Purpose
For some patient groups, such as pediatrics, there has been concern about the radiation dose resulting from daily CBCTs. In this study we investigate how much we can reduce the CBCT dose, by changing the acquisition parameters, and still be able to perform a reliable automatic bone match.

Material and method
- The head and neck area of an Alderson phantom equivalent to adult (to simulate a child) was CT scanned.
- 12 full-fan 200° CBCT scans with different parameter settings were performed on Varian Novalis Tx accelerator.
- The number of projections, mA and ms were systematically decreased; kV constant at 100.
- Dose measurements relative to the standard preset were performed on 6 of these scans, using RTI Barracuda system, consisting of a DCT10-pencil ion chamber positioned in centre of CTDI 16 cm diameter cylindrical phantom.
- A new imaging preset was made comprising the parameters with the largest dose reduction and ability to auto-match.
- The phantom was CBCT scanned with old and new preset, in 4 slightly different positions.
- Four RTT’s independently matched these CBCT scans with the original CT scan offline.

<table>
<thead>
<tr>
<th>Avg. Dev (cm)</th>
<th>Position 1</th>
<th>Position 2</th>
<th>Position 3</th>
<th>Position 4</th>
<th>Position 5</th>
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<tbody>
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<td>0.00</td>
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<tr>
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<td>0.18</td>
<td>0.03</td>
<td>0.63</td>
<td>0.03</td>
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</tbody>
</table>

Table 1 Average match difference between scans obtained with standard preset and new preset.

Results
A dose reduction of up to a factor of 14 was achieved by changing the full-fan CBCT scan parameters from 20 mA and 20 ms (standard preset) to 10 mA and 2 ms. Reducing the number of projections from 650 to 360 added no further dose reduction. The new imaging preset results in a total dose of only 0.39 mGy compared to 0.14 mGy for 2 orthogonal X-ray images. Table 1 shows the average match difference between the different presets. The maximum deviations are +/- 0.5 mm and 0.6º. Figure 1a+b show the difference in image quality between the standard and the new preset.

Conclusion
It is possible for RTT’s to use low dose daily CBCT scans and still perform a reliable automatic bone match in image guided pediatric radiotherapy.

Keywords: IGRT, pediatric RT, dose reduction.

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