“Ask the Expert”

Using ClinCheck to Achieve Optimal Smile Design

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What is “smile design”?

Let’s take a look at some basic principles we might define as “Smile Design”

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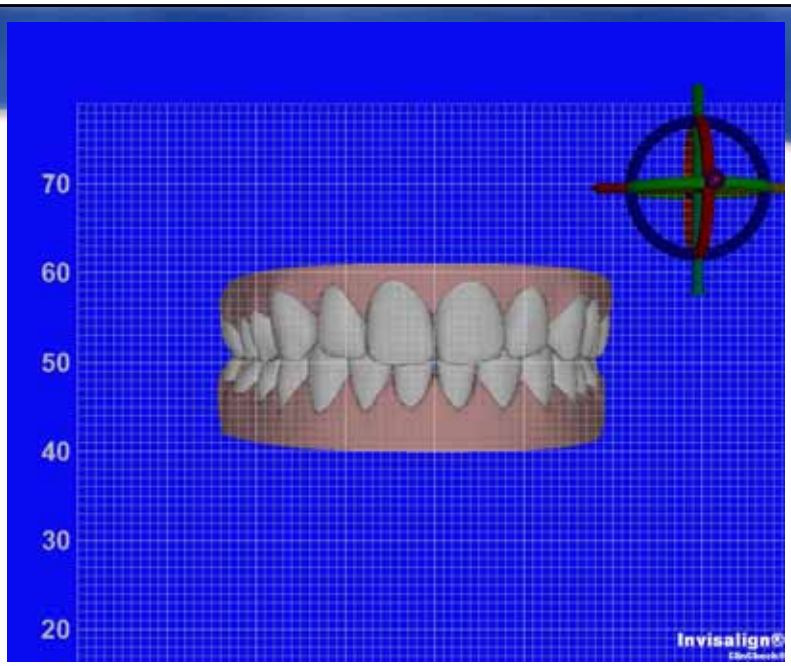

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Some things we cannot see with ClinCheck BUT are important

- Facial midline
- Skeletal midline
- Relationship of lips to teeth
- Functional movements/protrusive/ lateral positions
- Incisal edge anterior guidance
- Incisal edge phonetics
- Root positions

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Let's looks at esthetic considerations we can evaluate with ClinCheck

- Midlines: Maxillary to Mandibular
- Tooth size and proportion
- Incisal edge position
- Gingival heights of contour
- Contact points
- Gradation
- Buccal corridors
- Axial angle of crown angulation
- Labial angle of crown angulation
- Overjet
- Intercuspation
- Curve of Spee
- Arch form
- Black Triangles

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Discussion format

- Let's first look at an esthetic consideration and then I'll open a ClinCheck to demonstrate specific viewing tools
- Useful tools include:
  - grid feature
  - superimposition tool
  - navigation feature
  - magnification feature

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Esthetic concepts

- Esthetic concepts may differ, by definition esthetics is both “science and subjective art”
- The points I want to make are directed at “HOW” to use the features of ClinCheck to apply esthetic concepts as you may feel important for your case.
- I may use various esthetic examples, but my point is not to produce a rigid set of principles that somehow represent the last word in esthetic concepts.
- I do not want to portray optimized esthetics as a set of absolutes.

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Midline

Midline Smile Concepts:

- Midline is centered on the face
- The incisal curve is perpendicular to the interpupillary line
- Midline is the focal point of the smile
- Total symmetry is rare
- For Compromise: smile midline in harmony with facial features nearest the mouth (column of nose/ philtrum)
- Maxillary midline equal to facial/skeletal midline is first in importance
- Maxillary midline equal to mandibular midline is second in importance

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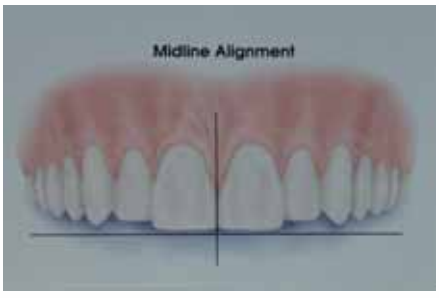
Midline and Arch Alignment

- Midline represents the axis running down center of face- may or may not align w/ nose
- Ideal midline of teeth centered/ straight/ not canted
- Arch alignment perpendicular to midline



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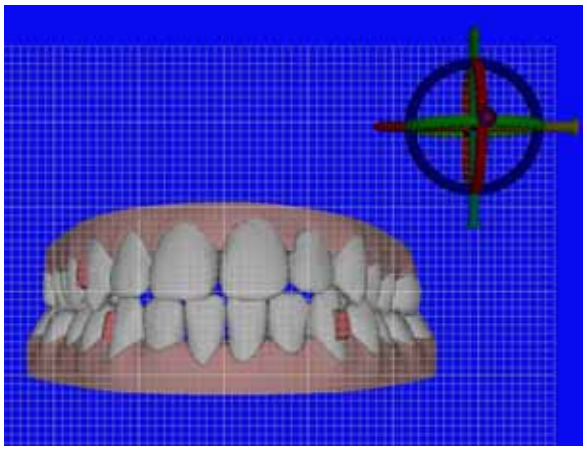
Grid Feature to evalaute midline



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Grid Feature to evaluate midline

Let's follow a ClinCheck for case TH

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Case TH ClinCheck V1

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Steps in setup of “GRID” feature

- Select ClinCheck from patient data base
- Select “anterior” predefined view
- Zoom feature: select 200%
- Grid feature: click on
- Move cursor to white dot in center of “pin head” axis directed into grid on control widget.
- Left click to activate “control axis”.
- Move finger up/down on pad with simultaneous left click to bring grid just forward of the anterior teeth.
- If necessary, select “anterior” to reset the model orientation.
- Select “horizontal” orientation widget “red” pin. Finger left/right on pad to move larger vertical line to midline.
- Select “vertical” orientation widget “green” pin. Finger up/down on pad to move larger horizontal line to place.
- When the pin is activated, color of pin is highlighted.

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Midline modifications: Case TH

- Apply asymmetrical IPR to help create concurrent midlines

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- ClinCheck for TH


TH M3 Final

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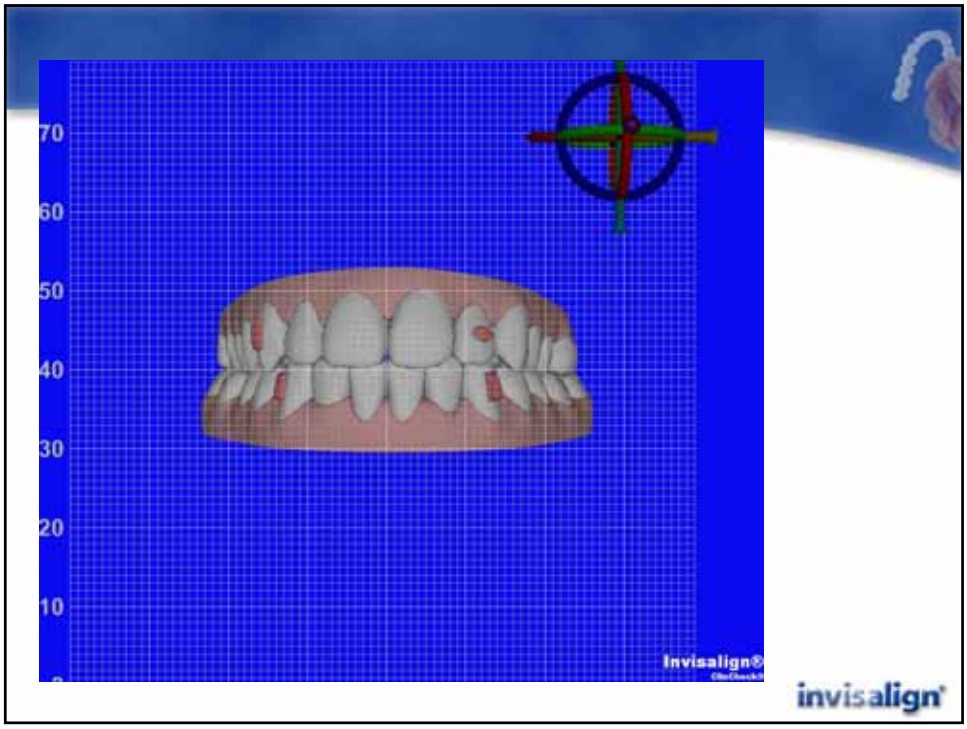

Tooth size and proportion

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Tooth size and proportion

Let's look first at tooth size length:

- **Tooth length or I-G height**
- **Symmetry and proportion**

Second let's look at tooth size width:

- **Tooth width**
- **Symmetry and proportion**

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Tooth size and proportion: Length Considerations

- **Study by Tjan, 80% "young" subjects displayed entire length of maxillary anterior teeth in smile**
- **Study by Vig, women show nearly twice as much maxillary anterior teeth as men (3.4 to 1.9mm respectively) with lips at rest**
- **Study by Tjan, men are 2.4 times more likely to have a low smile line than women**
- **Length of maxillary incisors cannot be established by esthetics alone. They play an important role in both anterior guidance and phonetics.**
- **Prosthodontics uses "F" sound to place Mx incisal edges at vermillion border. "S" sound to establish Md incisor position in conjunction with occlusal contact.**

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Tooth size and proportion: Length Considerations

- Little seen of mandibular central incisors in age under 30
- Women show less and men more (1.2 to 0.5mm) of the lower incisors
- With time gravity wins out and length of Md incisors increase and Mx exposure is less. At age 60, the length of Mx central showing below lower lip is 0.00mm, while nearly 3mm of Md incisor is exposed (Study by Vig)

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Tooth size and proportion

Tooth length/ I-G height:

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Proportions of the Central incisors

- Cornerstone of an esthetic smile design is the central incisor
- Divide length of central into width to obtain a length to width ratio
- Various ratios have been published
- Many consider 77.5% ideal length to width ratio
- 75-80% seems acceptable range

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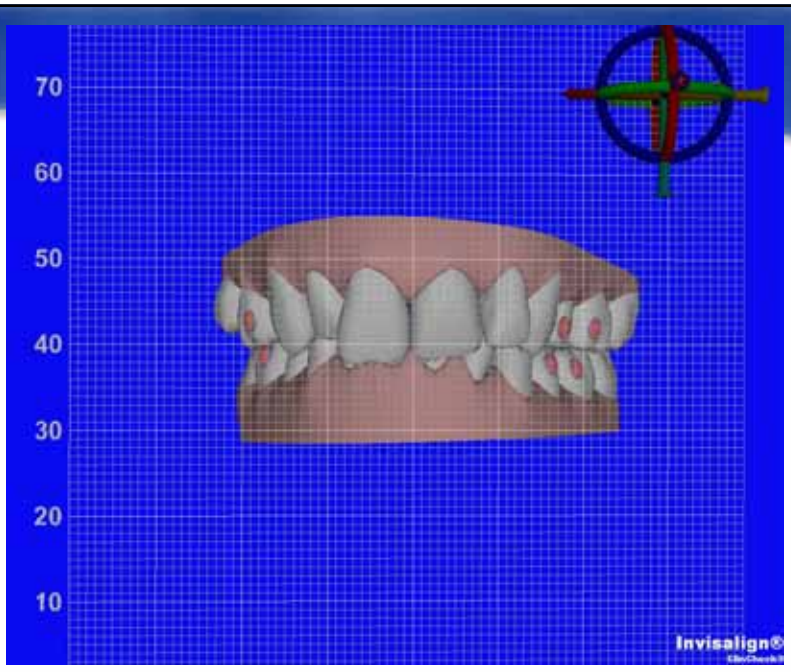

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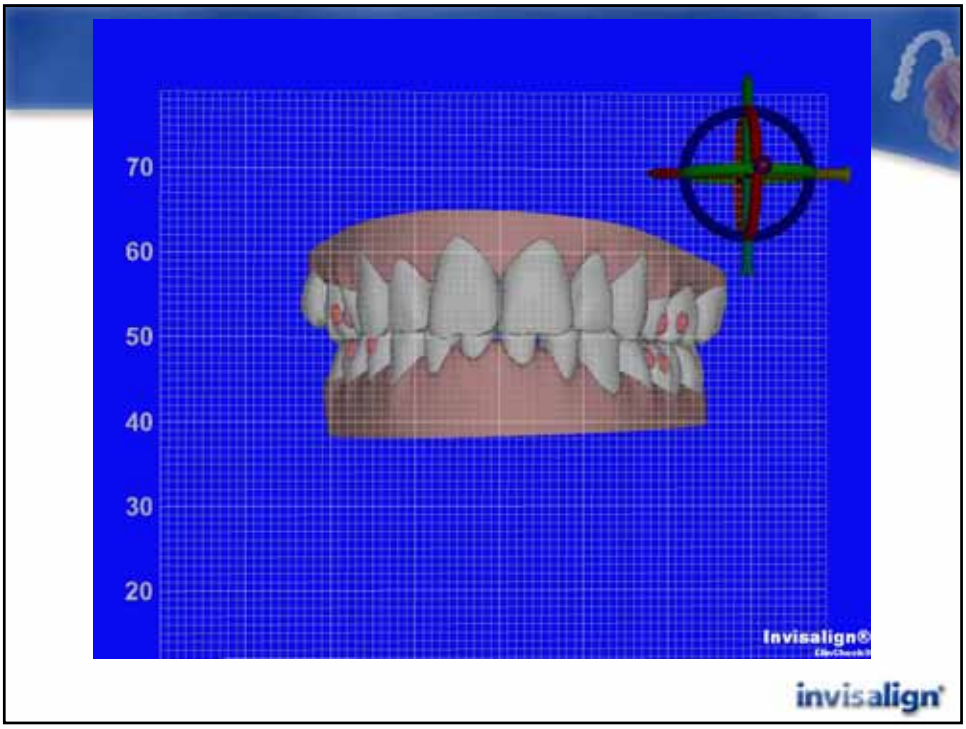
Don’t forget tooth “I-G” height will change as labial crown tipping with “relative extrusion” gives tooth more length in the anterior view!



ClinCheck RM


RM M1 final

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Tooth size and proportion

Tooth length

1. **Use anterior predefined view**
2. **Click to use “grid” feature**
3. **Tooth #8 about 12 units (mm) I-G height**
4. **Tooth #8 about 8 units (mm) width**
5. **0.75 X 11= 8.25**
6. **Central width to length would be 11 rather than 12, using ratio of 75%**
7. **ClinCheck w/ grid may help you with height size and proportion**

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Remember that using the grid should be seen as a relative evaluation not so much a tool for very precise measurements!

