Efficient and effective use of the intra-oral scanning technology for orthodontic treatment

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Traditional imaging of the dentiton

• This could become history
State of the art

- 1 scan
- All images?
Use the CBCT for TAD planning

• Dolphin™ Imaging
CT for imaging the dentition

- A **CT** or CBCT has some advantages
- Should we use a CBCT for imaging of the dentition, because of the ALARA principle?
Accuracy of the dentiton and alveolar bone

- Excellent agreement between the measurements with the conventional and 3D methods in the 3 planes of space was found

but they used a CT slice thickness of 1.25 mm

How accurate is the dentition on CT’s (CBCT’s)

- CBCT’s should be taken out of occlusion

FOV

large Small

Our own Study

Three models were analyzed

- **Dimodels**
  - Scanned impressions

- **Anatomage model**
  - Volume rendered DICOM files

- **Anatomodels**
  - Segmented models

A.M. Cuperus, M. Harms, F.Rangel, H.Breuning
Results Digimodel vs Anatomage

- In 62%, significant difference in mean values were found.
- In these cases, 44% the measurements on digimodels were smaller, 46% the dimensions were larger.
Results Digimodel vs Anatomodel

- All dimensions are smaller
- Because of segmentation and smoothening of the images

Digimodel measurements are more repeatable, less time consuming, more accurate
Systematic error for measurements on a CBCT

- The effect of partial volume averaging

Halazonetis DJ COMMENTARY on the article of Baumgaertel et.al
Imaging for a digital set-up

invisalign

PVS Impressions
Digital set up for custom appliances
Very accurate impressions are needed

- Pvs impressions for Insignia

Robine Rischen / Hero Breuning
Custom made appliances

- Custom brackets
- Custom wires
- Indirect bonding
What are the results?

Multi Centre Clinical trial: Standard Damon™ vs Insignia™

- Pilot started 4 months ago,
- Clinical trial will start Jan 2011

Robine Rischen, Jan Govers, Robert Peerlings, Hero Breuning
How accurate are these images?

Volume rendered `CBCT’s

Intra oral scan

Segmented models

suresmile®
Digital set up for finishing wires

- Treatment time reduced 25%
- Quality improved 14%

Scanners on the market
Intra oral scanning will replace Orthodontic impressions

- Alternative for impressions
  - Lava COS (3M)
Intra-Oral scanning of the Palate and Alveolar Bone

- iOC intra oral scanner (Cadent™)
These are the images we get

- Lava C.O.S.
Time needed to take 2 impressions and a bite registration

- PVS
- Lava COS
- Alginate

N = 23

Secods

Henk van Diermen, Hero Breuning
Mean time needed for 2 impressions and bite registration

- **PVS**: 20 min (SD 9.5) \( N=23 \) \( P<0.001 \)
- **LAVA C.O.S**: 18 min (SD 15.3) \( N=23 \) \( P<0.001 \)
- **Alginate**: 8 min (SD 5.8) \( N=23 \) \( P<0.01 \)
**Accuracy**

- Intra oral scans show more detail?
- Accuracy scans vs dental casts?
Accuracy of Intra Oral Scans

- Compare the dentition on skulls
- and the SLA models
Results of the study

- 10 skulls
- 2 researchers
- Every measurement: 80 times

Olivier de Waard, Lydia Brons, Anne Margreet Cuperus, Frits Rangel, Hero Breuning
Results

In 18 of 36 measurements the SLA models are different; SLA dimensions are always significant smaller.

Difference in mesio-distal dimensions: 0.002-0.07 mm

Segments (Bolton) 0.02-0.16 mm; mean difference 0.07 mm

Inter canine and intermolar difference 0.13-0.43 mm; mean difference 0.28 mm

• Is a difference < 0.28 mm clinically relevant?
Digimodels of the Skulls

- Digimodel™ of a LAVA C.O.S. Intra Oral Scan of the skull
STL files transformed into Digimodels™

- 10 skulls
- 2 researchers

In progress

Anne Margreet Cuperus, Marit Harms, Frits Rangel, Hero Breuning
Fusion of CBCT’s and intra-oral scans

• Fusion of I.O. scans and CBCT to improve accuracy
Lava C.O.S. intra-oral scanner

- Powder needed
- Difficult scanning
- Time limit for scanning
- No digital set-up of the dentition
- No (digital fabrication) of appliances

Can be efficiently used for Crowns + Bridges

Limited use for orthodontic patients
iOC scanner

- No powder needed
- Contact with the dentition is no problem
- Relative, easy scanning
- No time limit for scanning
- Dental measurements are possible
- Digital set-up of the dentition
- Digital treatment planning
- Digital planning of appliances
Summary

- CBCT scanners are excellent for diagnosis for treatment planning and evaluation.
- CBCT scanners are less accurate for dental measurements and fabrication of appliances.
- Intra oral scanners are very accurate for imaging.
- Intra oral scanners should be used for fabrication of appliances.
- Fusion of CBCT’s and I.O. scans will be the future.

Traditional dental impressions
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Thank you for your ATTENTION