Measuring Acetabular Version by Ellipse Method

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HOW TO EVALUATE THREE-DIMENSIONAL ANGLE ERROR FROM PLAIN RADIOGRAPHS

Evaluating three-dimensional angle error is necessary because we cannot get every patients' CT or MRI at all times. Creating a method that can calculate angle error from plain radiographs is therefore important. Using vector and trigonometric mathematics, we gradually deduct our formula which can calculate angle error from goal angles (the angles we plan to achieve before operation) to result angles (the angles we get after operation) by two perpendicular radiographs. We also encode it into Microsoft Excel® (Redmond Campus, Redmond, Washington, U.S.) so that it becomes more user-friendly. We hope this tool can be used when evaluating TKR, corrective osteotomy, fracture fixation, and so on.

COMPUTERIZED ELLIPSE METHOD FOR MEASURING ACETABULAR VERSION AFTER THR- A PRECISION STUDY USING SYNTHETIC AND REAL RADIOGRAPHS

Background and purpose Previous work by our group to address the problem of acetabular positioning based on 2D methods resulted in the development of a measurement method with better precision-Liaw's version. This method may help early diagnosis of acetabular loosening. In this work, we hypothesized that our computerized ellipse method can improve the precision of measuring acetabular version. Methods We built our software Elliversion to measure the acetabular version. We synthesized 96 radiographs with random femoral inclination and 5o to 52o version by THR Simulator, half with femoral head and half without it. We measured these synthetic radiographs and 28 real radiographs with Elliversion and trigonometric method twice by one of the authors with one week interval. Then we calculated the difference of repeated measurements. We used student t-test for statistical analysis of measuring error and inter-measurement difference. Results In precision study, for synthetic radiographs with femoral head, the ellipse method was significantly better than trigonometric method

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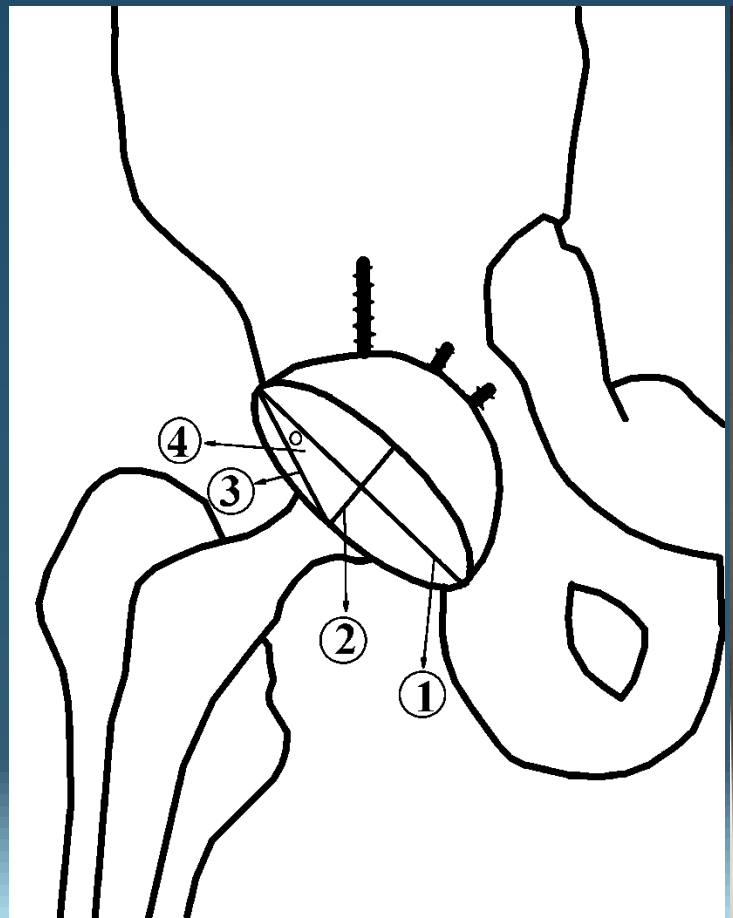
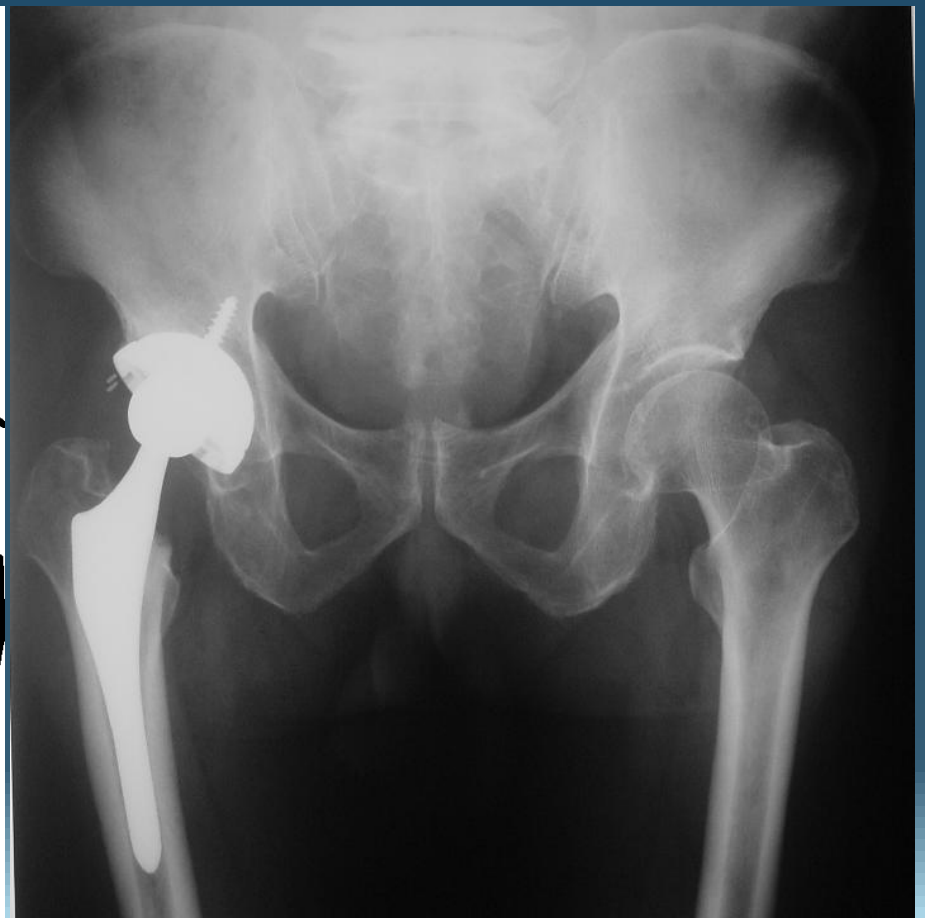
Introduction

