Calibr8 – A prototype radiograph holder for measurement of PSP's

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Objective

The aim of this pilot study was to evaluate a prototype Snap-A-Ray system with an integrated calibrated radiopaque marker to assess tooth measurements on radiographs obtained using a Photostimulable Phosphor plates (PSP).

Materials and Methods

- Materials: Prototype Snap-A-Ray, adult and pediatric dentiform teeth with corresponding mannequin models, photostimulable phosphor plates (PSP), nomad portable x-ray unit, operator worn lead shield, dental patient management software (Axium), radiographic processing and viewing software (Mipacs), Microsoft Excel, GraphPad Prism, digital calipers.
- Mesial-distal value of dentiform teeth are pre-measured using digital calipers.
- The mounted typodont model with prototype Snap-A-Ray holder is used to obtain Bitewing x-rays (BW) following the paralleling technique.
- 15 replicates of both the adult and pediatric models are obtained.
- All BWs are calibrated prior to measuring using the digital ruler tool in Mipacs.
- All values tabulated and appropriate statistical analysis is performed.
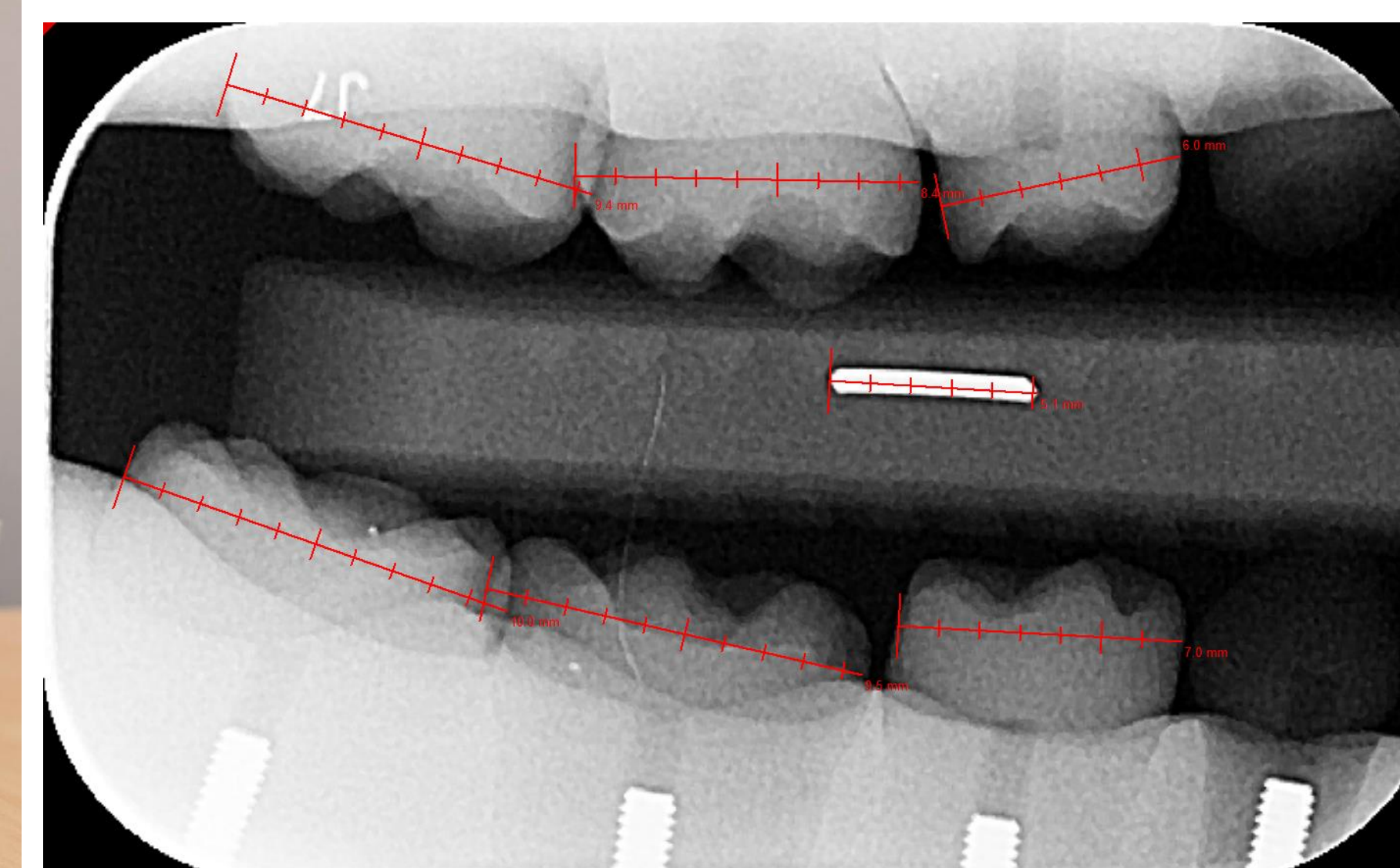