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Tooth size and proportion

Let's look at tooth size:

Tooth width

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Tooth size and proportion

- Variety in shape and arrangement produces a more natural appearance
- Dentists tend to prefer more irregularities than patients (Brisman, et al)
- Perfect horizontal symmetry and even radial symmetry is monotous and appears artificial
- Important to discuss the concepts with patients to develop an appreciation for role of subtle irregularities in creating a more natural smile appearance

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Let's look at tooth width

- Maxillary central incisors are positioned in the middle of the smile making them the most prominent
- They have crowns with the widest M-D width of the anterior teeth (Black)
- From a frontal or anterior view the apparent sizes of the teeth should become progressively smaller from the midline distally
- Different ratios have been suggested:

  "Golden proportion" factor of .618

  (Chiche), has suggested ratio of 0.75 to 0.8

  (Ward), RED: Recurring Esthetic Dental proportion. He uses a mathematical formula to relate tooth height and proportion.

  (Ali), published that the these proportions are NOT readily observed in nature.

  (Chu), reports a broad range of tooth widths occur in the population.

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For the sake of example let's use the Golden proportion ratio for width consideration

Golden proportion

When viewed from the facial aspect of each tooth:

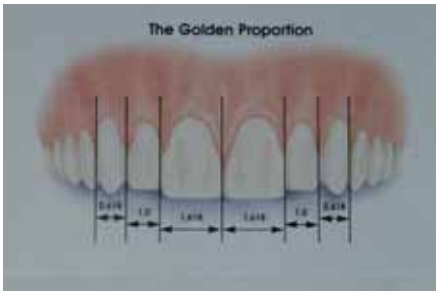
Canines are second in width to central incisors, BUT when viewed from the anterior view of the midline each tooth is narrower than the tooth mesial to it.

We might use certain tools to help quantify the Golden Proportion ratios.

For example, the Golden Proportion ruler may help determine if the laterals are proportunately smaller, and so on.

The Rule of Golden Proportion

- Anterior view: central to lateral to mid-face of canine reduce by a factor of 0.618 (62%)
- This is a factor of about 60%
- M-D width of Central= 60% of M-D width of Laterals
- M-D width of mid-face of Canine= 60% of width of Lateral



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Golden Proportion

- Other Terms: Golden mean, golden section, golden rectangle, divine proportion
- The ratio of 1.618 to 1.0 is the constant and is designated as (phi)
- (phi) is also related to a series of numbers called Fibonacci series where each number is the sum of the two numbers preceding it (n1+n2=n3). The ratio between numbers approximates 1.618 or (phi)
- Fechner found that 75.6% of subjects preferred rectangles with ratios from 0.57 to 0.67 and further choose the golden rectangle (0.62) as the most pleasing.
- Classic architecture follows the golden rectangle (Parthenon in Athens for example)

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Evaluate Tooth Size and Proportion

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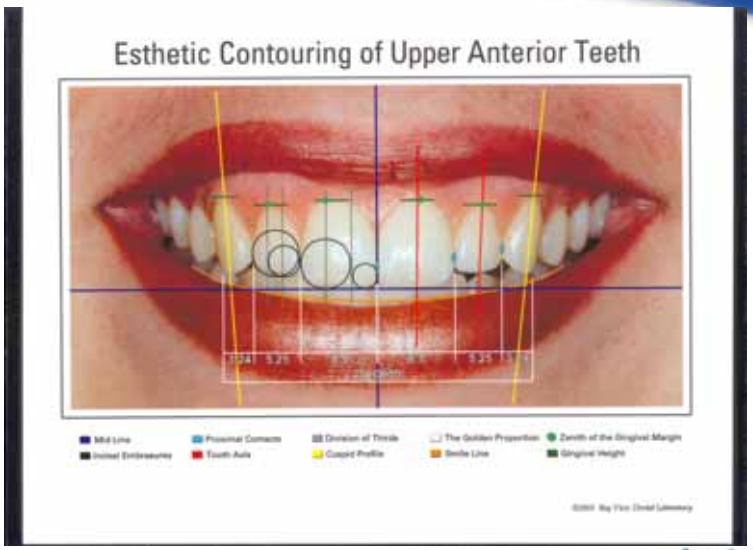
The Golden Proportion



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How can we use ClinCheck?

- We can use the “grid” feature to help quantify these ratios

Let’s use the ratio of “Golden Proportion” long celebrated as the standard of visual esthetics

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Tooth size and proportion

Case AI ClinCheck: small laterals

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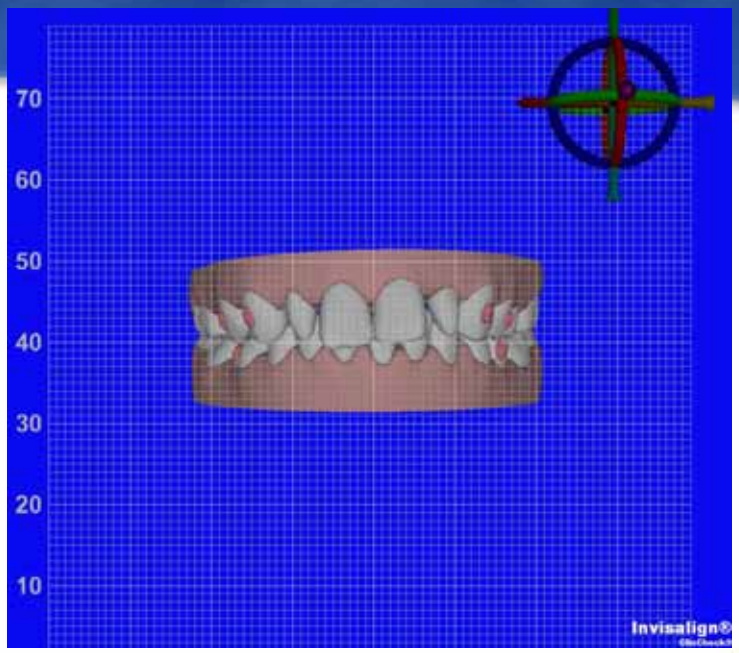

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Tooth width/ proportion:

- **Use anterior predefined view**
- **Click on “grid” feature**
- **Central width is about 7 units (mm)**
- **7 X 60%= 4.2 units (mm)**
- **Send modification: using Treat software create M-D lateral space proportunate to central width. Measure central width multiply by ratio .618 or about 60%. This will be approximately 4.25mm.**

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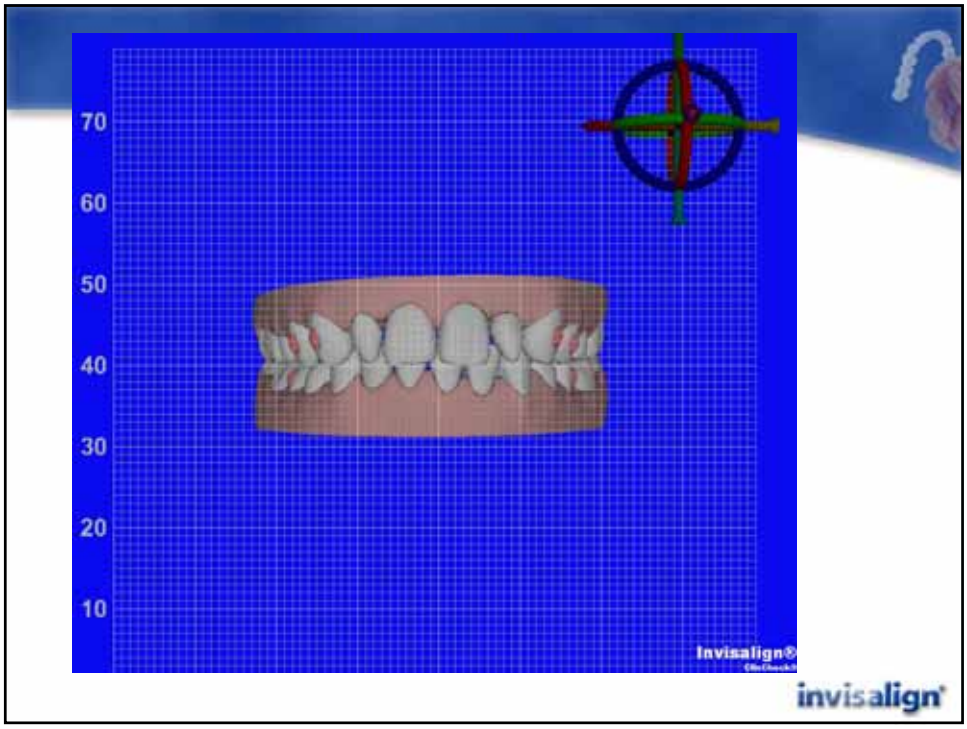

AI ClinCheck

AI M1 final

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Tooth size and proportion

Case KHo ClinCheck: small laterals

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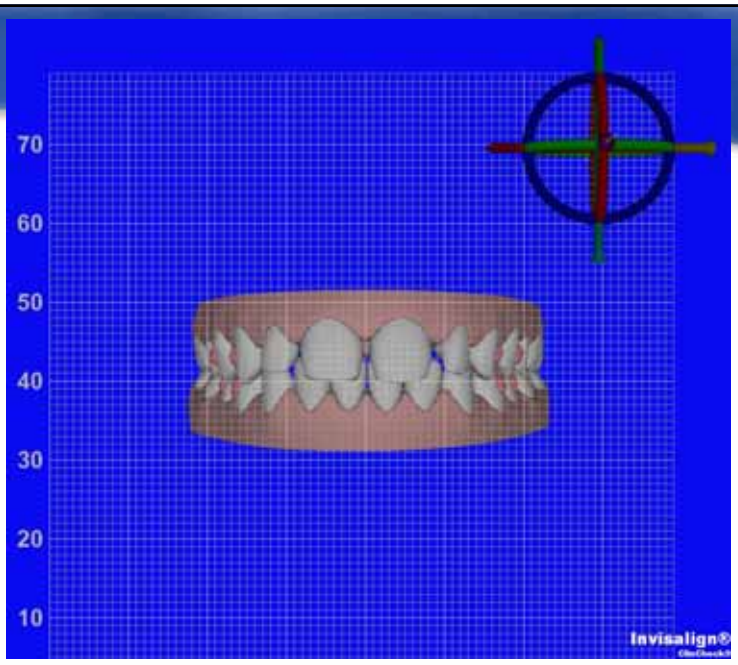

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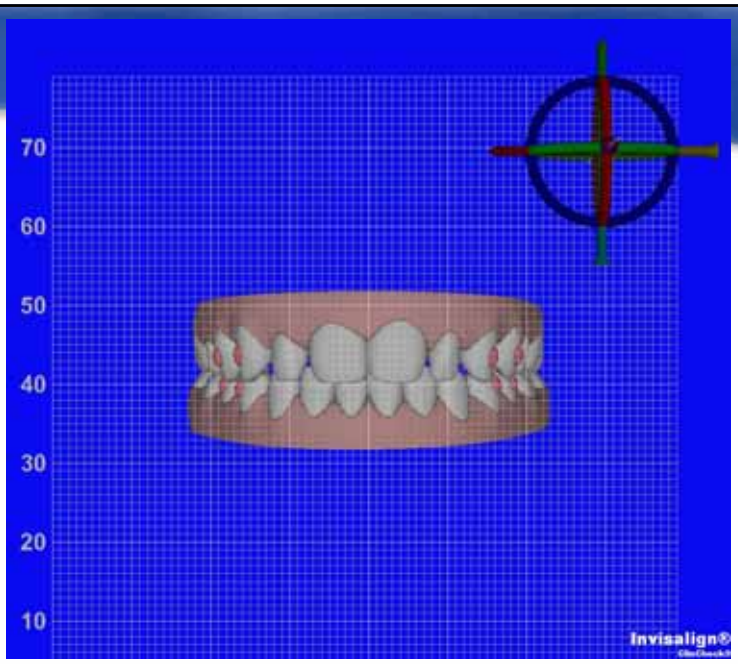

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Case KHo ClinCheck: Initial

KHo Initial

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Tooth size and proportion

Modifications:

1. **Add equal space mesial and distal to the Mx lateral incisors to create space for post tooth movement restorations. Use the TREAT software to measure the M-D width of the Maxillary central incisors. Reduce the central incisor width by a factor of .618 or about 60%. Use this to establish the M-D space for the Mx laterals. This will create an optimium space to redistribute space for post tooth movement lateral restoration.**
2. **Close the diastema space between the Mx central incisors.**

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Case KHo ClinCheck

KHo M2 final

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Incisal Edge Position

Incisal edge position

- Incisal edges of maxillary central incisors and cusp tips of the maxillary canines on the same curved horizontal line
- Incisal edges of the maxillary lateral incisors about 1/2mm to 1mm apical to horizontal line passing through canines cusp tips and central incisor incisal edges
- Small I-G height teeth look more proportunate with less apical position to the incisal edges of the laterals

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Incisal Edge vs. Lip Line

- Ideal: incisal edges follow the contour of lower lip
- Distance between lip line and dentition should be the same posteriorly to canines
- If dentition is in contact with lower lip then all anterior dentition is in contact w/ lower lip

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Incisal edge position

- Let's look at specific modifications for case TH
- Let's look at how the modifications improved the esthetics and help optimize the anterior proportion/ incisal edge position

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ClinCheck case TH


TH Initial

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ClinCheck Modifications

- **Maintain the position of the Mx right canine at stage 10**
- **Add extrusion to the Mx left canine. Set the cusp tip of the Mx left canine #11 equal to a horizontal line passing through the Mx right canine cusp tip at stage 10 of this ClinCheck. Use the anterior predefined view with the grid feature at 200% zoom to establish the described horizontal line.**
- **Add extrusion to the Mx central incisors. Set the Mx central incisor incisal edges equal to the above described horizontal line passing through the Mx right canine cusp tip at stage 10 of this ClinCheck. Use the anterior predefined view with the grid feature and 200% zoom to establish the described horizontal line.**

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ClinCheck modifications

- **Add extrusion to the Mx lateral incisors. Set the Mx lateral incisor incisal edges 1/2mm apical to a horizontal line passing through the Mx canine cusp tips and the Mx central incisor incisal edges as seen on the anterior predefined view with the grid feature and 200% zoom.**