- Measuring the version of acetabular component after total hip arthroplasty is important.
- Trigonometric method
- Protractor method
- Computer tomography method

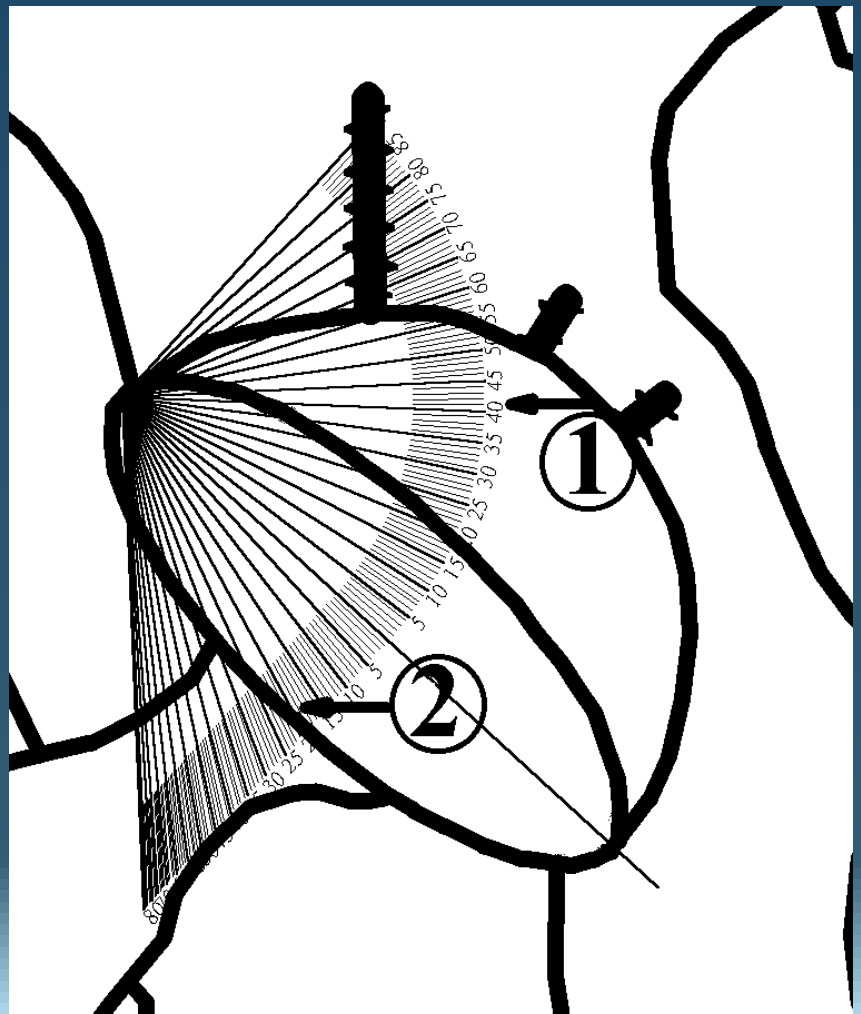
Measuring methods

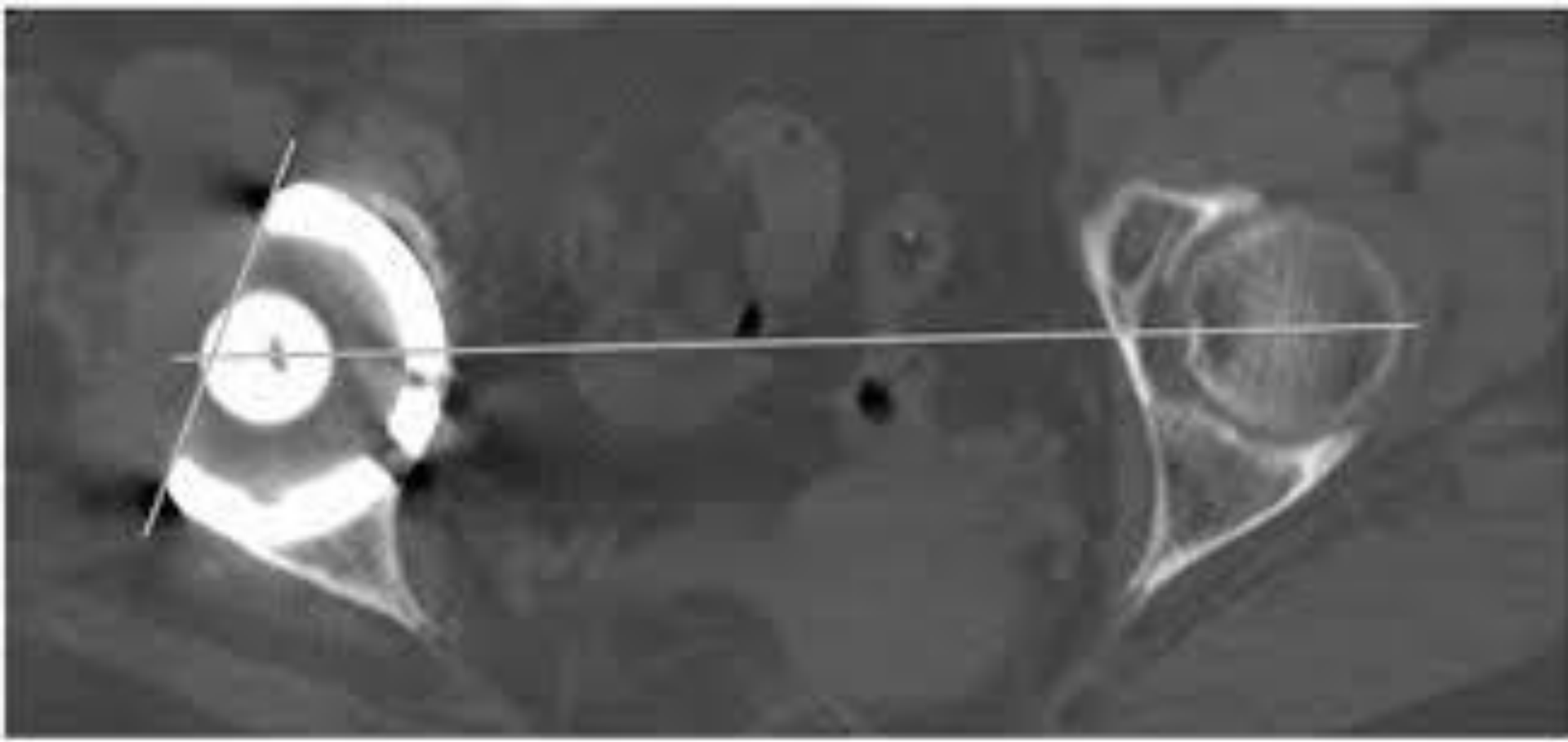
- Lewinnek's method
  - Measure short axis and long axis of ellipse





