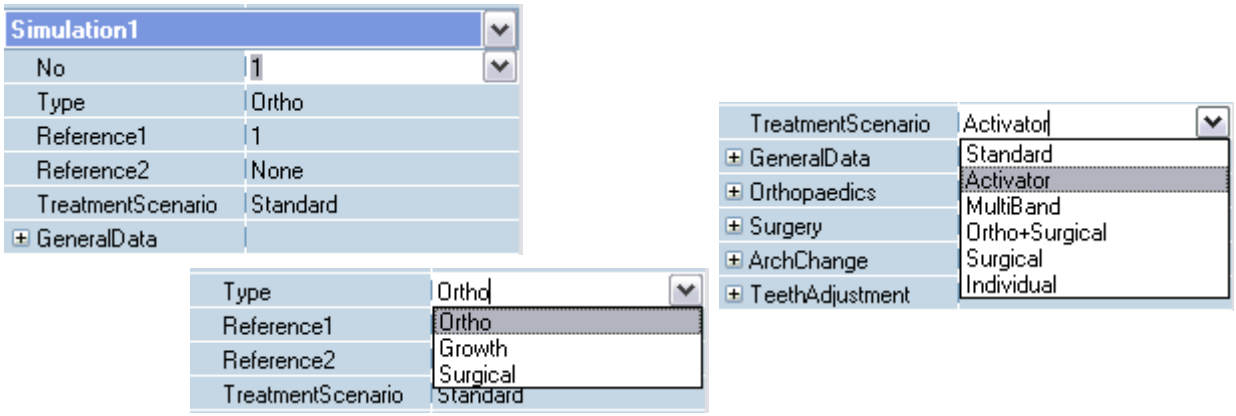
Tiops Simulation, Part 1

Simulation of Growth and Orthodontic/Orthopedic correction

One of the most valuable features of the TIOPS program is its ability to aid the clinician in simulating treatment. This feature is a great help in treating difficult cases as it provides a means of obtaining a clear idea of the treatment possibilities and the needed dental movements as well as the anchorage needs in a specific patient.

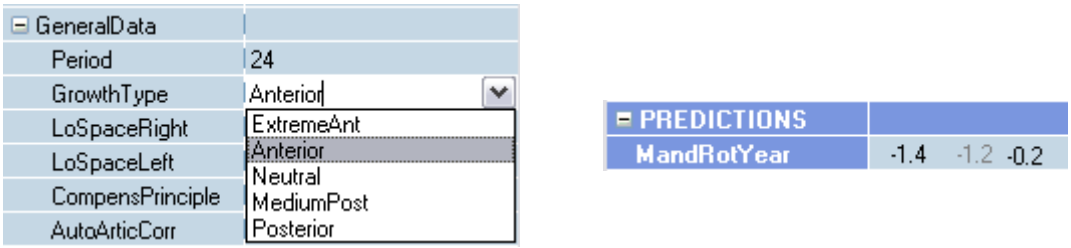
The process of simulating a patient's treatment begins with a file saved as a .txd file that should be located in the Analy2005 folder. The file is opened in the TIOPS program and can now be simulated as needed. The simulation process starts with a click on the purple icon on the top menu bar or pressing <Alt> and <A> together. A new purple icon will emerge labeled 1.

1. On the menu bar on the left side of the screen move down to the box labeled **Type** and click on this bar to open up a selection of options that includes **Ortho, Growth and Surgical**. Click on **Ortho** or the letter <o> in the Type field. You may have done more than one analysis. If so make sure to select the appropriate one as Reference1. For the Reference2 item see note1. Then proceed to your choice of treatment. For further explanation see note 2.



2. Go to **GeneralData** and make any changes needed:

   The default values for the simulation **Period** you may not wish to change at first but **GrowthType** you should consider changing to suit the individual patient. The options are based on the structural signs as suggested in the growth analysis studies by Björk. One of those growth prediction parameters is calculated in TIOPS2005 (Björk, A, 1963). The program has built in values for each possibility and places the lower incisors at different relationship to the A-Pg line according to growth rotation type (Ricketts, 1957).