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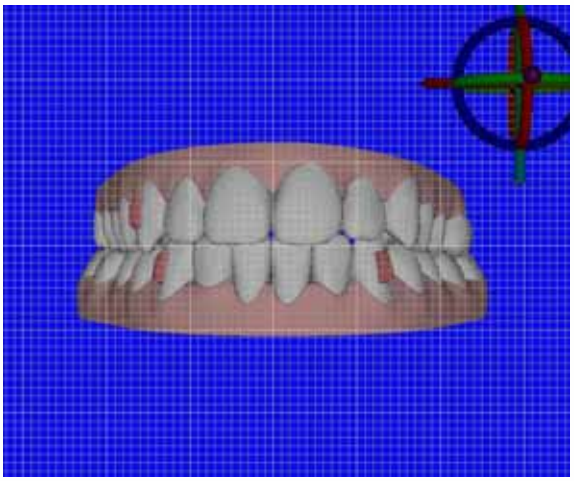

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Case TH ClinCheck V2


KH V2

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ClinCheck modifications

- **Maintain the position of the Mx left canine cusp tip at stage 13 of this ClinCheck**
- **Add slight INTRUSION to the Mx right canine #6. Set the cusp tip of the Mx right canine EQUAL to a horizontal line passing through the Mx left canine cusp tip at stage 13 of this ClinCheck. Use the anterior predefined view with the grid feature and 300% zoom.**
- **Add slight EXTRUSION to the Mx central incisors such that the incisal edges are equal to a horizontal line passing through the Mx left canine cusp tip at stage 13 of this ClinCheck. Use the anterior predefined view with the grid feature and 300% zoom to establish the described horizontal line.**

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ClinCheck Modifications Con't

- **Maintain the position of the Mx right lateral incisor at stage 13 of this ClinCheck. Add slight EXTRUSION to the Mx left lateral incisor. Set the incisal edge of the Mx left lateral incisor equal to a horizontal line passing through the Mx right lateral incisor incisal edge as seen at stage 13 of this ClinCheck. This will place the Mx lateral incisor incisal edges equal to each other and 1/2mm apical to a horizontal line passing through the Mx left canine cusp tip at stage 1 of this ClinCheck.**

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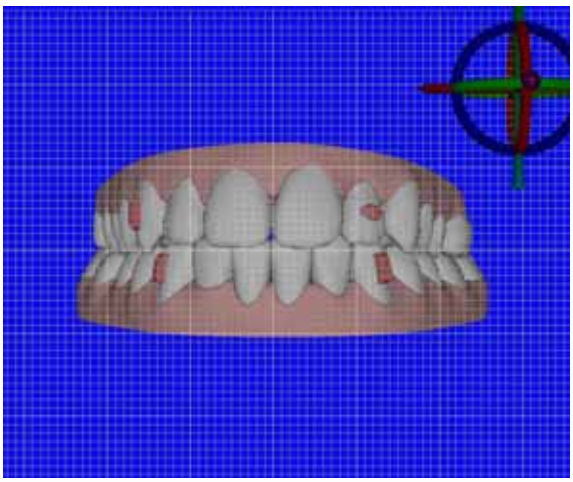

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Case TH ClinCheck V3

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Incisal edge position

Be careful to check the “occlusal” for proper orientation

- Use navigation feature
- “Rotate” about “occlusal” axis
- Use “saggital” feature + or – box to “tip” occlusal up or down so that it approximates level
- Activate horizontal “purple” pin and move GRID close to model
- Activate the round “red” ring to set grid perpendicular to the occlusal
- Use “occlusal” axis to rotate to anterior view
- Use “facial” axis if needed to “level” the model view

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Gingival Height of Contour

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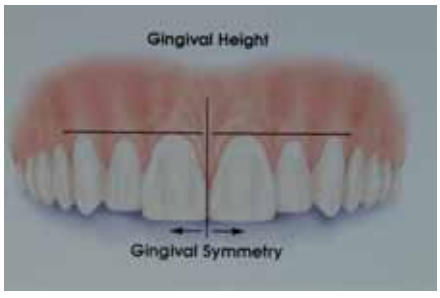
Gingival Contours and Gingival Symmetry

- Gingival apex at laterals should be 1-2mm lower than canines or centrals
- Both sides should be symmetrical
- Must determine which side is most esthetic
- One side the “mirror” image of the other
- Lip line may determine relative importance



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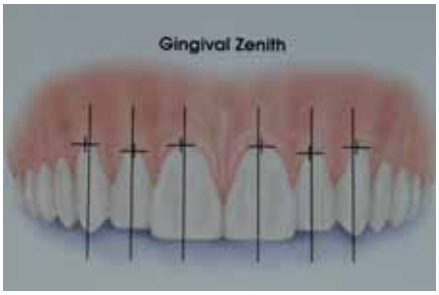
Gingival Zenith

- Gingival zenith of laterals is generally lower than canines and central incisor
- Canines and Centrals: Zenith is just distal to a vertical line down the long axis of each tooth
- Laterals: Zenith is equal to a vertical line drawn down the long axis of each tooth



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Gingival height of contour

- Consider if you will optimize the gingival heights of contour and use post tooth movement restoration or enamaloplasty to “level” the incisal edges
- Use the anterior predefined view with the grid feature to evaluate gingival heights of contour

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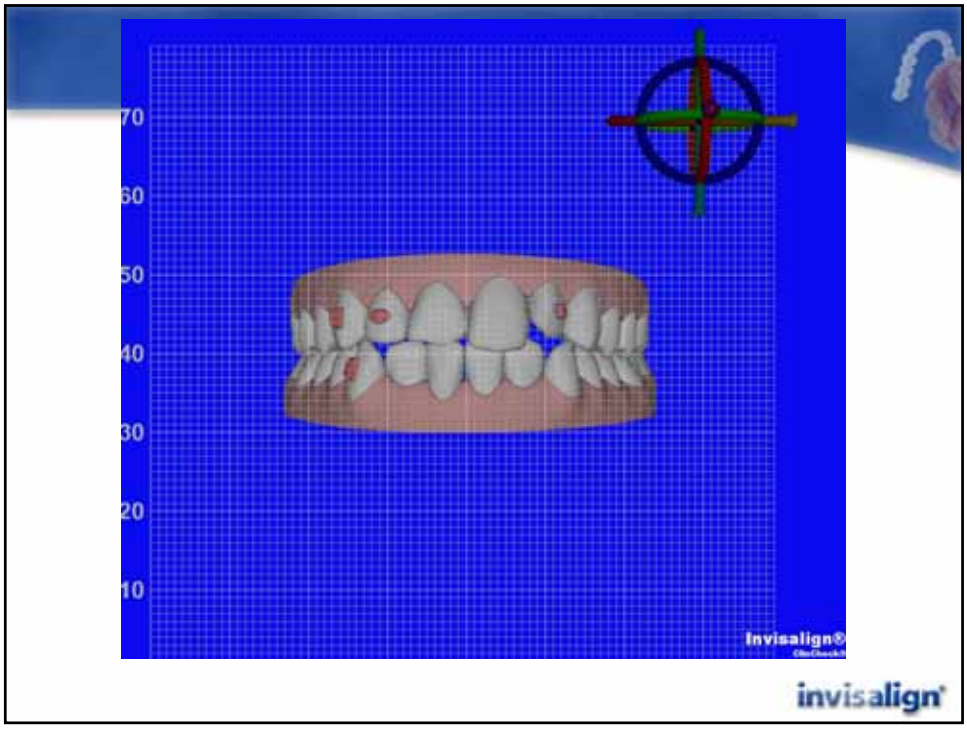
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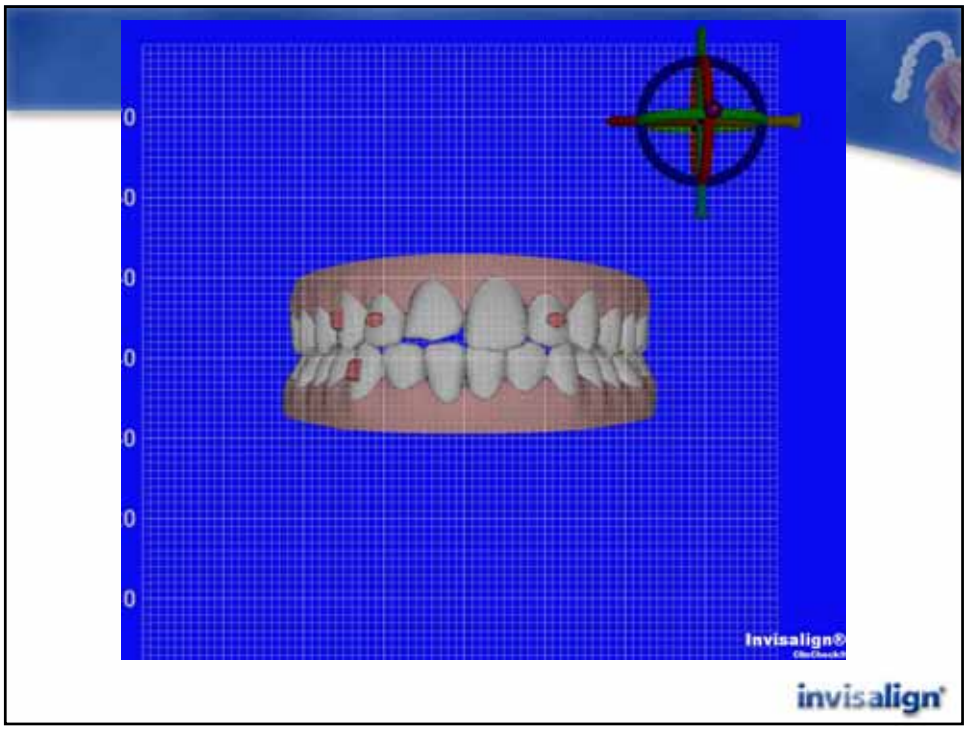
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Case KD ClinCheck: Final

KD Final

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Contact Points

Contact Points

- Interproximal contact points should be in close proximity to incisal edge
- There should be a gingival progression of the contact points between central and laterals and laterals to canines
- The incisal embrasures open as move posteriorly

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Contact Points

- Difficult to evaluate with ClinCheck
- As you perform IPR be aware of the gingival progression of the contacts
- Try to keep contacts to the incisal as you perform IPR
- Use the “zoom” navigation feature at 300% to evaluate contact points
- Refer to photos and models

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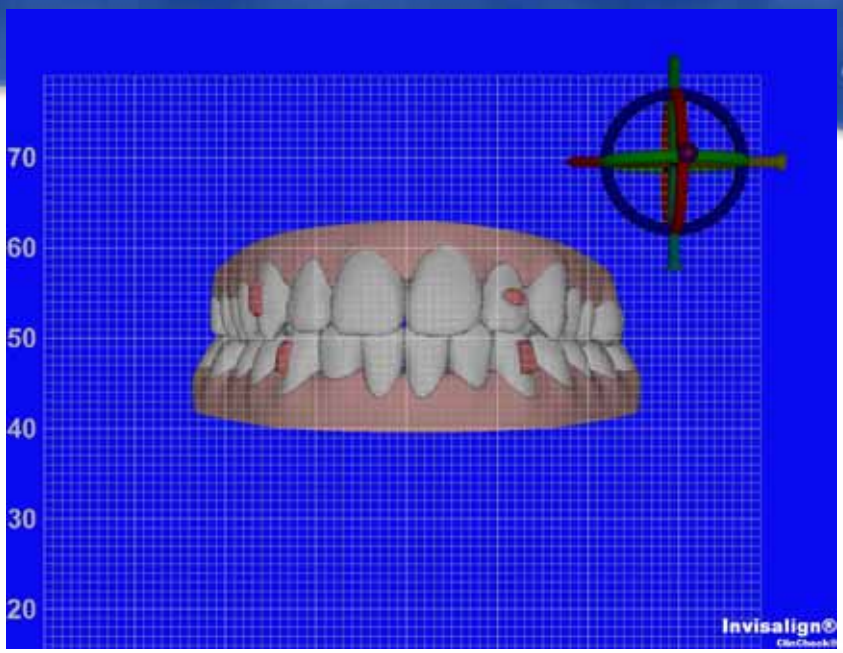

Case TH ClinCheck V3


KH V3

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Gradation

Gradation

- Anterior to posterior teeth should exhibit geometrical symmetry- shorter from canines to molars
- Like seeing city tall buildings and they appear to get smaller

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Gradation

ClinCheck tools to aid gradation evaluation:

- **anterior predefined view with grid feature**

Also note the long axis of the crowns of posterior teeth are inclined toward the lingual

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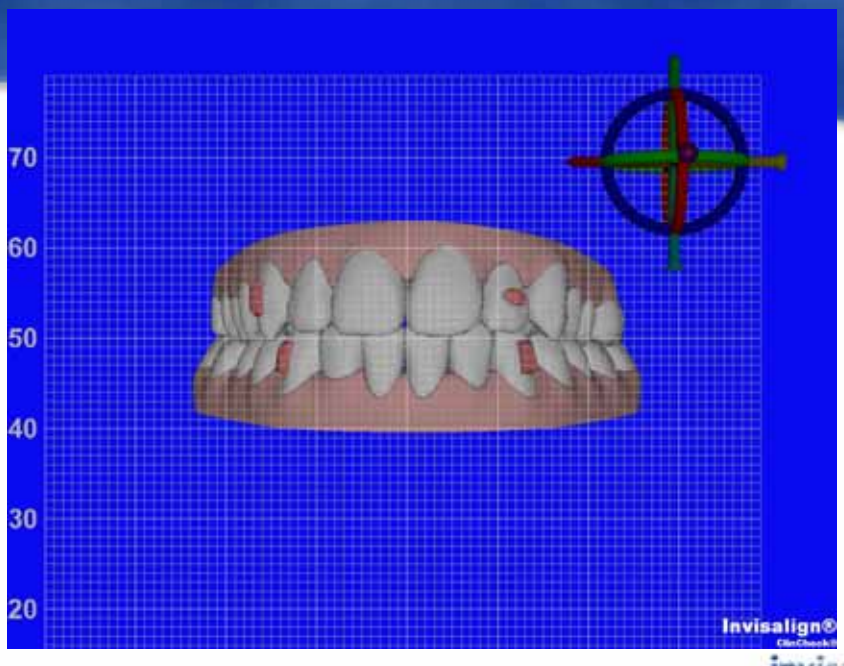