Liaw's Method

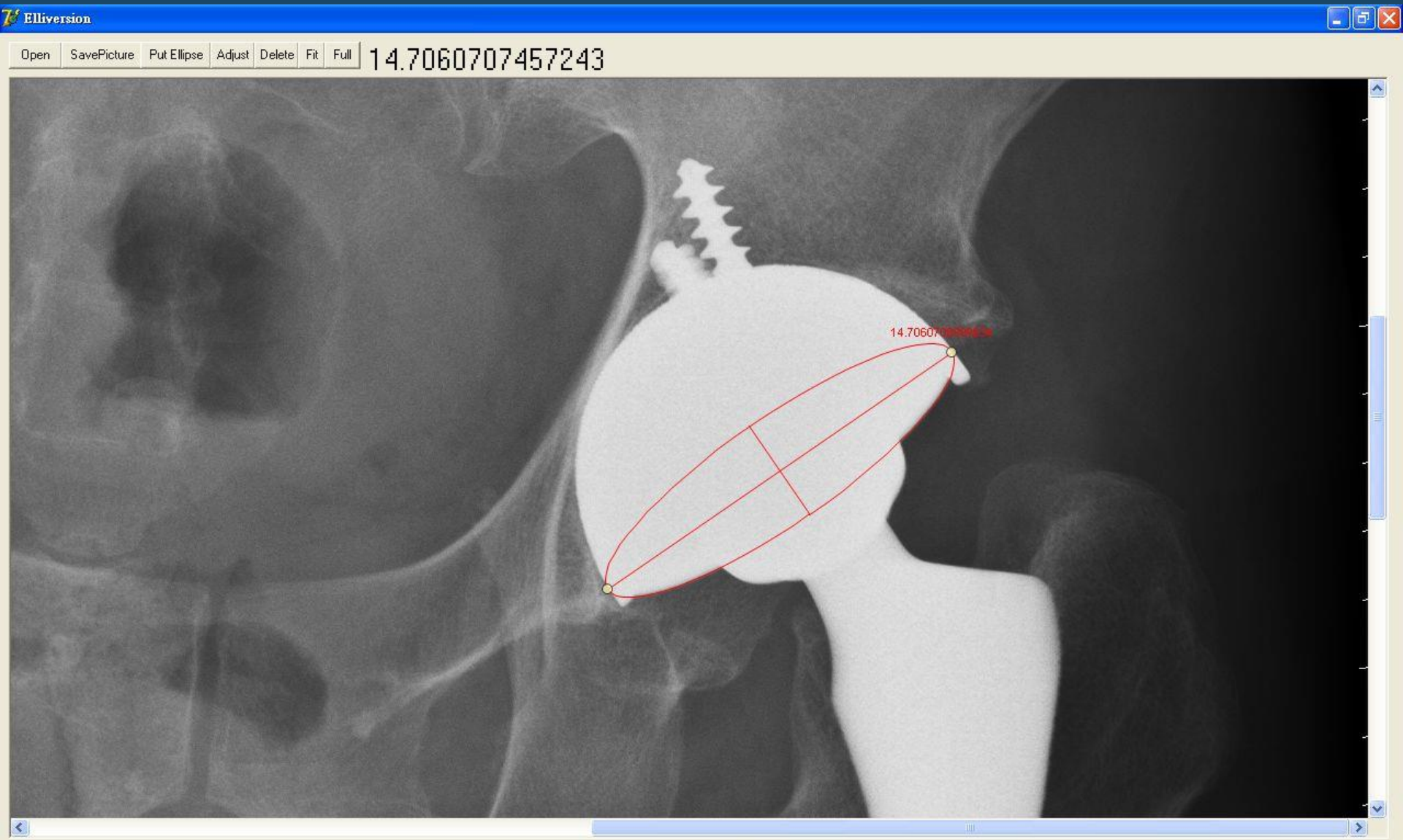




Introduction

- PACS system
- Redundancy
  - Measuring whole ellipse should be better than one point.