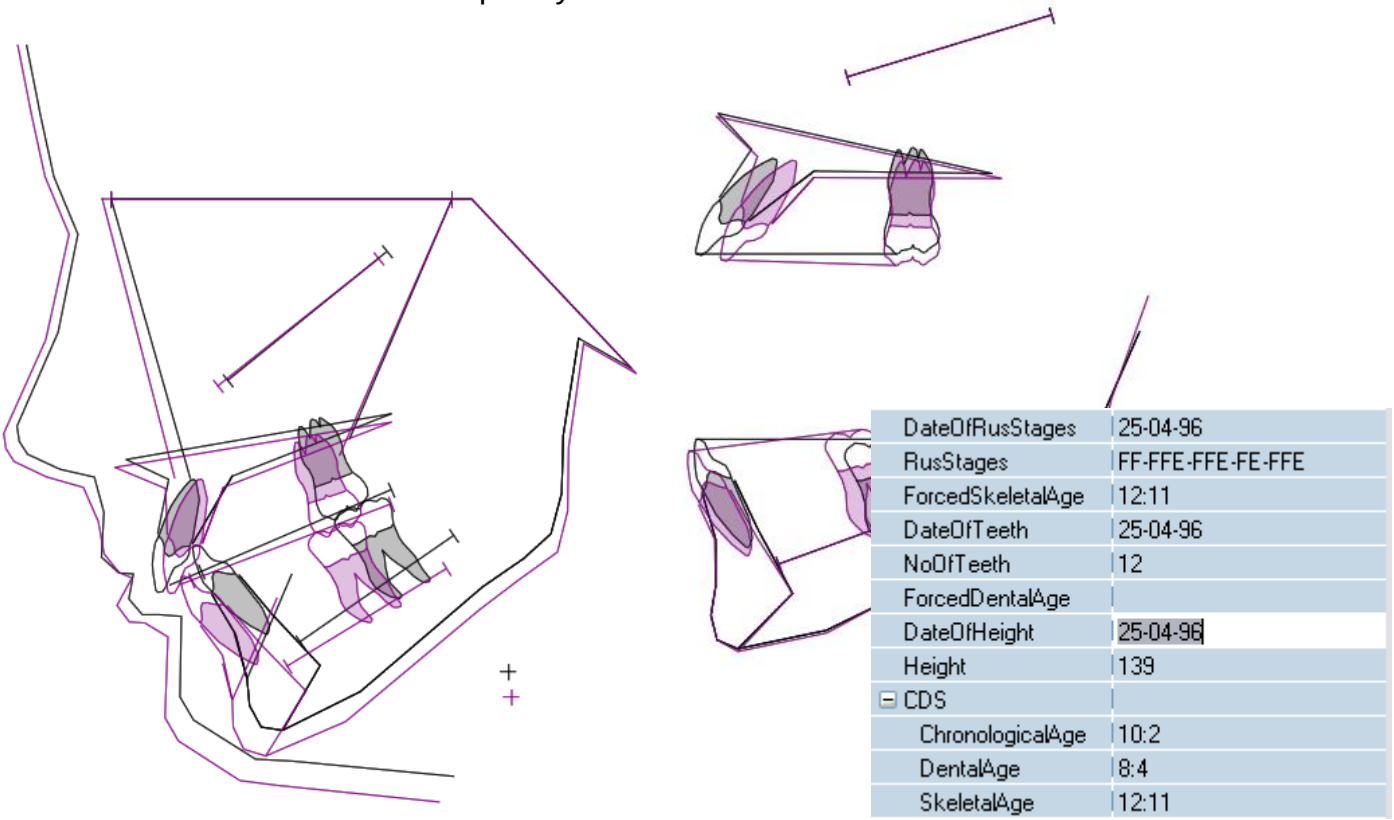


3. Space conditions are important values to enter in the box labeled **LoSpaceLeft** and **LoSpaceRight**. These numbers should be accurate as they influence the simulation greatly as we will see later. If you have added occlusograms to the analysis then use the calculated space parameters. For further explanation see note 3. The items CompensPrinciple and AutoArticCorr will be explained in Part 2 of this guide.

⊟ GeneralData	
Period	24
GrowthType	Anterior
LoSpaceRight	1.1
LoSpaceLeft	2.3
CompensPrinciple	Compensation
AutoArticCorr	False
⊞ Orthopaedics	

SpaceR	1.1	0.0	0.6
SpaceL	2.3	0.0	1.1

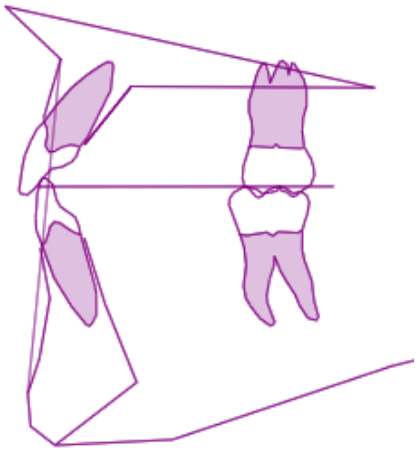
4. Now take a look at the tracings to see what you have got! Please notice the separate upper and lower jaw tracings are superimposed on the respective reference lines and the tooth movements are consequently the true movements within the jaws.