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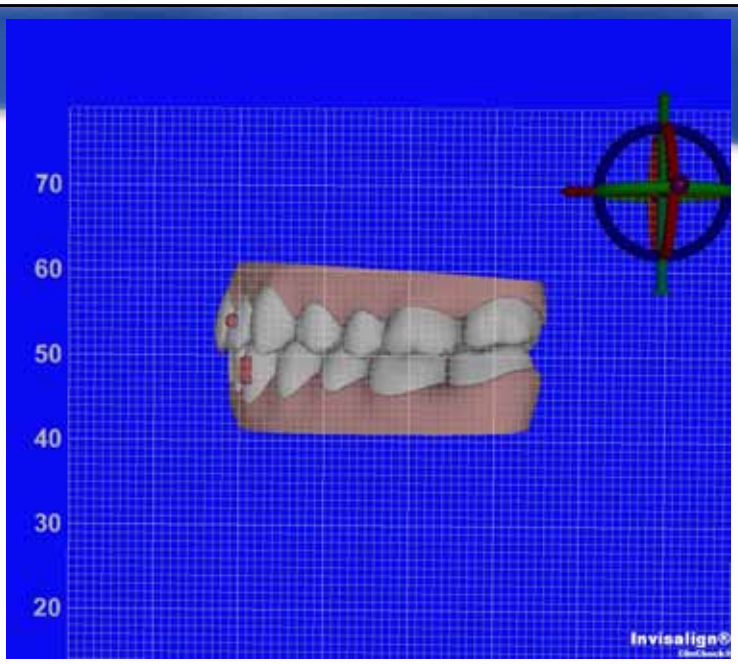

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Case TH ClinCheck V3

KH V3

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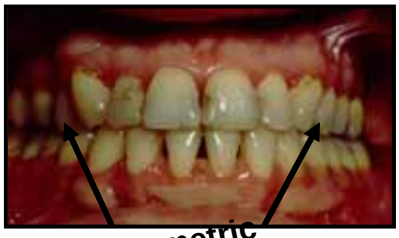
Buccal Corridors

Buccal corridor: Symmetry

Arch Symmetry

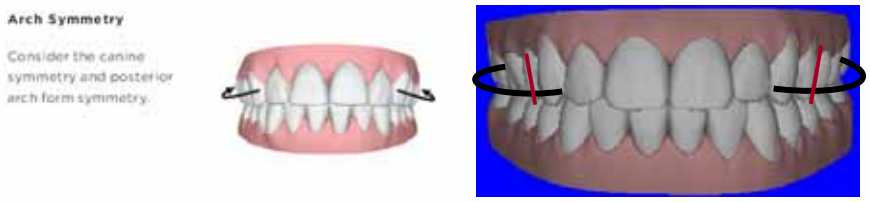
Consider the canine symmetry and posterior arch form symmetry.

Symmetric



Asymmetric

Buccal corridor



- From the cuspids to the posterior segment, is it symmetrical on both the right and the left?
- Evaluate for proper expansion. It should appear as though the bicuspids are out to the buccal the most.
- Long axis of the posterior crowns are inclined toward lingual.

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Buccal Corridor

- Smile attractiveness was determined to be important to lay persons in several studies (Moore, et al)
- Buccal fullness is a prefered esthetic feature for both men and women.
- Broad smile fullness was consistently judged to be more attractive than a narrower smile fullness
- Omega arch forms are not favored

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Buccal Corridors

ClinCheck:

Use grid feature anterior predefined view

Use grid feature with occlusal view.

Change orientation to “occlusal” and orient

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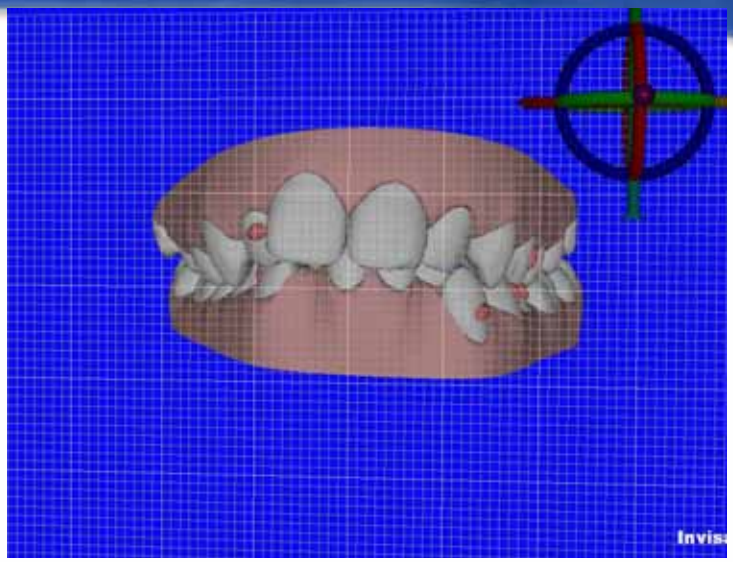

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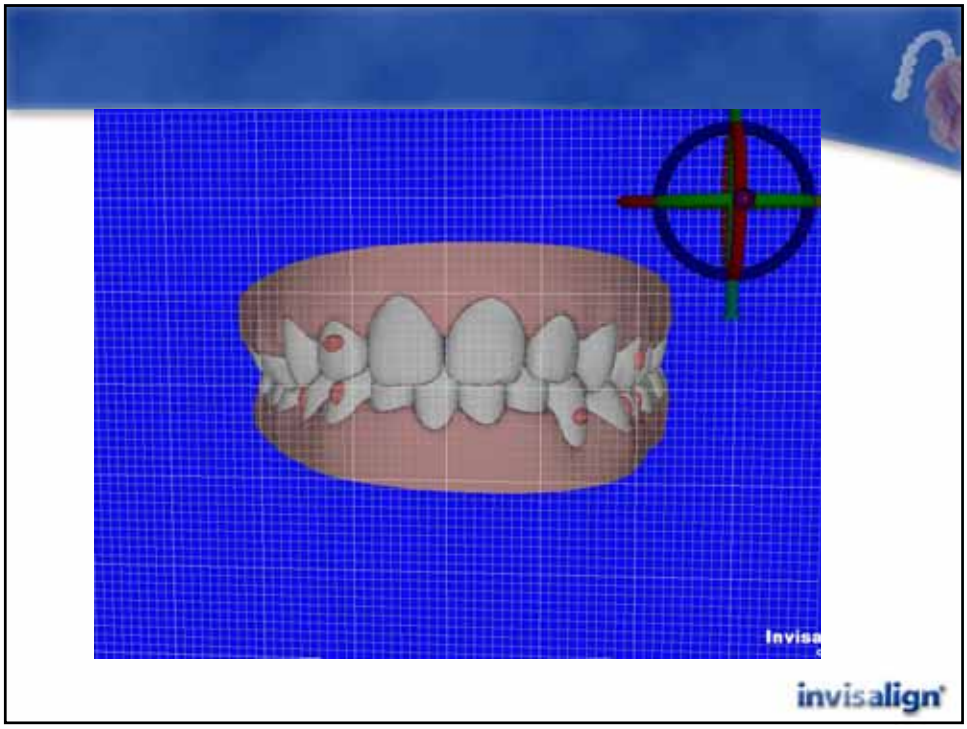
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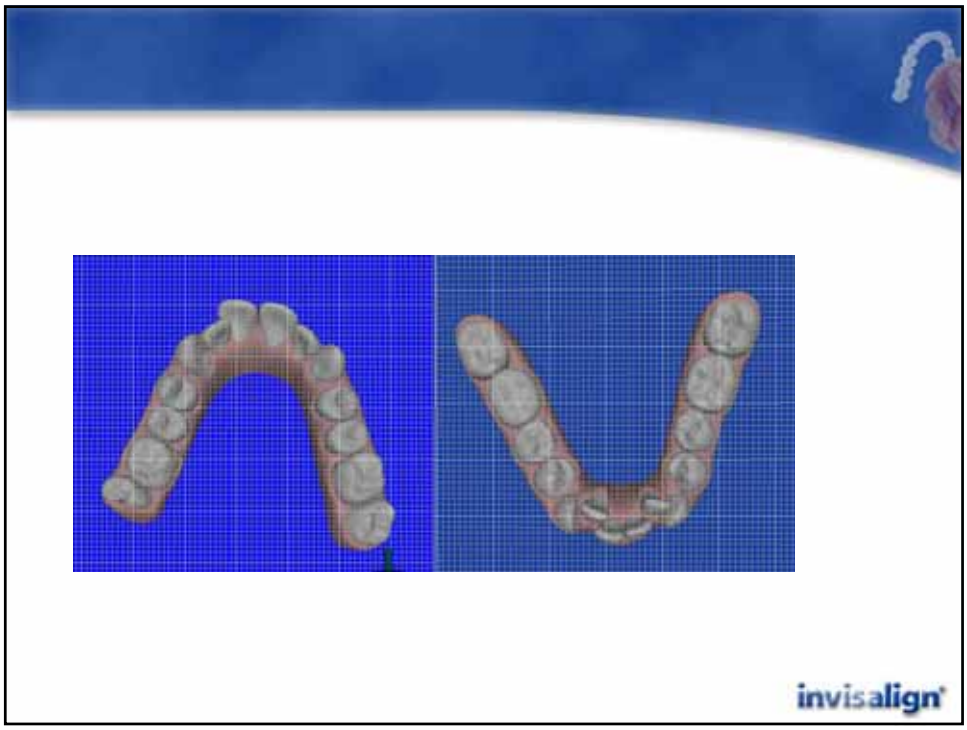
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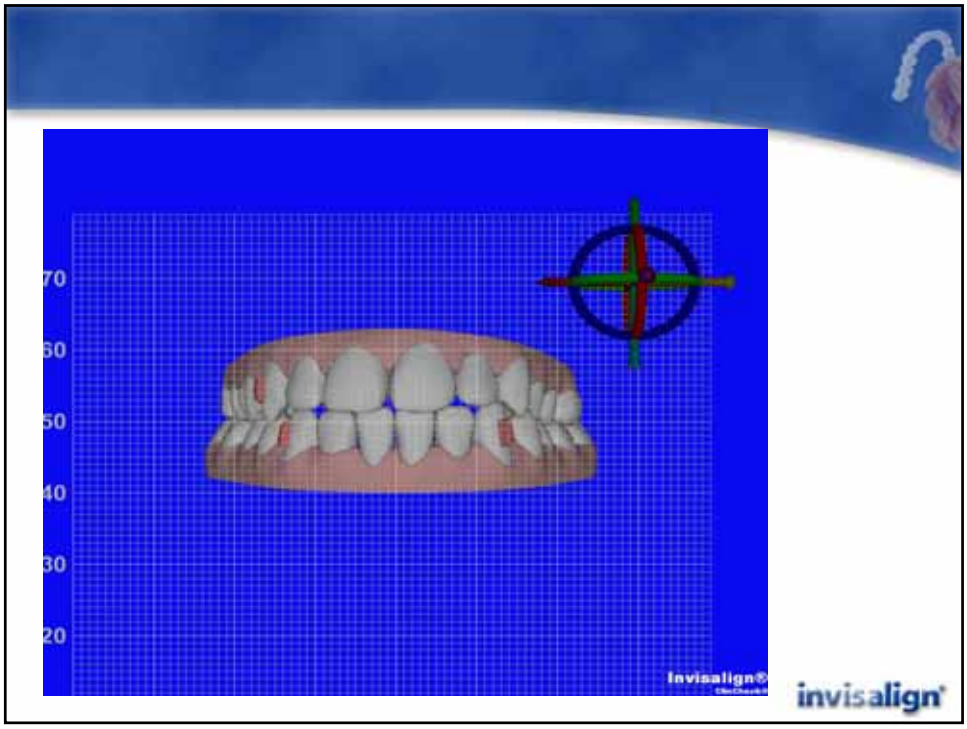
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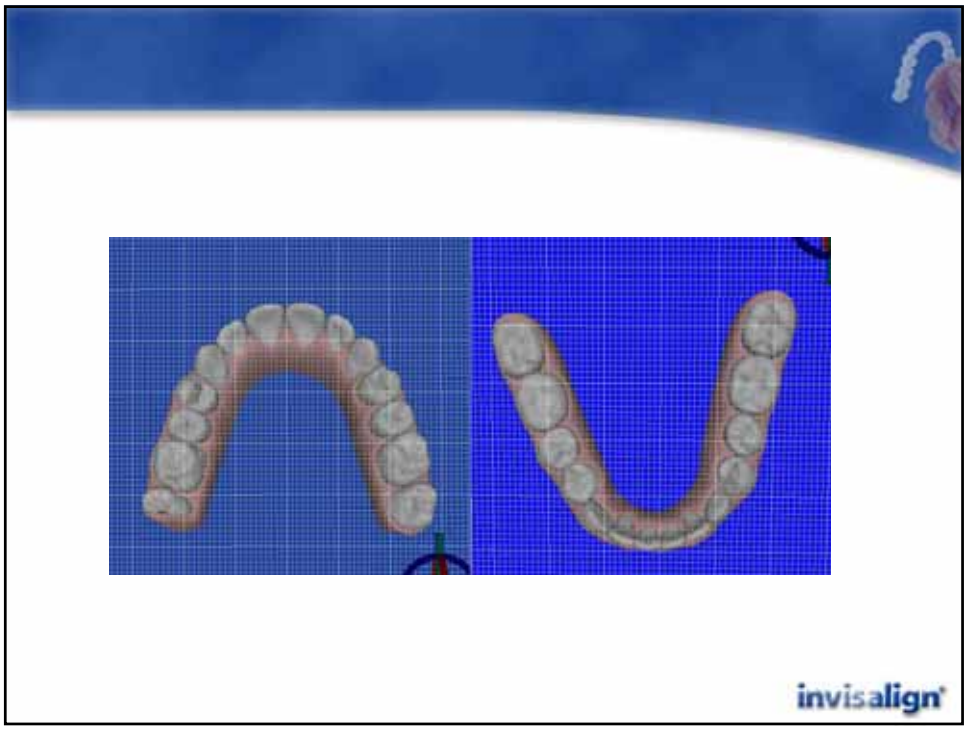

invisalign

Case KC ClinCheck

invisalign

Steps to orient occlusal with grid:

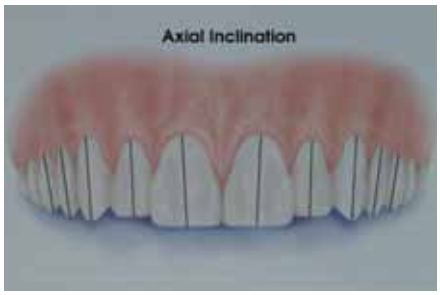
1. **Select occlusal predefined view Mx or Md**
2. **Click on grid feature**
3. **Select occlusal orientation**
4. **Use “Upper jaw” remove feature to remove Mx model**
5. **Use Navigation and widget to orient grid over occlusal view**
6. **Note that the Mx occlusal must be “flipped” for proper orientation**

invisalign

Axial angle of crown inclination

Axial Inclination

- Ideal is slight mesial inclination of vertical axis
- Mesial inclination is line drawn gingival apex to center of incisal edge or canine cusp tip



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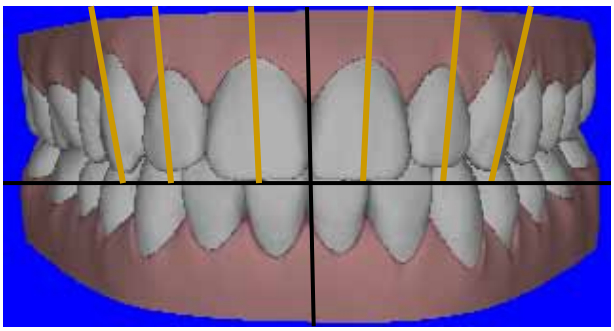
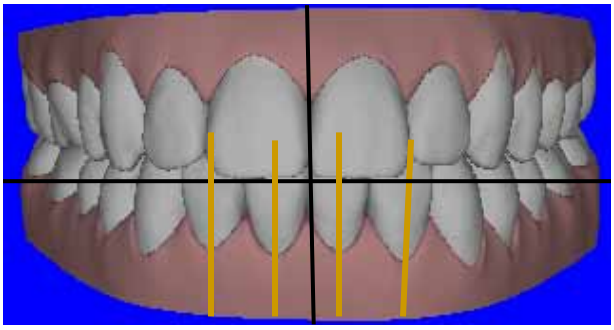
Axial Crown Inclination



On Average Maxillary incisors
Centrals+ 5 degrees
Laterals+ 9 degrees
Cuspids +11 degree

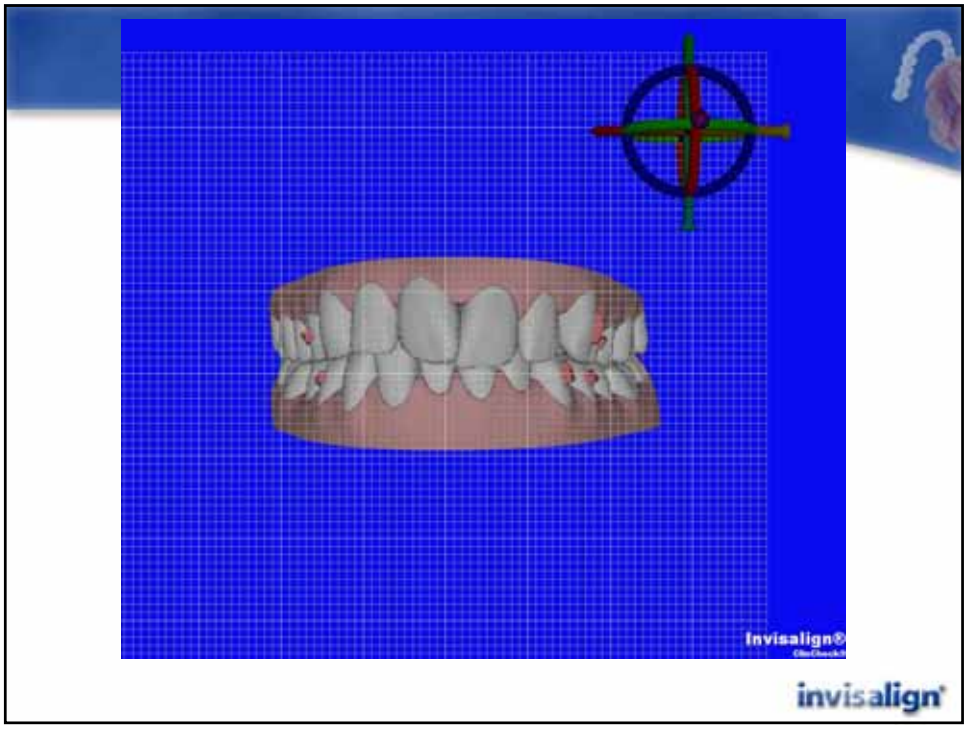
invisalign

Anterior view: Crown Angulation



On Average
All mandibular incisors are + 2 degrees

invisalign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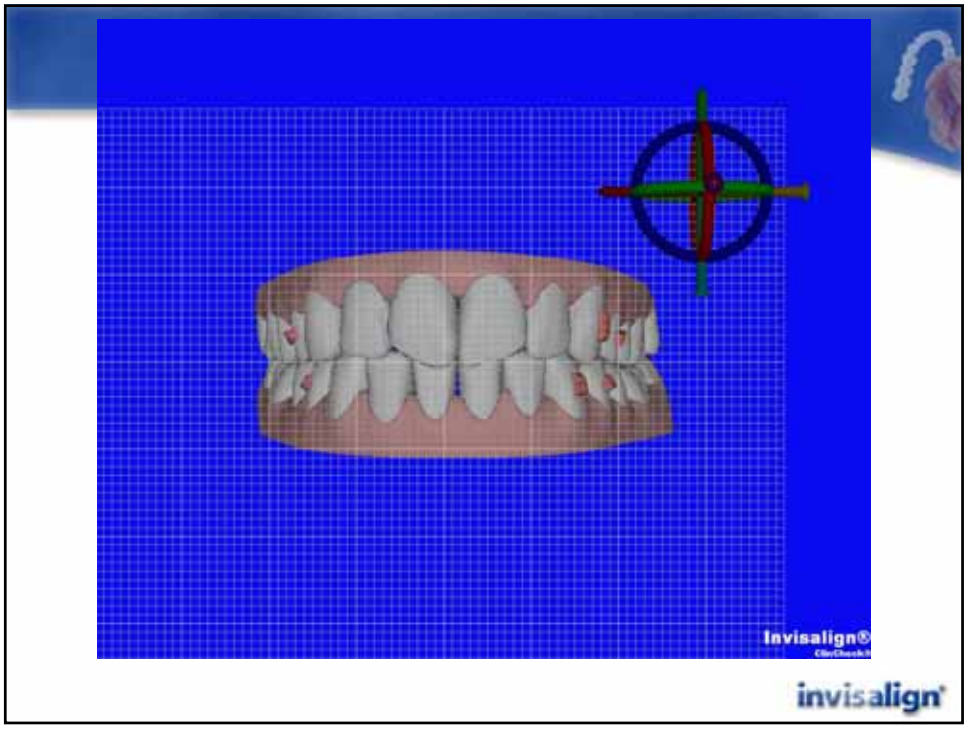
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Axial Angle of Crown Angulation

Case LS ClinCheck


LS Initial

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Case LS ClinCheck: V2


LS V2

invisalign

ClinCheck modifications:

1. **Adjust the crown angulation of the Mx central incisors. Adjust the crown angulation with less controlled root torque. In the M-D plane of resistance maintain an ideal 5 degrees of crown angulation. The ClinCheck shows that both central incisors are derotated and and it appears that from the crown movement the roots are torqued to the mesial in the M-D plane of resistance . You may stop this movement to establish 5 degrees of crown angulation for the central incisors. It is understood that ClinCheck does not represent roots. Set the crowns to maintain 5 degrees of crown angulation for #8 and #9.**

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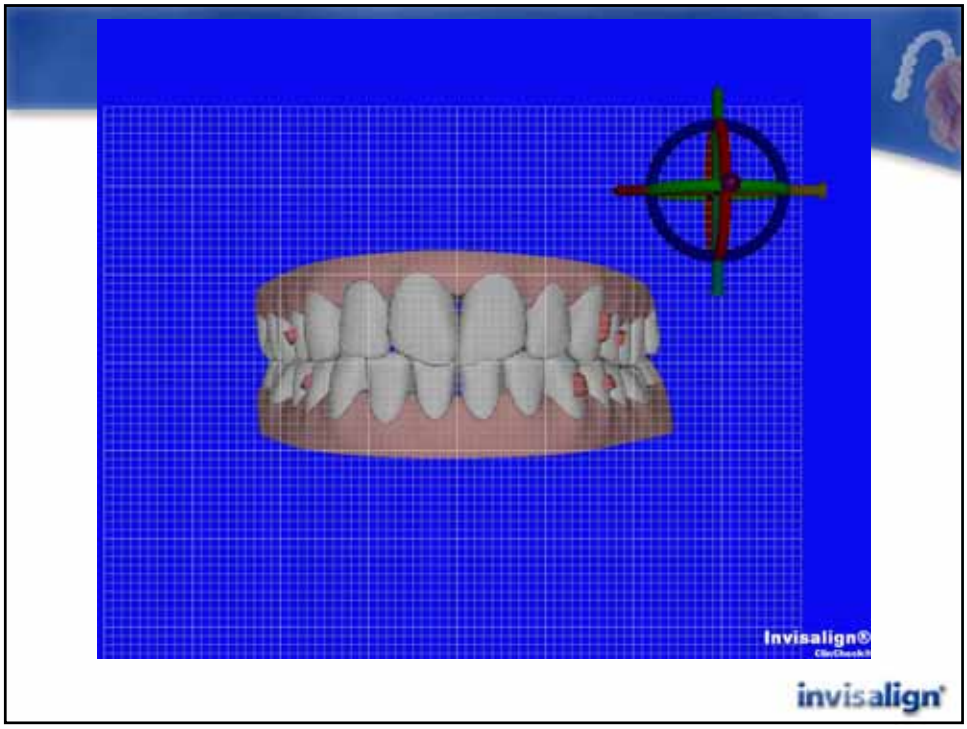
Case LS ClinCheck: V3 Final


LS V3 Final

invisalign



Labial Crown Angulation

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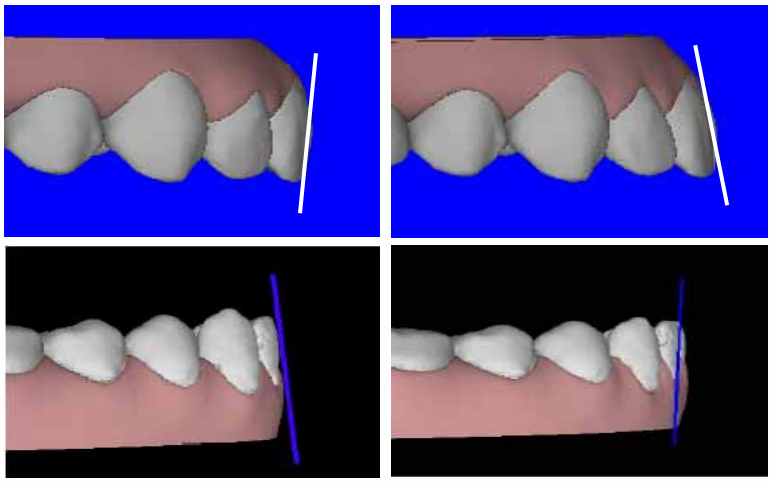
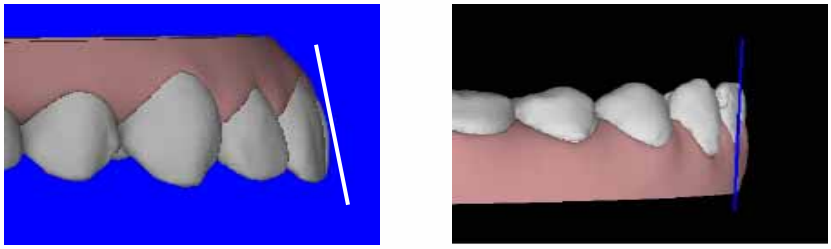
Buccal View
CROWN INCLINATION

Retroclined **Satisfactory**



invisalign

Buccal View
CROWN INCLINATION



Crown Inclination is critical for esthetics and function.

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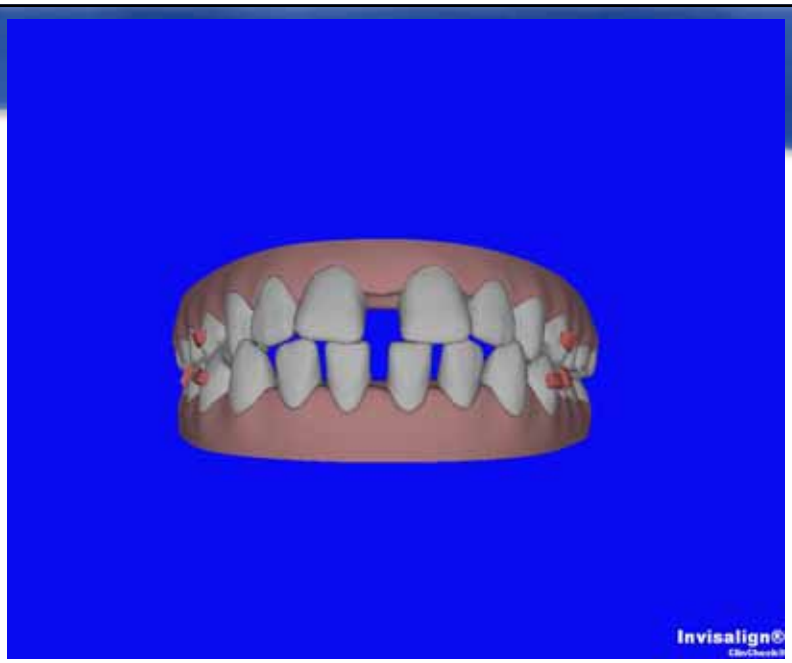
Labial Crown Inclination

- Interincisal angle (mean) 131 degrees Mx incisor to Md incisor
- Mx incisor to NA (mean) 22 degrees
- Md incisor to NB (mean) 25 degrees

ClinCheck:

Use the buccal view with the grid feature

invisalign

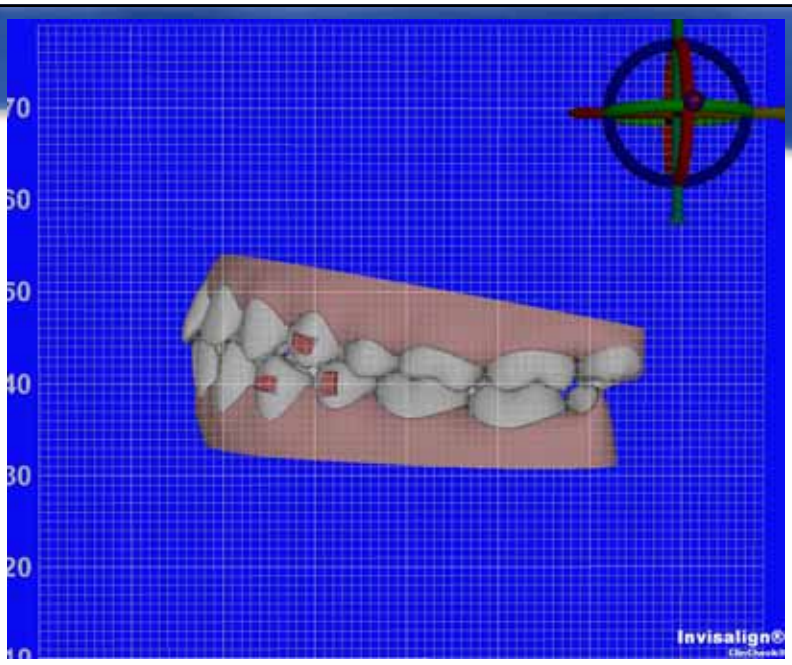


invisalign

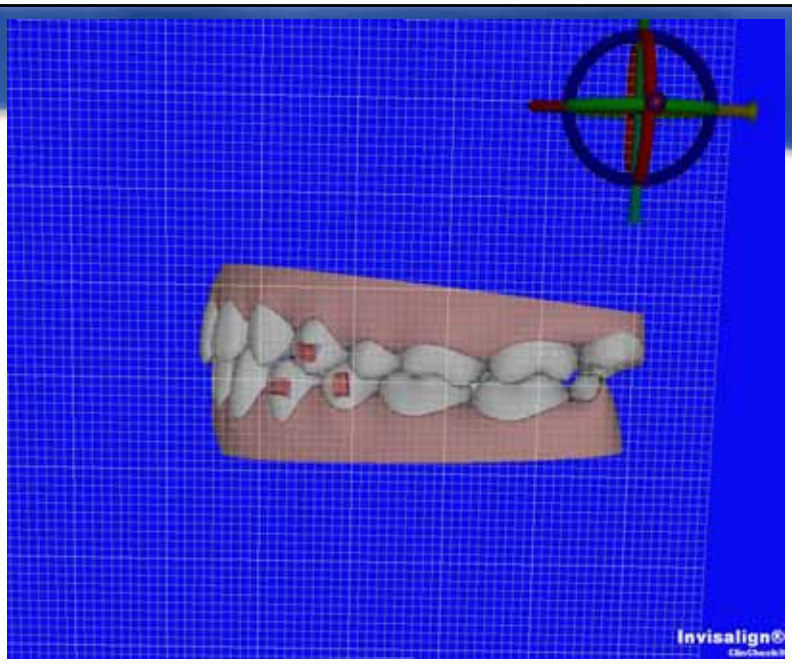
ClinCheck:

- **Anterior predefined view**
- **Grid tool**
- **Orientation Saggital**

invisalign



invisalign



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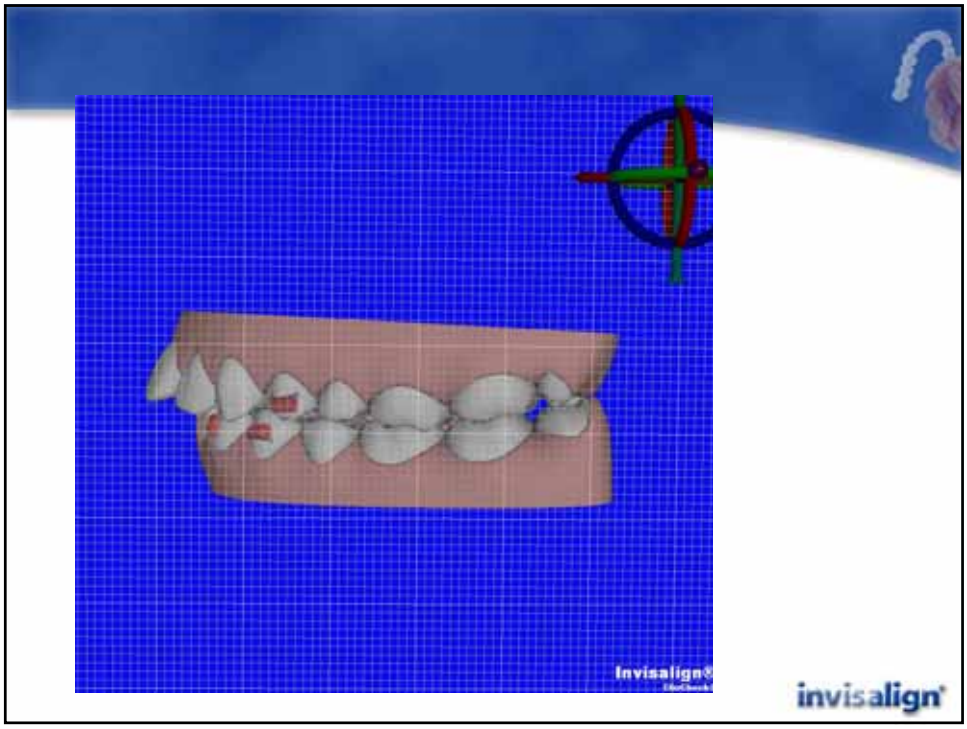
Case SL ClinCheck


SL

invisalign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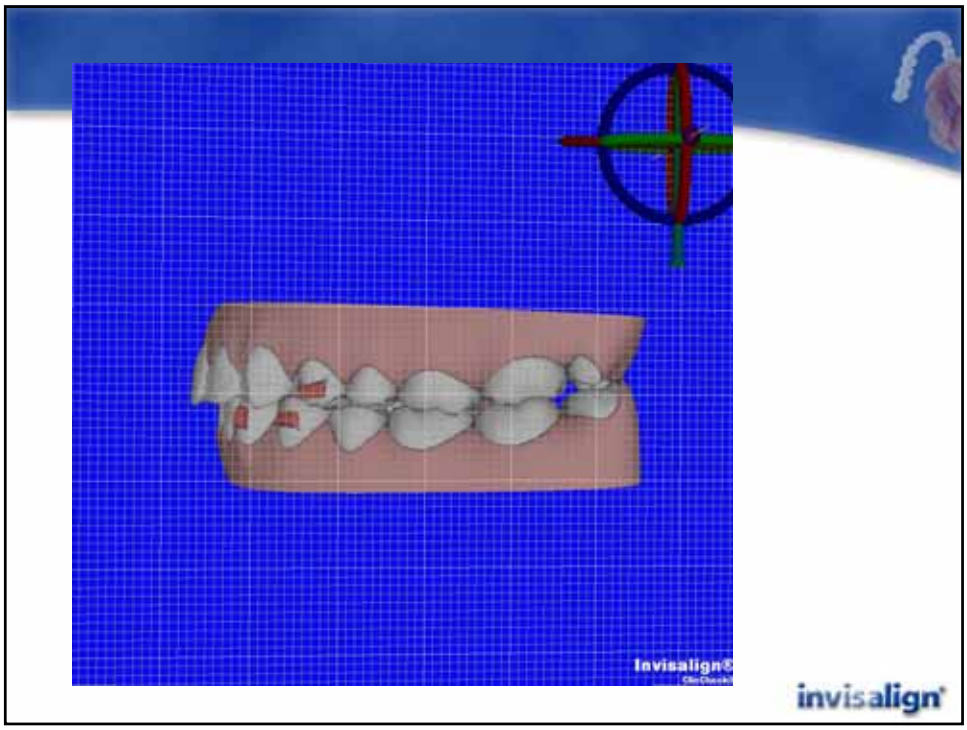
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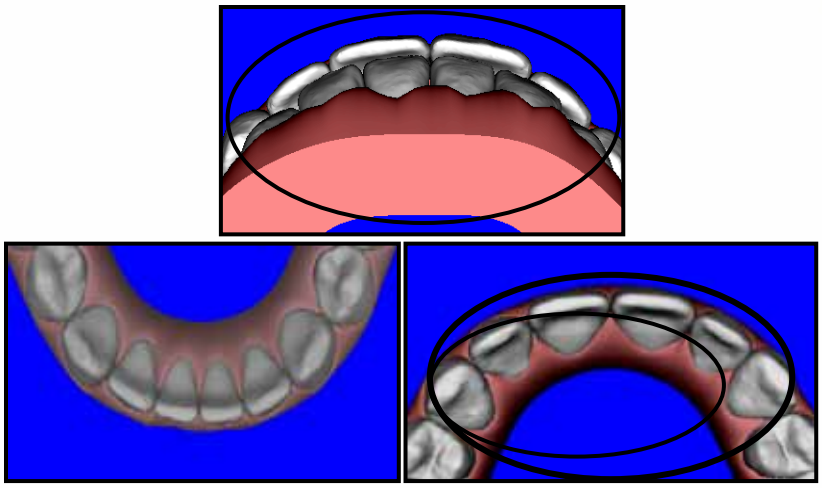
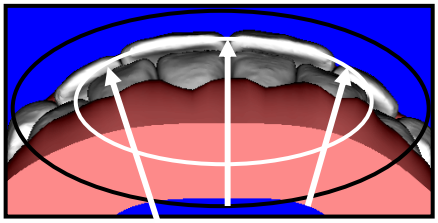
Overjet

Anterior coupling



Anterior Overjet view
SYMMETRY “Arch curvature”



Only when you have ideal posterior occlusion and tooth size, will the overjet be symmetric

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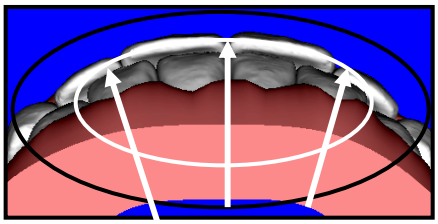
Anterior Overjet view
SYMMETRY “Arch curvature”



To obtain ideal overjet may mean adjusting the AP and/or performing IPR

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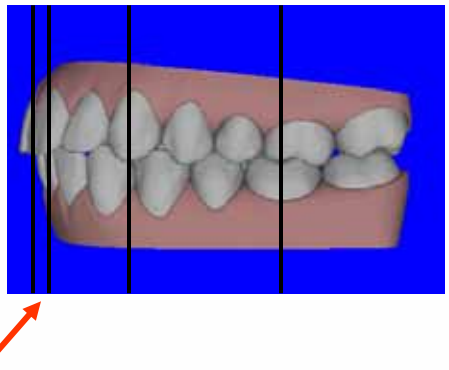
Buccal View Overjet



Overjet is dependent upon the AP relationship of the anterior and posterior teeth.

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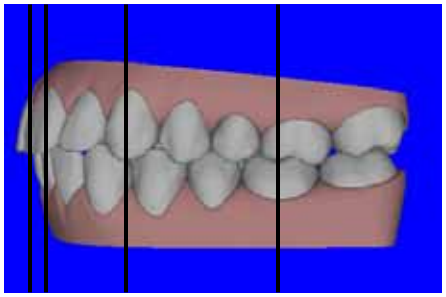
Buccal View Overjet



As the AP occlusion changes so does the overjet. If the biological limits allow, the overjet can be adjusted in the anterior teeth by proclining the lowers and retroclining the uppers with IPR.