Methods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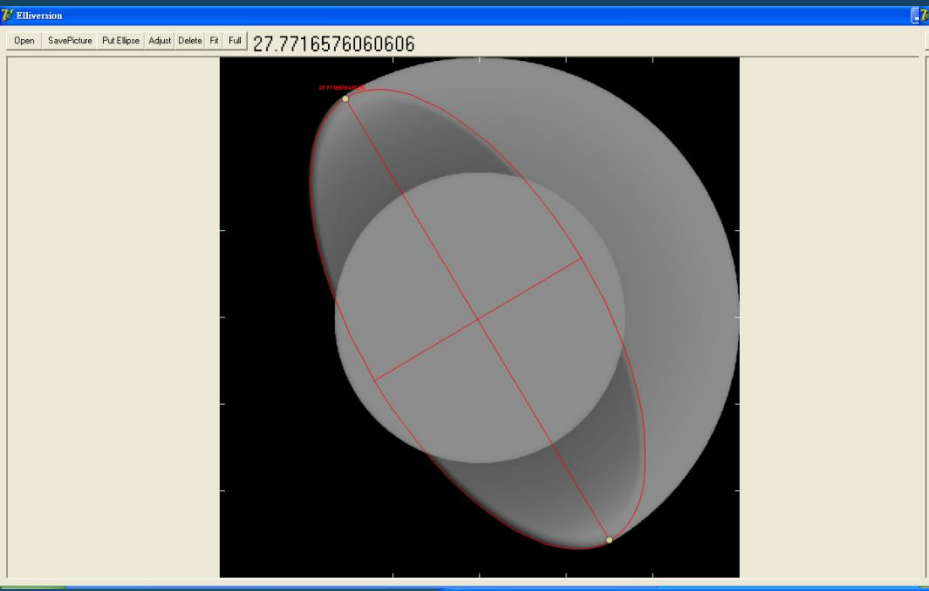
Methods