DateOfRusStages	25-04-96
RusStages	FF-FFE-FFE-FE-FFE
ForcedSkeletalAge	12:11
DateOfTeeth	25-04-96
NoOfTeeth	12
ForcedDentalAge	
DateOfHeight	25-04-96
Height	139
⊟ CDS	
ChronologicalAge	10:2
DentalAge	8:4
SkeletalAge	12:11

a. The estimated amount of growth is added to the total facial skeleton using the axis from **sa** (sella anterior) to **pg** (pogonion) as a guide. The amount is based on the age of the patient or stage of skeletal maturation, sex and simulation period. The estimated growth and rotation of the maxilla and the mandible is thereafter calculated using the principles from the Björk Growth Studies.
b. A refinement of the estimation of stage of maturation can be obtained by using a hand wrist radiograph and the TW2 method-RusStages (Tanner and Whitehouse, 1975, 1983). You may too force a skeletal age of your choice into the data. This will override the Rus data.

c. The lower incisor is then placed so as the incisal edge is related to the APog line and to the growth type. The inclination is set to ideal to the APog line as well.
d. The upper incisor is then placed in an ideal (mean) relationship to the lower incisor and in a normal overjet and overbite relationship. The functional occlusal plane is overlapped by 1 mm of the upper and lower incisors respectively. The overbite and the overjet are both adjusted to 2.2 mm.
e. The next step is the location of the lower first molar which is placed by the program at the initially digitized distance from the lower incisor plus or minus the amount of crowding or spacing. As the space estimate is critical for a reliable simulation it might be determined making an occlusogram of the lower jaw and then transferred to the simulation.
f. The upper first molar is then placed by the program in a solid Class I occlusion. The result of the steps d - g should be comparable to a virtual setup of the dentition.
g. From here on the simulation can be altered as needed to fit the treatment situation.



5. In the group of options labeled **Orthopedics** you should enter values for each option as appropriate.

⊟ Orthopaedics	
MaxSagInhib	33
MaxSagStim	0
InducMaxRot	0
MaxRotCent	sp
MaxVertInhib	0
MaxTransStim	4
MandSagStim	0
⊞ Surgery	
⊞ ArchChange	
⊞ TeethAdjustment	

If you plan to use an activator in treatment of a Class II malocclusion we suggest you put 30 (30% of the predicted amount of the sagittal growth) in the box labeled **MaxSagInhib**.
Maxillary Sagittal Stimulation is used when a protraction headgear is planned. Enter the expected amount of advancement in mm. If you expect that during treatment you will have some downward rotation of the Maxilla then enter the amount in degrees. The center is in most cases at pm (PNS) and located in the posterior nasal spine area. However, if you are using a reverse pull headgear it may be at sp (ANS).

