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## Original research article

# Effect of preoperative flexion contracture in the knee joint on the accuracy of digital templating before knee replacement surgery

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## ARTICLE INFO

## Article history:

Received 11 June 2014

Received in revised form

11 May 2015

Accepted 13 January 2016

Available online 11 February 2016

## Keywords:

Knee arthroplasty

Templating

Digital templating

Preoperative planning

Flexion contracture

## ABSTRACT

**Introduction:** Flexion contracture in the knee joint before knee replacement surgery has been implicated as one of the factors that could affect the accuracy of digital templating.

**Aim:** The aim of the study was to detect the accuracy of digital templating in predicting the size of knee implants and to detect the effect of preoperative flexion contracture in the knee joint on the accuracy of digital templating.

**Material and methods:** The flexion contracture of the knee joint was measured in every patient prior to knee replacement surgery and digital templating of the knee joint was made in mediolateral (ML), anteroposterior (AP) and AP long leg views. The sizes of prosthetic components predicted by templating were compared to the sizes of prosthetic components implanted during the surgery. The effect of flexion contracture on the accuracy of digital templating was analyzed using  $\chi^2$  test and Mann–Whitney *U* test.

**Results and discussion:** The size of the prosthetic component predicted by templating matched the size of the implanted component in 45.2%–62.9% of the cases, in 91.9%–98.4% of the cases it was within the range of one size. Statistically significant effect of the flexion contracture in the knee joint on the accuracy of digital templating was observed in the femoral component, AP view if the flexion contracture exceeded 10°.

**Conclusions:** Digital templating is very accurate method in predicting the size of knee implants. Flexion contracture in the knee joint that exceeds 10° diminishes the accuracy of digital templating of the femoral component in AP view.

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## 1. Introduction

Preoperative planning is an important aspect of knee arthroplasty. It allows the surgeon to detect the size of the implant and to assess the joint alignment.<sup>1</sup> Malalignment is inversely correlated with implant survival.<sup>2</sup> Accurate planning leads to precise prosthetic component placement, correct size of the implant, shorter surgical time and fewer complications.<sup>1,3,4</sup> Therefore it can reduce the overall costs of joint arthroplasty.

Historically templating has been done on analog radiographs but recently digital templating has taken its place providing better options of picture archiving and data processing.<sup>1</sup> The accuracy of analog and digital templating has been compared and none of them has been found clearly superior to the other.<sup>5</sup>

According to data in literature, digital templating of the knee joint allows to precisely predict the size of the femoral implant in 48%–70% of cases; in 92%–100% of cases it allows to predict the femoral implant within one size. Digital templating allows to precisely predict the size of the tibial implant in 48%–67% of cases; in 94%–100% of cases it allows to predict the tibial implant within one size.<sup>1,5–10</sup>

Several factors that could affect the accuracy of digital templating of the knee joint have been implicated: quality of radiographs, rotation of radiographs, surgical technique and patient's preoperative deformity such as flexion contracture or rotational deformity.<sup>11</sup> Larger degree of knee flexion contracture leads to greater distance between the knee and the X-ray plate, thereby changing the degree of magnification on the radiographs.<sup>12</sup> The effect of flexion contracture in the knee joint on the accuracy of digital templating has not been extensively studied, therefore the exact degrees that make the measurements significantly less accurate are still not known.

## 2. Aim

The aim of the study was to detect the accuracy of digital templating in predicting the size of knee implants and to detect the effect of preoperative flexion contracture of the knee joint on the accuracy of digital templating.

## 3. Material and methods

Prospective study was made including all patients who underwent primary knee arthroplasty from September 2013 to December 2013 in Hospital of Traumatology and Orthopaedics, Riga, Latvia. An agreement of Bioethical Commission of Riga Stradins University and an agreement of Hospital of Traumatology and Orthopaedics were obtained. There were 63 patients who met the inclusion criteria. Data were obtained from 62 of them; 1 patient refused to participate in the study.

The flexion contracture of the knee joint was measured with a goniometer in every patient one day before the surgery. The digital templating on the radiographs of the knee joints in mediolateral (ML), anteroposterior (AP) and AP long leg views was made using AGFA Orthopaedic Tools software. The sizes

of prosthetic components predicted by templating were then compared to the sizes of prosthetic components implanted during surgery.

To detect the effect of flexion contracture in the knee joint on the accuracy of digital templating the measurements were divided into several groups according to the observed degree of flexion contracture. The statistical significance of differences in accuracy of templating between those groups was detected using  $\chi^2$  test and Mann-Whitney U test. Differences were considered statistically significant at  $P < 0.05$ .

Data analysis was performed using IBM SPSS Statistics 20.0 software.

## 4. Results

The study consists of 62 patients (12 males, 50 females). Age of the patients on the day of surgery varied from 48.4 to 85.9 years, mean age was 69.7 years, SD 8.7 years. The age histogram is presented in Fig. 1.

The observed flexion contractures in the knee joint varied from 0° to 22°. Median value was 9°. The histogram of measured flexion contractures is presented in Fig. 2.

The sizes of prosthetic components predicted by templating were compared to the sizes of prosthetic components implanted during the surgery. Differences between those sizes are shown in Table 1.

The size of the femoral component predicted by templating matched the size of the femoral component implanted during the surgery in 45.2%–58.1% of cases, in 96.8%–98.4% of cases it was within the range of one size. The size of the tibial component predicted by templating matched the size of the tibial component implanted during the surgery in 46.8%–62.9% of cases, in 91.9%–98.4% of cases it was within the range of one size.

There was very strong correlation between the size of prosthetic component predicted by templating and the size of the component implanted during surgery for both femoral and

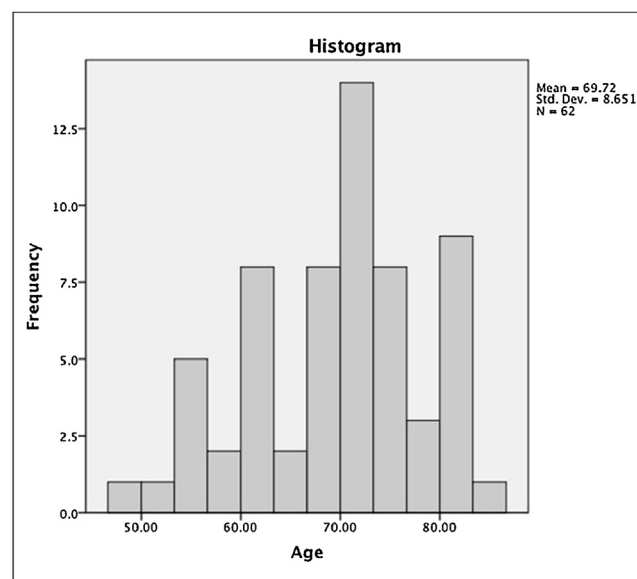


Fig. 1 – Age histogram of patients included in the study.

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