- To verify the software, we synthesized 96 radiographs with random inclination and 5^{o} to 52^{o} version by *THR Simulator*, half with femoral head and half without it.
- We measured these synthetic radiographs and 30 real radiographs.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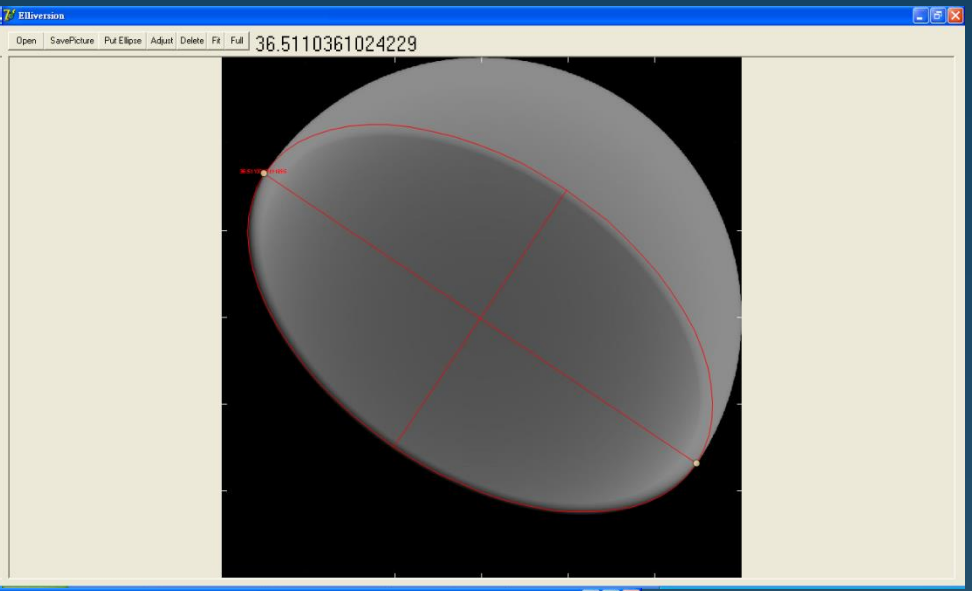
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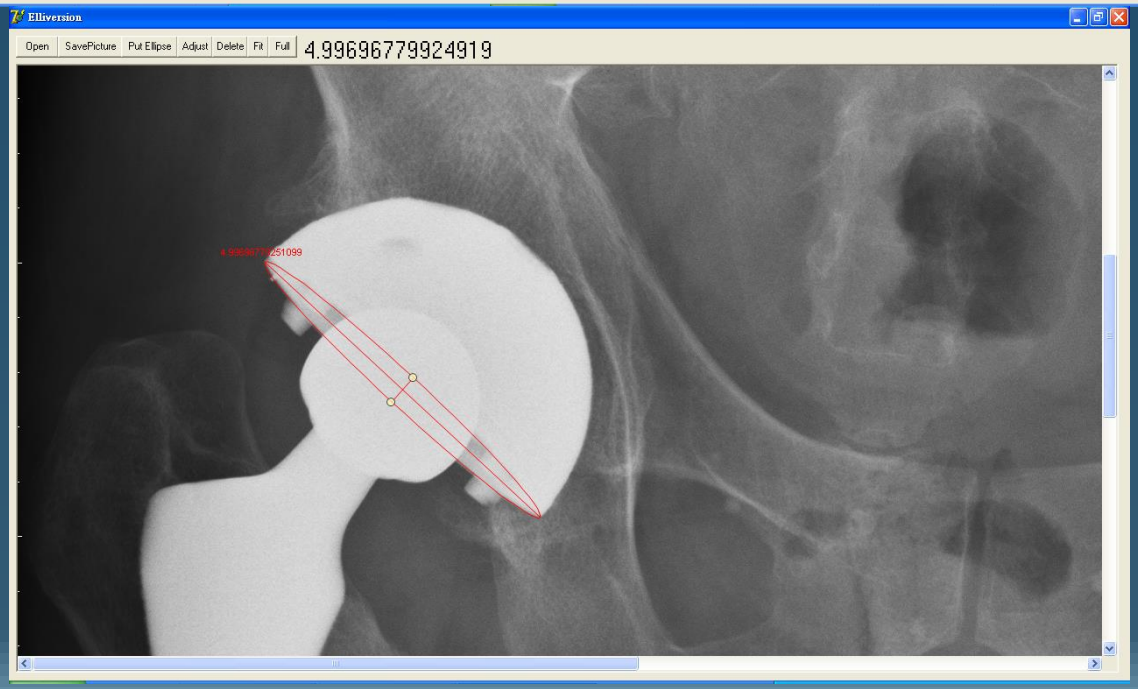
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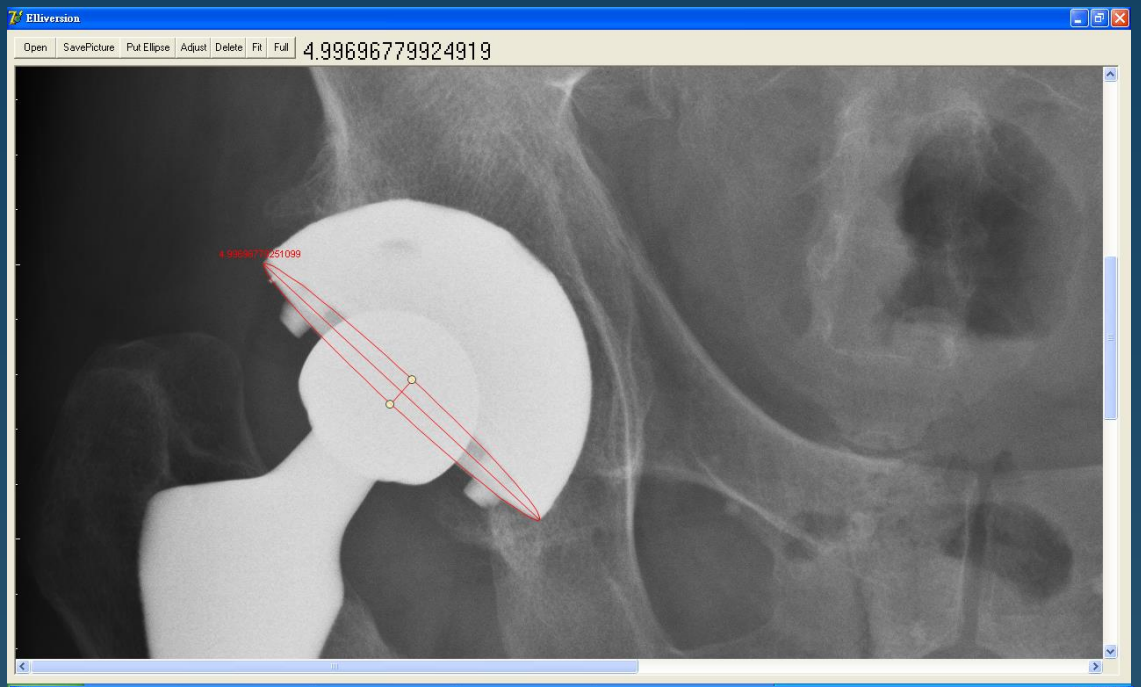
Results