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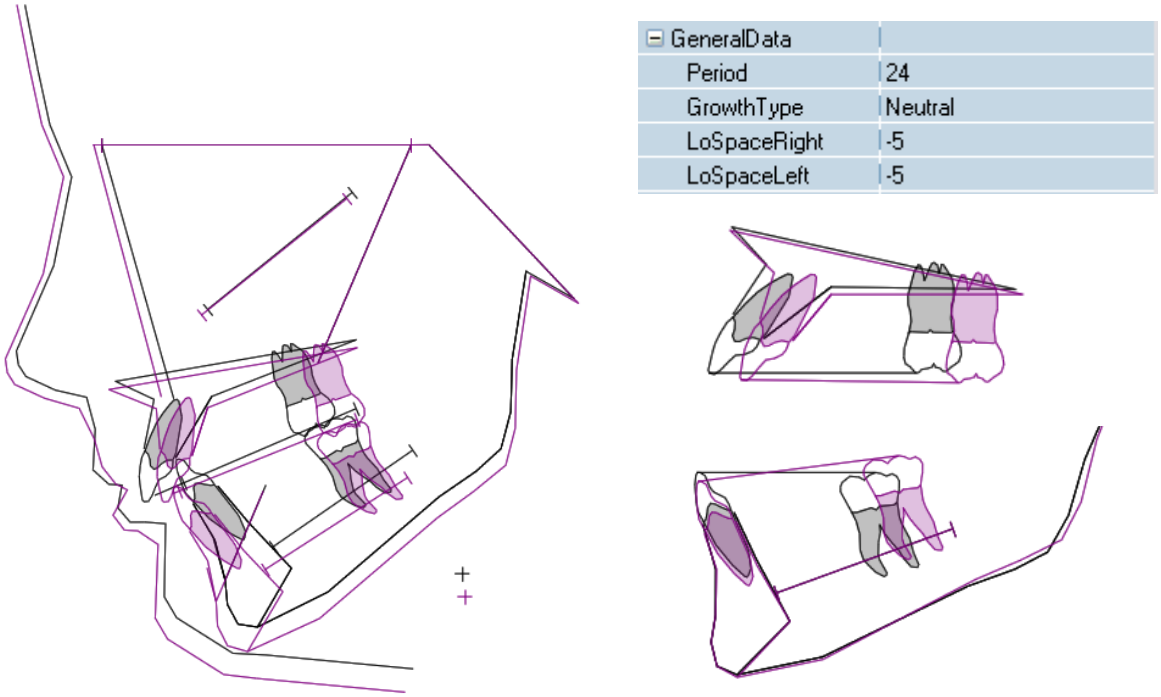
In the box **MaxVertInhib** you should enter the percentage of the expected vertical inhibition when using a HP headgear or similar.
The option **MaxTransStim** provides the possibility of expanding the maxilla. You can follow this on your upper occlusogram. With each mm of expansion there is 0.25 degrees of induced opening (Posterior rotation) of the mandible associated so an accurate estimate is important of the need for expansion to get a useful simulation. If you don't agree with this adverce effect of the expansion you may counteract this by entering some negative value in the box **InducMandRot** (See later).
The item **MandSagStim** (in mm) is provided for the Herbst appliance fan group.

Until now we have not discussed the standard placement of the lower incisors proposed by the program itself. To cover the aspects we will go through a **Treatment Simulation of an Extraction Case.** In the following we will create a simulation of a patient's treatment that includes extraction of four bicuspids for severe crowding to see how the program is applied to an 11 years old boy that is considered an extraction case. The following parameters were present: An estimated treatment period of 24 months. Lower arch crowding estimated to 10 mm.



The superimposition of the original head film and the simulation, seen above shows that according to the stage of maturation of this patient and the information from the cephalometric analysis a downward forward growth trend is anticipated for the next 24 months with a moderate degree of forward growth rotation of the mandible.
The mandibular simulation shows that the molars in order to alleviate the 10 mm lower crowding needs to be moved distally about 3-4 mm after the incisors have been placed in an ideal position for this facial type. Two possibilities are now available for correcting this under normal circumstances impossible tooth movement.
First, we could move the lower incisors further forward but this might place them in an unstable position. Second, we could consider the extraction of four bicuspids to alleviate the crowding. We should also notice the extensive amount of torque need to place the maxillary incisors in an ideal position in addition to the distal movement of the maxillary first molars to obtain Class I occlusion. It seems logical in this patient to consider four bicuspid extractions, however, the question is still

open if it should be first or second bicuspids? Should the position of the incisors be changed? To answer this question we continue the simulation process by going to the submenu labeled **ArchChange**.

6. Notice that the box **ArchesSagAdjust** shows a 0 mm change. When you are considering extractions the lower incisor might be expected to move back a little. This means that both arches as a whole needs to be moved back 1-2mm. At least -1 mm has to be entered.

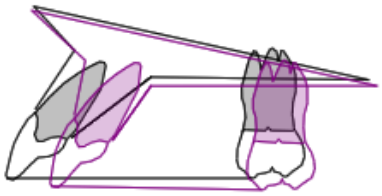
ArchChange	
ArchesSagAdjust	0
ArchesExpansion	0
⊞ LowerExtractions	
⊞ UpperExtractions	
InducMandRot	0

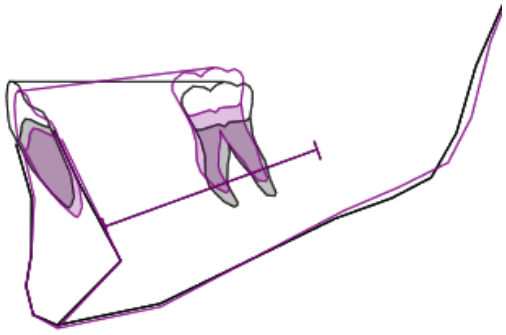
ArchChange	
ArchesSagAdjust	-1
ArchesExpansion	0

7. A value entered in the **ArchesExpansion** box will expand upper and lower arches with the same amount. 1 mm of expansion (at the first premolars) will provide extra space in the lower arch with 0.95 mm. Negative values can also be entered in case of constriction of the arch width.