Figure 1: Prototype + Typodont set-up
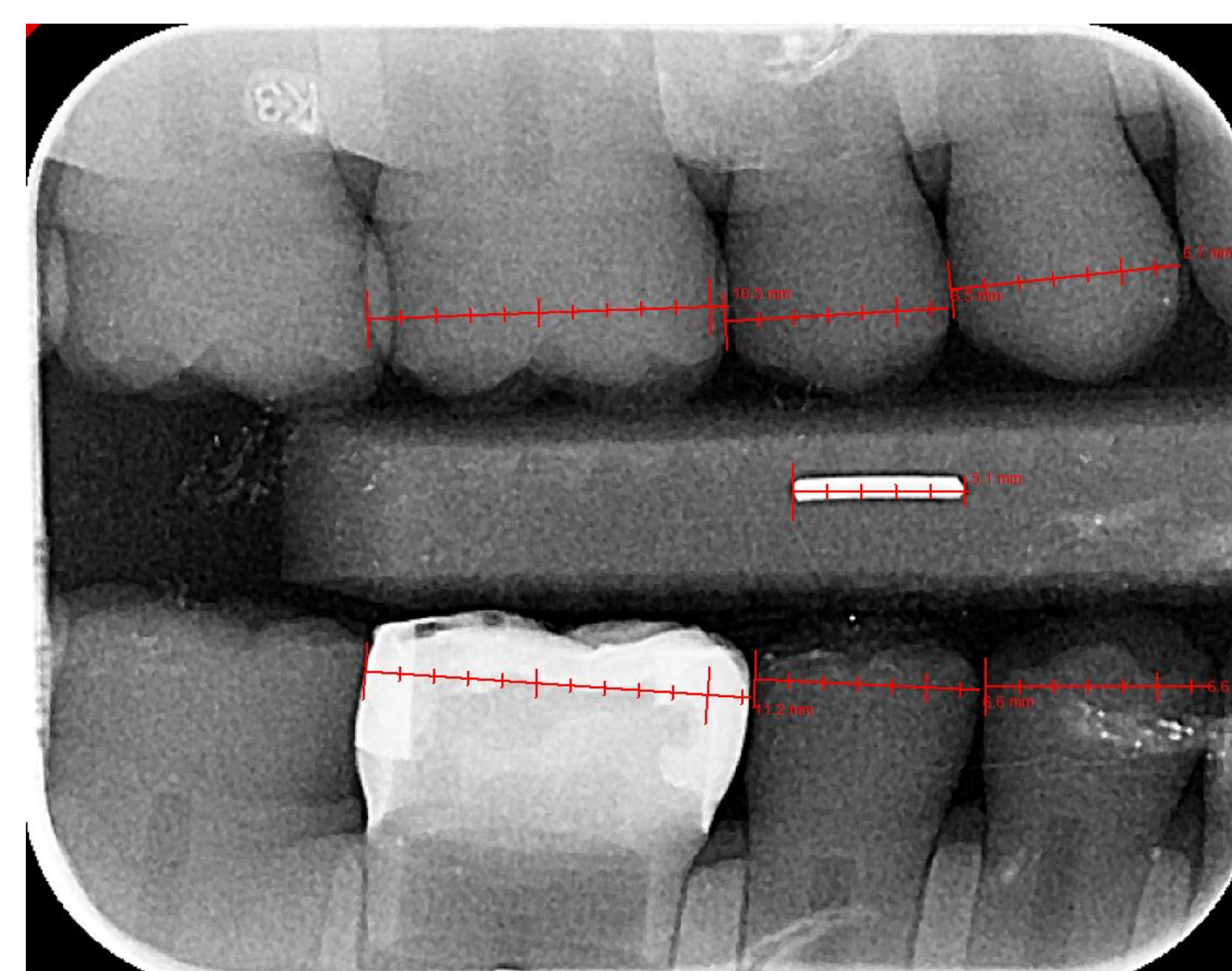

Figure 2. Annotated BW – Pediatric
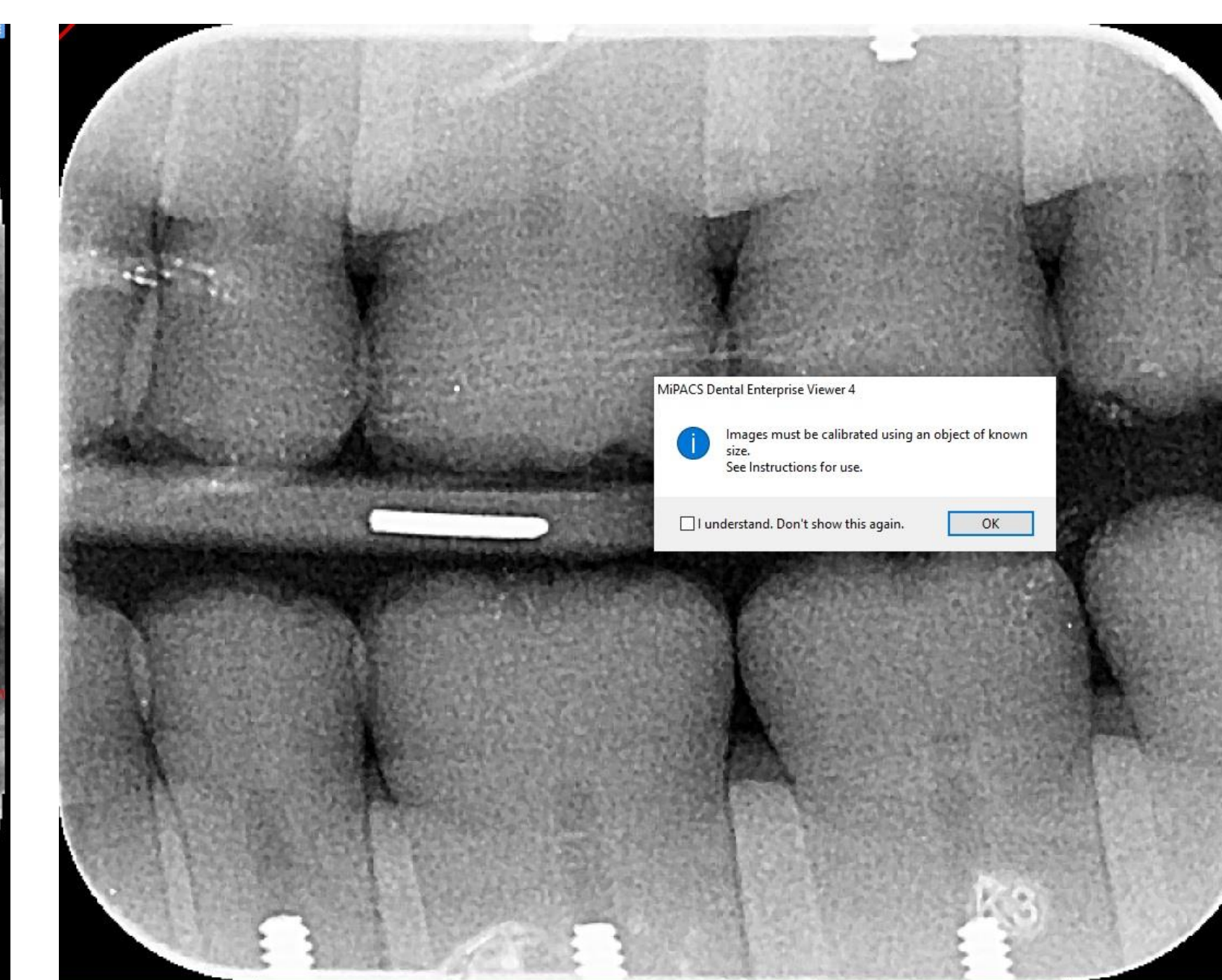

Figure 3: Annotated BW - Adult

Figure 4: Error message when using ruler tool

Teeth	Extra Oral Measurements (mm)	Measured Mean (mm)(n=15)	P-Value	Mean of Differences (IO-EO)(mm)
A	8.5	8.4	0.0281	-0.08
B	6.3	6.1	<0.0001	-0.24
S	7.3	7.1	<0.0001	-0.21
T	9.3	9.3	0.8963	-0.01
3	10.5	10.6	0.2188	0.06
4	6.8	6.7	0.182	-0.07
5	7.1	6.8	<0.0001	-0.26
28	6.8	6.6	<0.0001	-0.18
29	7	6.6	<0.0001	-0.4
30	11.4	11.3	0.1442	-0.06

Table 1: Paired t-test results for 30 bitewings

Results

- Mean of all measured values on bite wings are within 5% of the extra oral values of the typodont teeth .
- No statistical significance found on paired t-tests with Teeth A,T,3,4,30.
- A statistical significance was found on paired t-test with teeth B,S,T,5,28,29 .
- The majority of radiographic measurements tended to underestimate real dimensions.

Conclusions

- The prototype provides an acceptable method to calibrate a digital ruler tool built into viewing software.
- The prototype calibration tool can provide meaningful clinical information when applied to bitewing radiographs.

Future Directions

- Use of caries simulated teeth for better contrast and edge detection.
- Prototype a snap-a-ray holder with a PID for more accurate x-rays.
- Pilot Study to check clinical acceptability – pick SSC based on digital measurements, chart disease progression etc.
- Design Study to replicate results in patients.