In this rapidly evolving orthodontic marketplace, Invisalign® clear aligner therapy can help keep your practice competitive and fuel future growth. Dr. Glaser will show you how to achieve excellence with Invisalign® clear aligners to keep your practice on the cutting edge!



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