Table 2. Absolute difference for repeated intra-observer measurements.
good*: after removal of four bad quality radiographs.

	Minimum	maximum	mean	standard deviation	p-value
Ellipse with head #1 & #2	0.03	1.44	0.33	0.31	**0.001**
Trigonometric with head #1 & #2	0.06	2.19	0.56	0.43	
Ellipse without head #1 & #2	0	0.88	0.24	0.19	**0.17**
Trigonometric without head #1 & #2	0.01	1.41	0.26	0.28	
Ellipse real #1 & #2	0.01	1.89	0.44	0.43	**0.12**
Trigonometric real #1 & #2	0.01	2.11	0.58	0.55	
Ellipse(good*) real #1 & #2	0.01	0.78	0.30	0.24	**0.04**
Trigonometric(good*) real #1 & #2	**0.01**	**2.11**	**0.52**	**0.53**	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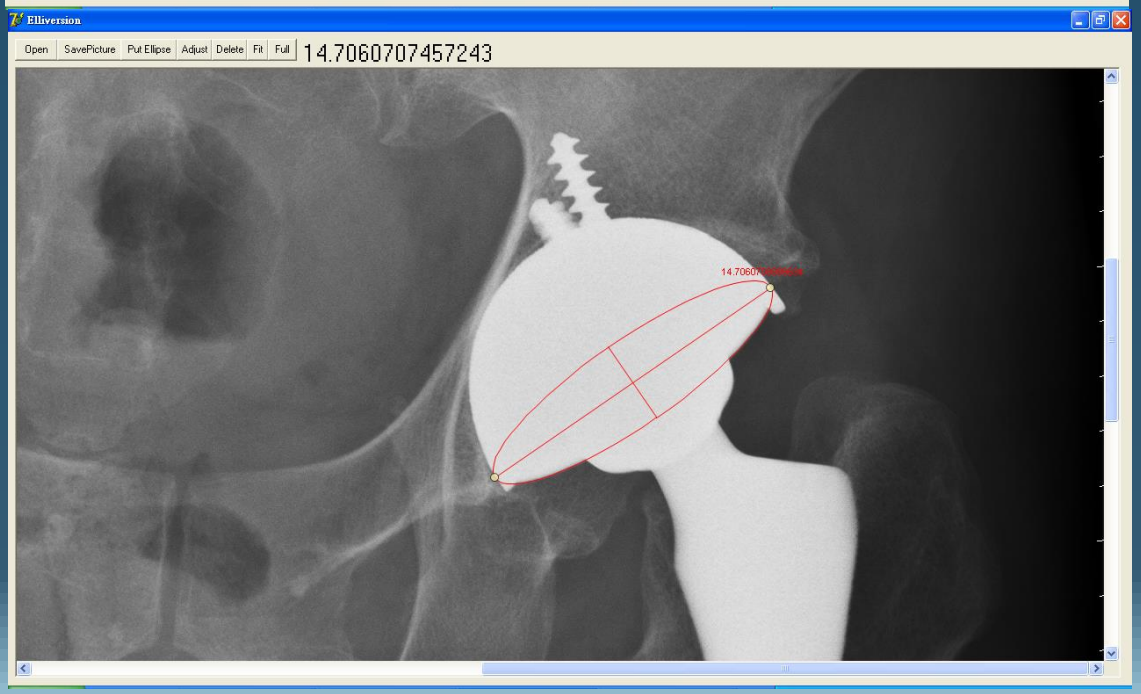
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Conclusions

- We build our own ellipse method for measuring acetabular version.
- We proved it to be more precise than the well-accepted trigonometric method in synthetic radiographs.
- It can be further used in measurements which required precision, such as Liaw's version.