8. Under the heading **Extractions** you can now enter your extraction decision. The individual teeth can either be *Erupted*, *Missing* or *Nonerupted*. To extract a tooth click on **Missing** (or hit <m>) and move to the next tooth you wish to extract. Then do the same in the Upper arch to complete the extract process. As you enter each extraction command the molars will move forward to take up the space made available while the incisor position is maintained. To answer the question "*first or second bicuspid extraction?*" look at the molar movements on the superimposition from this it can be determined how much movement is needed to leave the incisors in the decided position and how much anchorage is necesary in the maxillary arch to reach the treatment goals, see note 4.

ArchChange	
ArchesSagAdjust	-1
ArchesExpansion	0
⊟ LowerExtractions	
l6	Erupted
l5	Erupted
l4	Missing
l3	Erupted / Missing / Nonerupted
l2	
l1	Erupted
r1	Erupted
r2	Erupted

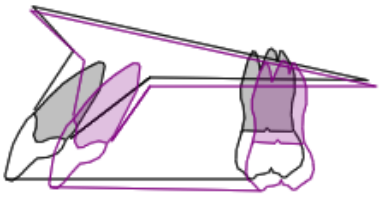


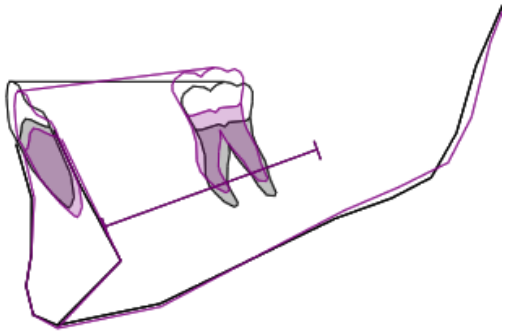


Orthopaedics	
MaxSagInhib	30

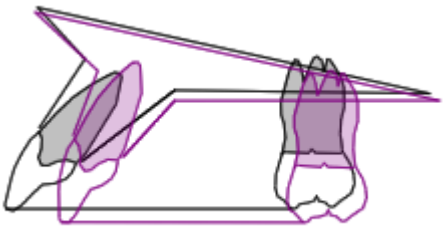
9. Above you see the result of the four premolar extraction simulation. Notice the **MaxSagInhib** has been set at 30 to indicate a holding effect on the maxilla from either a headgear or anticipated use of Class II elastics. It doesn't look very easy at the upper incisors! May be you should consider another approach?

10. If you decide to continue the simulation process the final step is to adjust the inclination of the incisors and molars to realistic inclinations. As the program moves the teeth in a linear fashion it is necessary that an experienced clinician makes adjustments to the inclinations so that the final tracing shows meaningful movements of these teeth.





11. In this patient upper incisors needed to have the roots moved forward to a more realistic inclination. The lower incisor roots looks good. Notice that root movement towards the labial is indicated as a - value (degrees) to the lingual as a + value (degrees). The item **OlfAdjust** is used to make the necessary treatment induced changes of the occlusal plane.



TeethAdjustment	
OlfAdjust	0
OlfAdjustCent	mop
LoIncAdjust	0
UpIncAdjust	-10
LoMolAdjust	0
UpMolAdjust	0

12. The last item is an important one: The treatment induced effects on the mandibular inclination (rotation). Could all this be done without any side effects? Could treatment possibly cause a backward mandibular rotation? If this is a possibility a simulation with this change should be attempted.

ArchChange	
ArchesSagAdjust	-1
ArchesExpansion	0
⊞ LowerExtractions	
⊞ UpperExtractions	
InducMandRot	?

Well to determine if this would be a better treatment option considering facial type, it would be prudent to carry out an additional treatment simulation without extractions as growth and long term stability.

Note: These treatment decisions should only be made by a qualified clinician.

Other notes are to be edited!!!

Jens Bjørn-Jørgensen, DDS, Ib Leth Nielsen, DDS, 2010/12