Virtual implant planning system – first clinical results

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Background: Digital planning of implants in regard to position and size is done preoperatively in most cases. Intraoperative it can only be made by navigation systems. With the development of the VIPS-method (Virtual Implant Planning System) as an application for mobile C-arms, it is possible to do an intraoperative virtual planning of the screws near the joint in treatment of distal radius fractures by plating. Screw misplacement is a well known complication in the operative treatment of these fractures. The aim of this prospective randomized trial was to gain first clinical experiences and to compare VIPS with the conventional technique. The study hypothesis was that there will be less screw misplacement in the VIPS group.

Methods: We included 40 patients with distal radius fractures type A3, C1 and C2 according to the AO-classification. In a pilot study the first 10 Patients were treated by the VIPS method to gain experience with VIPS in a clinical set-up. The results of the pilot-study are not part of this analysis. Then 15 Patients were web-based randomized into two groups. After diaphysial fixation of a 2.4 mm Variable Angle Two-Column Volar Distal Radius Plate and fracture reduction matching of a three-dimensional virtual plate to the two-dimensional image of the plate in the fluoroscopy shots in two plains was performed automatically in the VIPS group. The variable angle locking screws were planed in means of direction and length. Drilling was done by the use of the Universal Variable Angle Locking Drill Guide that was modified by laser marks at the rim of the cone to transfer the virtual planning. The drill guide enables drilling in a cone of 30°. In the control group the same implant was used in a conventional technique that means screw placement by the surgeon without digital planning. After implant placement an intraoperative three-dimensional scan was performed to check the position and length of the screws near the joint. OR- and fluoroscopy-time was documented. In addition the changes of misplaced screws were engaged.

Results: In the VIPS group six A3-fractures, one C1-fracture and eight C2-fractures were included. In the control group six A3-fractures and nine C2-fractures were included. The intraoperative fluoroscopy time was 2.53 min (SD 1.44, range 1.27-7.14) in the VIPS group and 2.26 min (SD 0.51, range 1.55-3.39) in the control group (p=0.40). The OR-time was 53.33 min (SD 34.49, range 34-171) in the VIPS group and 42.27 min (SD 8.76, range 20-58) in the control group (p=0.23). In the VIPS group we changed three screws (two were too long, one was borderline near the joint) and two screws in the control group (one was too long, one was borderline near the joint) (p=0.24).

Conclusions: The Virtual Implant Planning System is a reliable method that can be integrated easily in the workflow in treatment of distal radius fractures. There is a tendency that the virtual implant planning needs additional time, but there are no significant differences between the two groups. Further development is necessary to make the VIPS method beneficial.