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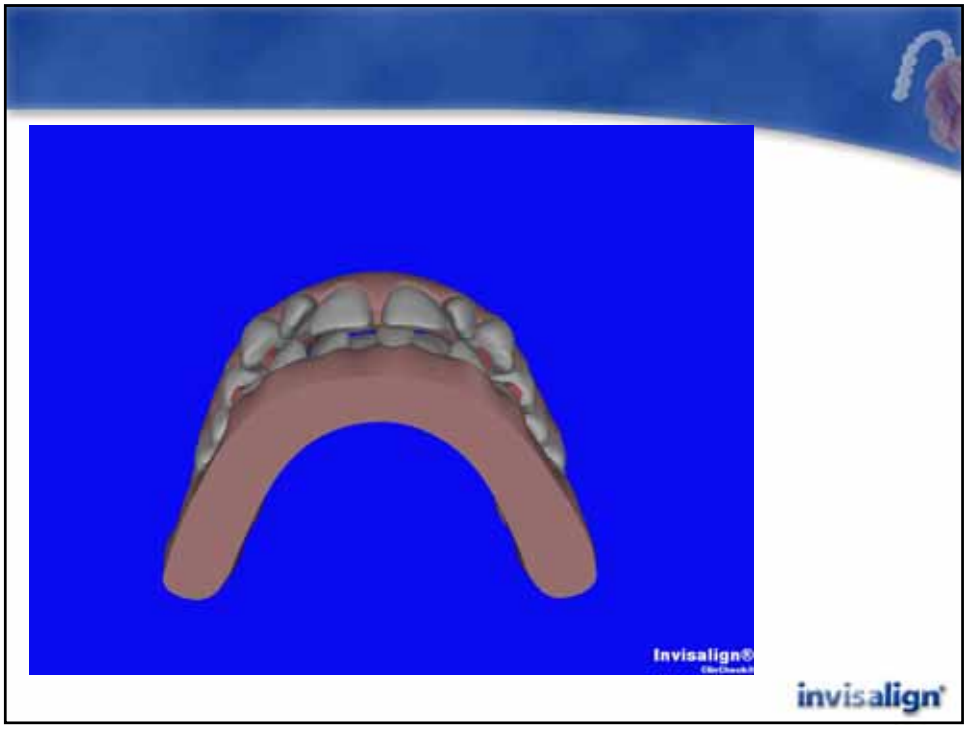
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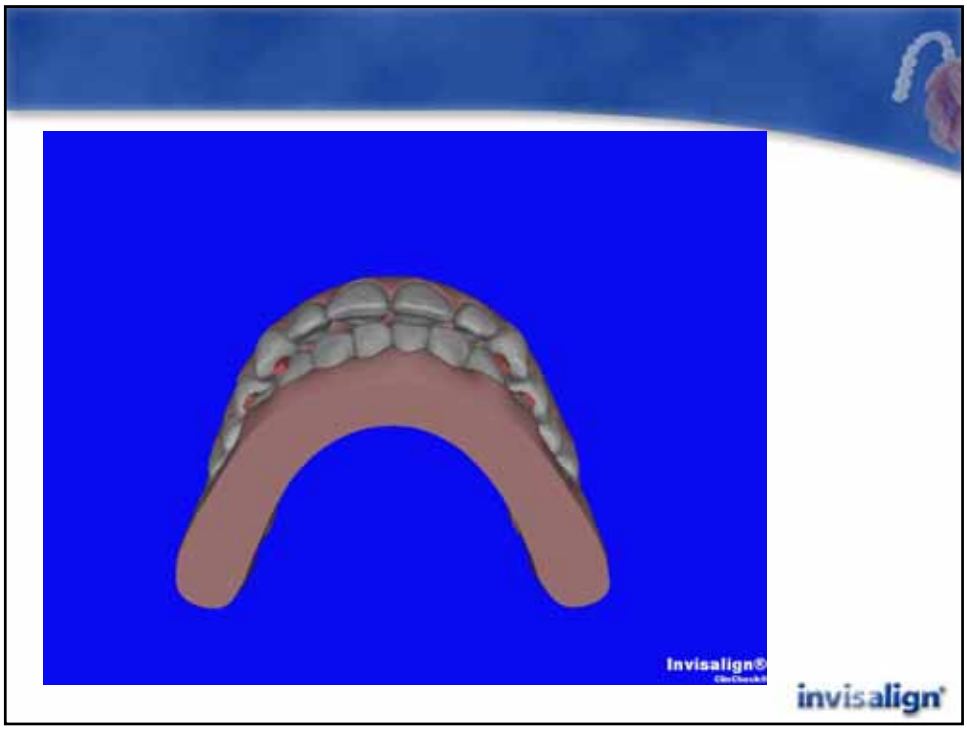
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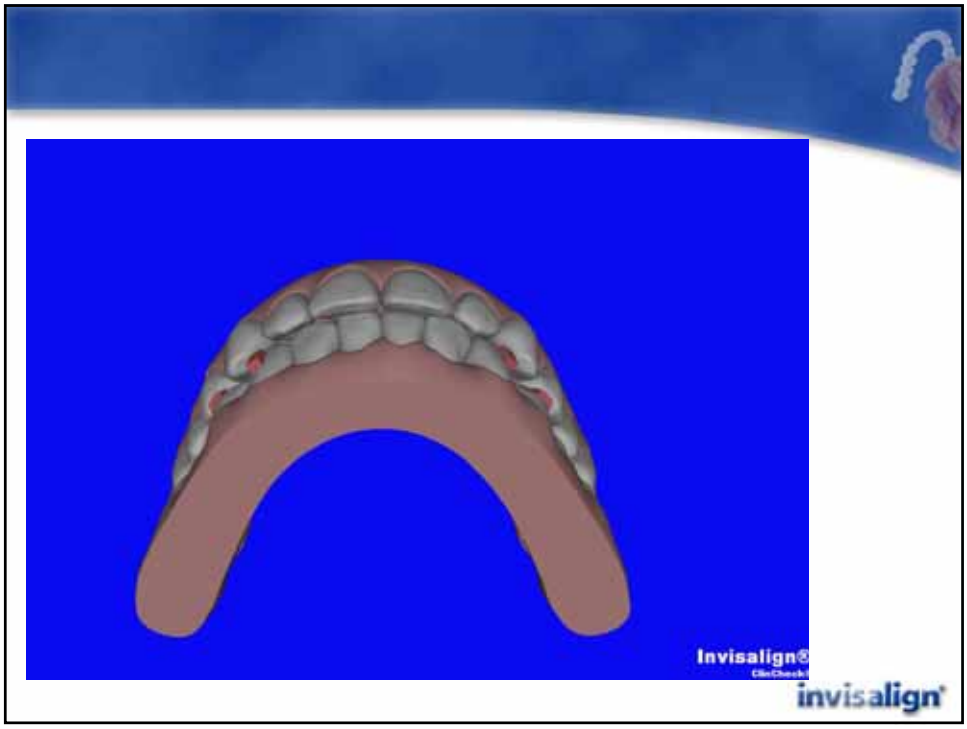

Anterior coupling

ClinCheck MB V1

MB V1

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Anterior Coupling

Case MB ClinCheck V2

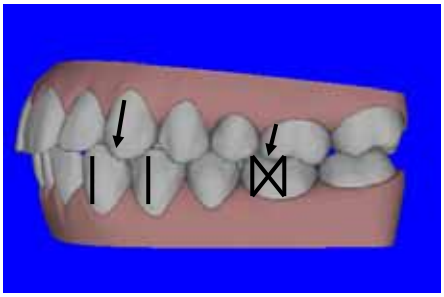

MB V2

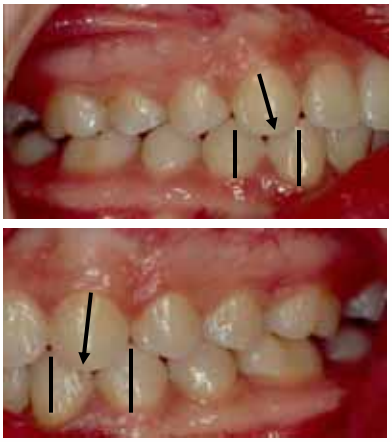
invisalign

Intercuspation

Buccal View
Classification I, II, III

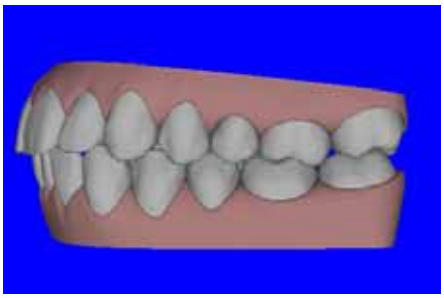
CLASS I





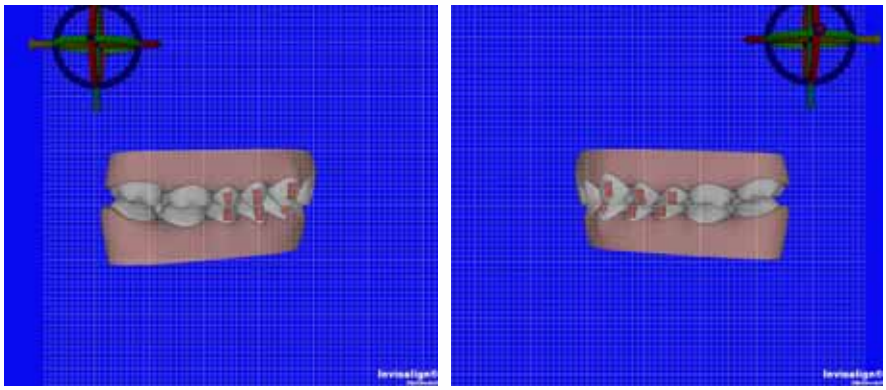
invisalign

Buccal View
Intercuspation



Intercuspation dependent upon the AP position of the teeth

invisalign

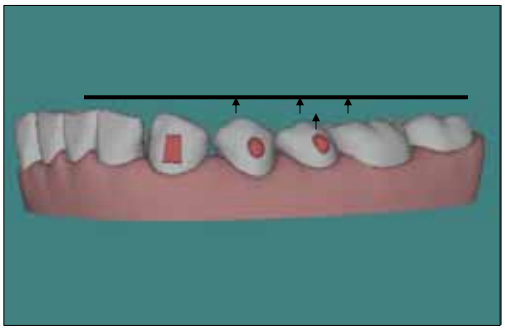


invisalign

Curve of Spee

invisalign

Buccal View
Curve of Spee



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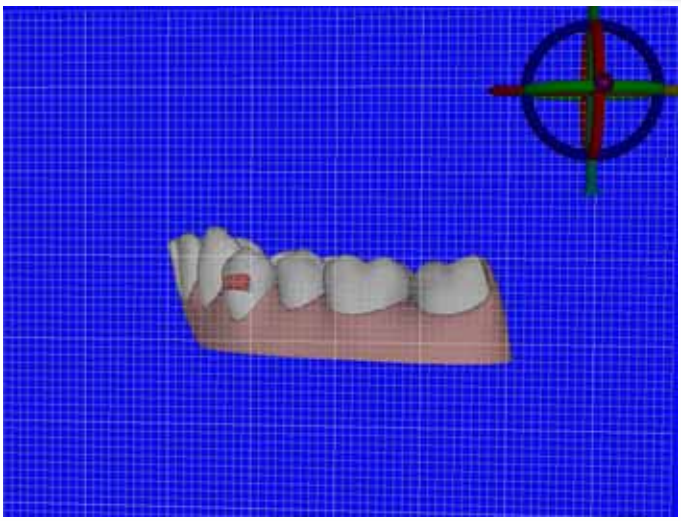
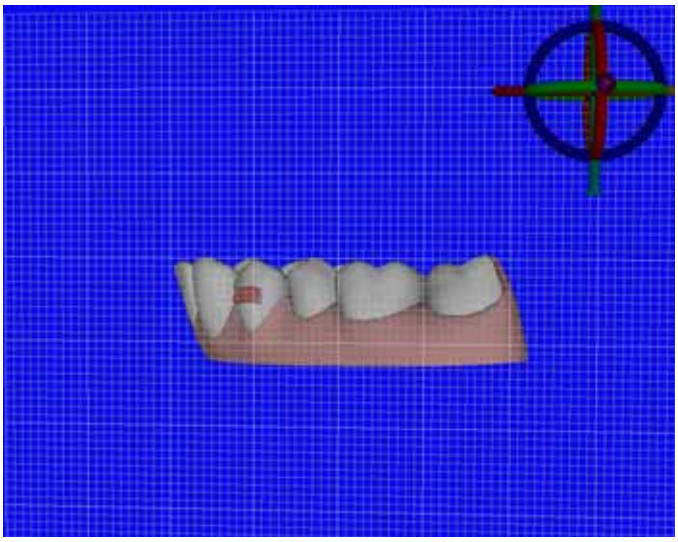


invisalign



invisalign

Case RD ClinCheck

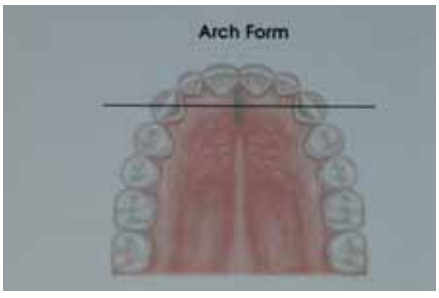
RD

invisalign

Arch Form

Arch Form

- Line drawn between tip of canines should bisect the incisive papilla
- Helps to determine proper arch form



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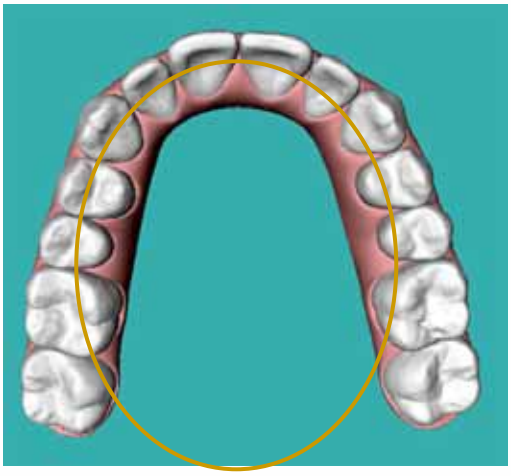
Arch form



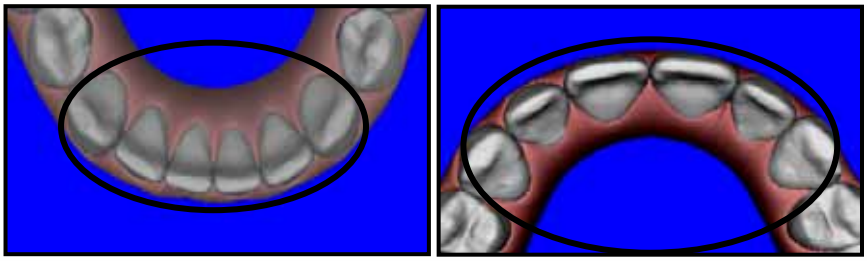
invisalign

Arch form

- Make sure the arch shape is what you feel is best for the patient esthetically and functionally. One must always keep in mind the muco-gingival support and stability when expansion is considered.

invisalign

Arch form



Care should be taken not to bodily expand the cuspids!

invisalign

Arch Form

Proper inclination is critical for lip support and functional guidance

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ClinCheck:

- **Superimposition tool**
- **Grid feature**

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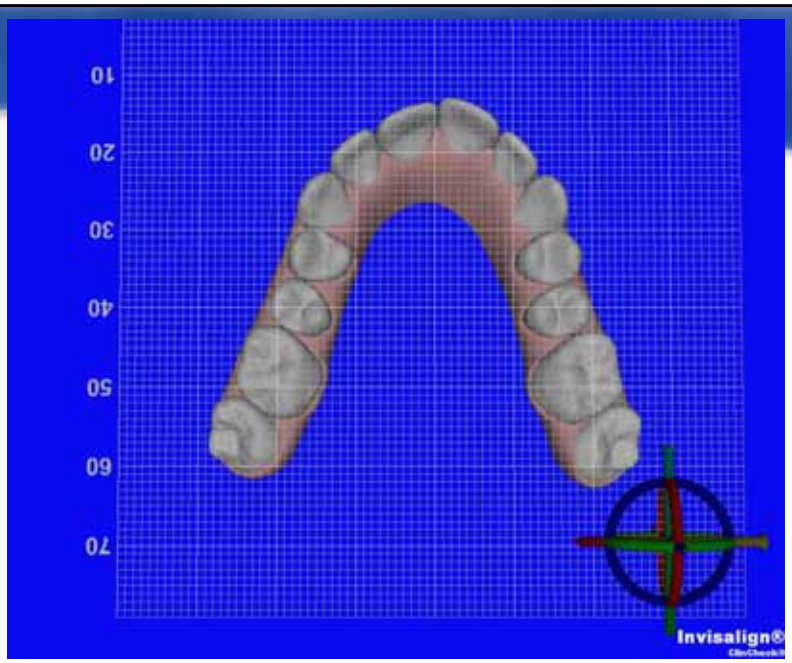
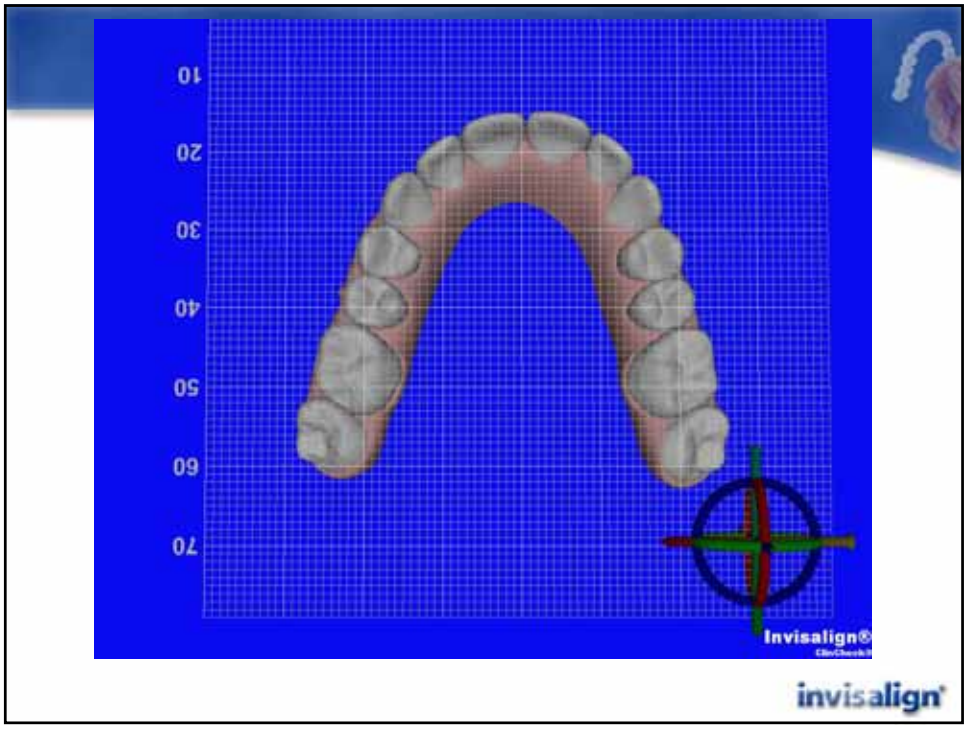


invisalign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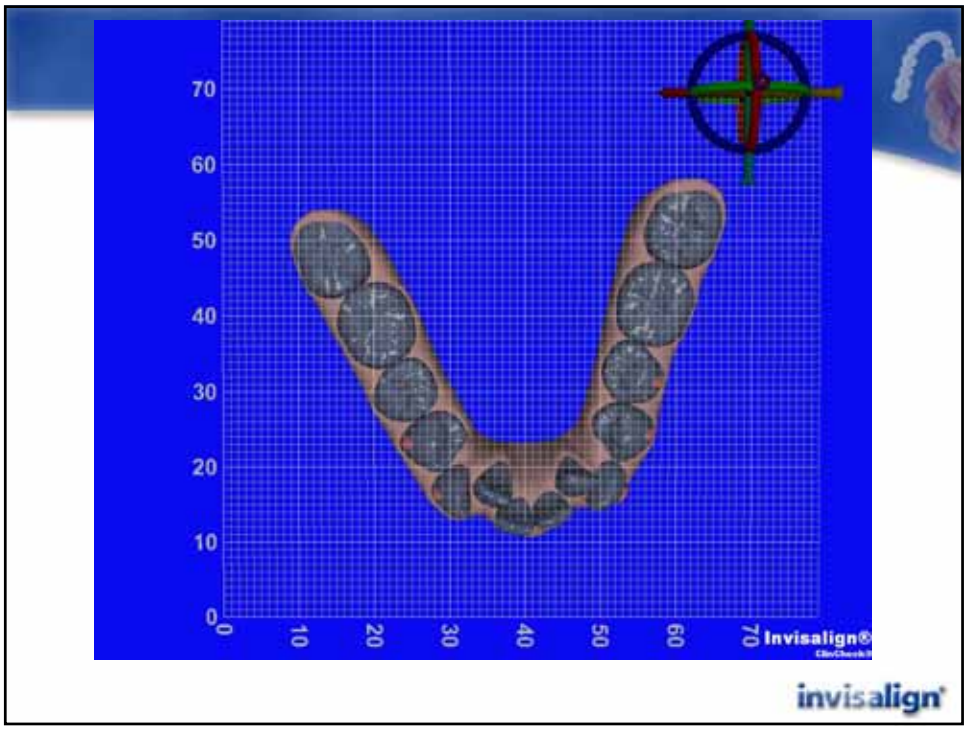
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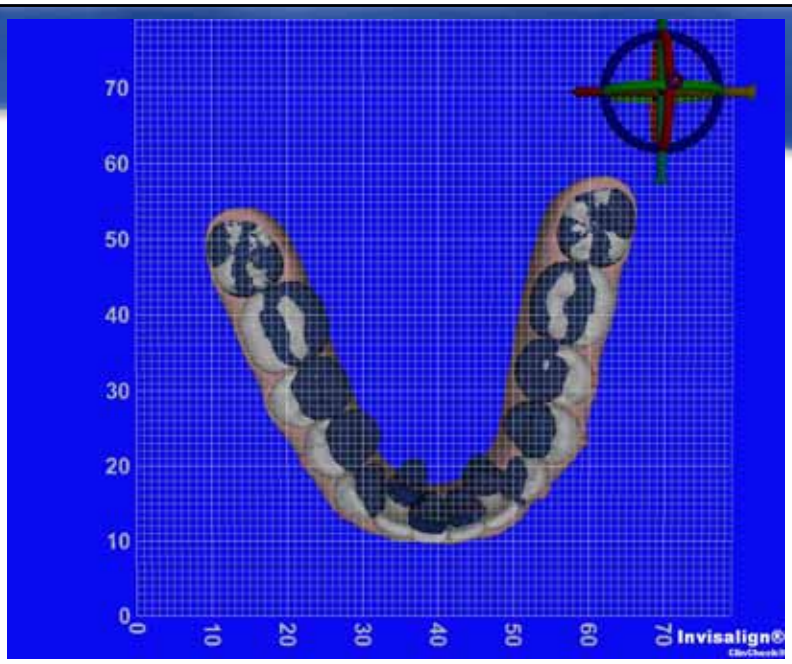

Case KC ClinCheck


KC

invisalign

Black Triangles

- ClinCheck gingiva is “virtual”. It is added with the software.
- Be cautious adding IPR to resolve black triangles represented from crowding resolution
- Other reasons to see black triangles include:
  - periodontal apical attachment migration
  - tooth morphology
  - angle of tooth inclination

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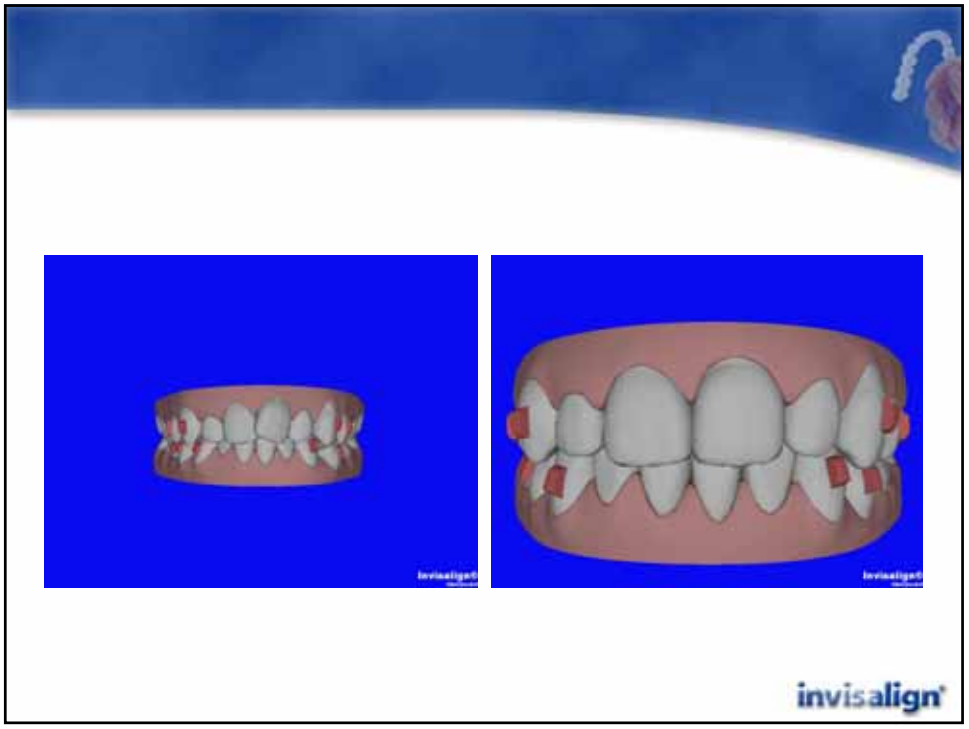
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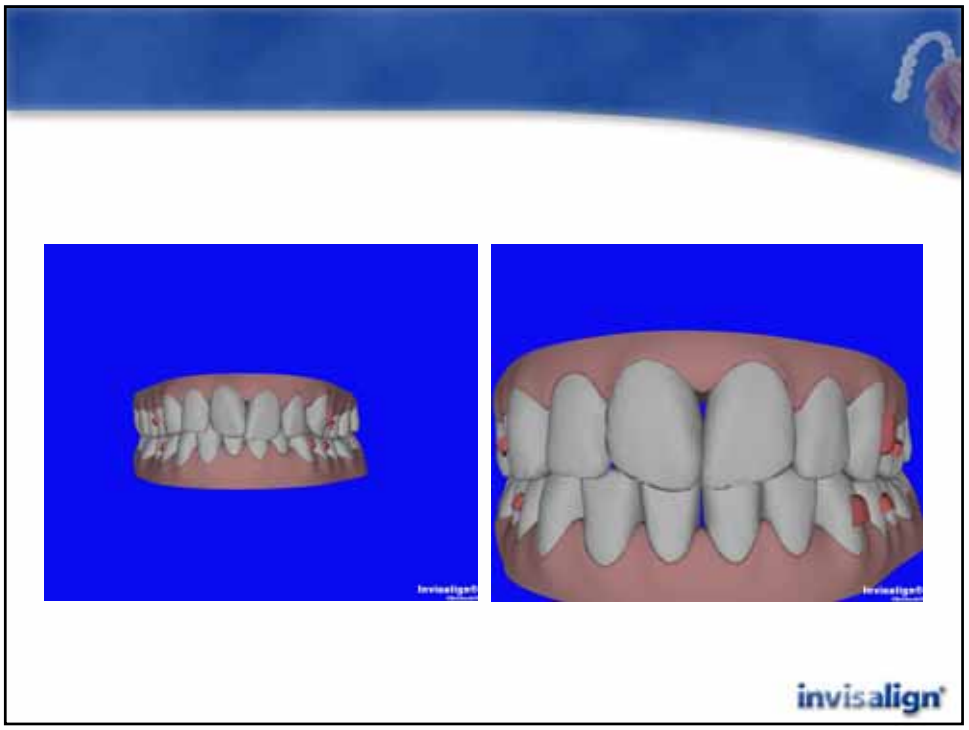
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Black Triangle

- May use the “seek, selective zoom” tool on the navigation bar
- Be aware of why the black triangle appears on the virtual representation
- In the two examples both have similar overlapped centrals yet black triangle appears in only one representation
- Note Align’s disclaimer: “Simulated gingiva and tooth movements” seen at the top of ClinCheck model

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Esthetics summary

- Ideal esthetics vary between cultures, generations and gender
- A dentist’s view of esthetics must not be the only determinant of the final result
- It is important to discover and discuss the patient’s esthetic expectations
- Consider the movements that play to Align’s strengths and exercise caution to understand the challenges of movements that are Align’s weakness
- For example: true extrusion of anterior teeth can be challenging and intrusion more predictable with Invisalign as the stand alone force system

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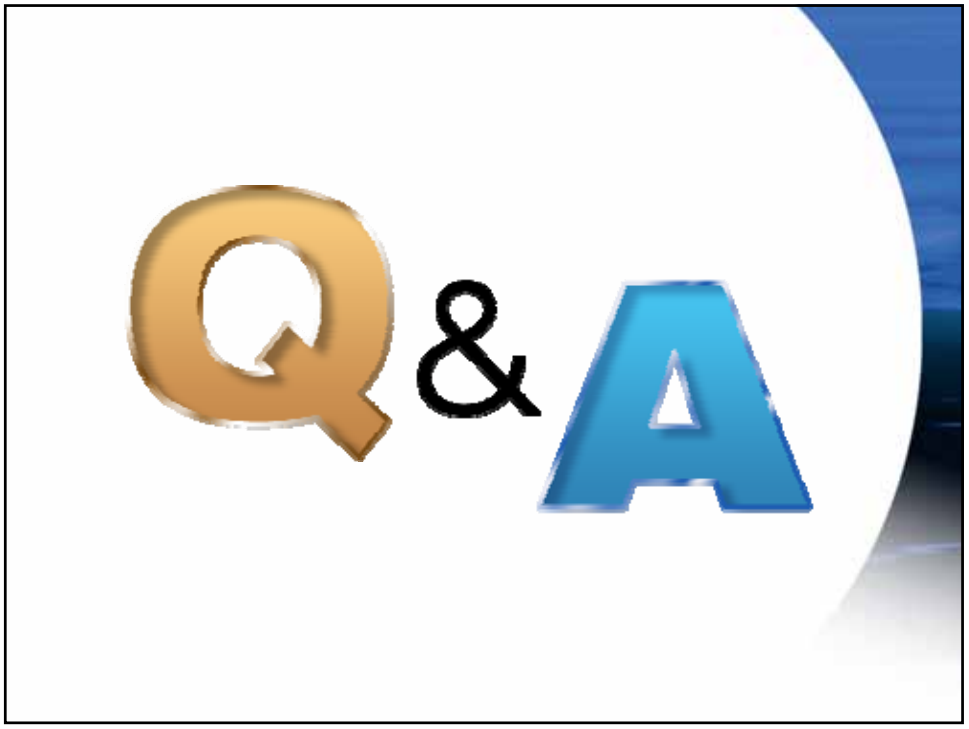
Q&A


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