OUR EXPERIENCE WITH ACTIVE SENTRY AND CENTURION OZIL HANDPIECES

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SUMMARY

Aim: To compare parameters of phacoemulsification using handpiece Active Sentry and Centurion Ozil.
Methods: We have evaluated results of 200 eyes of 129 patients that were operated for cataract at the Department of Ophthalmology. All surgeries were performed by one surgeon (NJ). In 100 eyes handpiece Active Sentry was used and in 100 eyes handpiece Centurion Ozil was used. The intraocular pressure during surgery (IOP), cumulative dissipated energy (CDE), ultrasound time (U/S time) and estimated consumption of balanced salt solution (BSS) were evaluated.
Results: Using handpiece Ozil Centurion the IOP was 65 mmHg, use handpiece Active Sentry enabled decrease safely peroperative IOP to 46 mm Hg withouth increase of fluctuation or declension of stability of the anterior chamber. The mean CDE a U/S time were significantly statistically decreased using Active Sentry versus Centurion Ozil handpieces. Difference in estimated consumption of balanced salt solution was not statistically significant.
Conclusion: Our results proved that using handpiece Active Sentry enabled statistically significantly decrease IOP during phacoemulsification and eliminated post-occlusion surge. This brings several advantages: more painless surgery for patients and more user-friendly procedure for surgeon especially in challenging cases (intraoperative floppy iris syndrome or severe myopia).
Key words: phacoemulsification, active fluidics, peroperative intraocular pressure, cumulative dissipated energy, utrasound time

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INTRODUCTION

The father of phacoemulsification is considered to be Charles D. Kelman, who also made a fundamental contribution to its spread and improvement. The development of this method is a continual process of increasing the effectiveness of the procedure and an endeavour to reduce the potential perioperative risks [1]. For the emulsification of the nucleus an ultrasonic (U/S) handpiece is used, which vibrates a sharp tip at an ultrasonic frequency (typically 28-40 Khz), emulsifying the nucleus upon contact. At the same time, the matter emulsified by the handpiece is drained from the eye with the aid of a controlled flow of fluids (fluidics). With regard to the method of application of phaco energy, for many years traditional longitudinal application of ultrasonic energy was used. In this case, the prong moves backwards and forwards. A disadvantage is the generated repulses (repulsion of fragments of the nucleus) and the pronounced heating of the tip at higher energies. An advance in this area has been brought by the technology of torsional phacoemulsification, which was introduced in 2005, in which the ultrasonic handpiece enables not only longitudinal movement of the tip but also its lateral fluctuations within the axis (torsional movement). Thanks to this movement, repulsion of the nucleus does not occur, the tip works with higher effectiveness, heating of the tip is markedly lower, and the phaco energy spreading through the eye is also lower.

Control of the flow of fluid through the eye (fluidics) is very important for the effectiveness and safety of pha-

coemulsification. A substantial advance in this area came with the introduction of the Active Fluidics system. With the aid of this system, pressure in the anterior chamber is maintained at a very constant value throughout the entire course of the operation, thanks to the fact that the irrigation pressure is adapted to aspiration during all steps of the surgery. The most recent innovation in this field is the introduction of a new handpiece with an integrated sensor for dynamic measurement of intraocular pressure very close to the patient's eye (Active Sentry). The previous technology enabled less precise measurement due to the sensors on the cartridge (fluidics management system), which led to a longer time delay upon stabilisation of the anterior chamber.

In our study, we focused on a comparison of the phacoemulsification parameters in the use of the Active Sentry and Centurion Ozil handpieces.

Cohort of patients and method

We observed the phacoemulsification parameters in 200 eyes of 129 patients who underwent cataract surgery at the Department of Ophthalmology at the University Hospital in Hradec Králové during the period of May-June 2020. In 71 patients, both eyes were operated on, in 58 patients one eye. This concerned a regular cohort of patients admitted for cataract surgery, in whom the average age was 72.4 years (59-86 years). The cataracts were classified according to the scale of nuclear hardness according to Buratto [2], the average hardness was 2.9 in the Active Sentry group and 2.7 in the Centurion Ozil group. All the operations were performed by a single surgeon (NJ) using the "quick chop" fracturing technique [1]. The Ozil handpiece was used on 100 eyes and the Active Sentry handpiece on the other 100 eyes. Both handpieces belong to the accessories of the phacoemulsification instrument Centurion® VISION SYSTEM (Alcon), equipped with active fluidics technology. No complications occurred in any of the procedures during the course of the operation.

The main observation parameters were perioperative intraocular pressure, cumulative dissipated energy, total U/S time and the volume of consumed fluid during the procedure.

A statistical analysis was conducted with the aid of the program Microsoft Office Excel 2019. Quantitative data is expressed by the average and scope. Changes were evaluated with the aid of a paired Student t-test for comparison between the Active and Ozil groups. A P value of 0.005 or less was considered statistically significant.

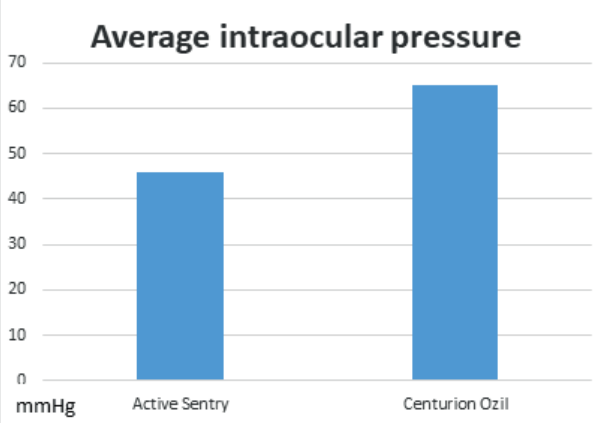
RESULTS

Upon the use of the Centurion Ozil handpiece, average perioperative intraocular pressure was 65 mmHg, upon the use of the Active Sentry handpieces it was possible to reduce perioperative intraocular pressure safely to 46 mmHg ($p < 0.005$) without an increase of fluctuation or a decrease of stability of the anterior chamber (graph 1). All the other parameters remained identical.

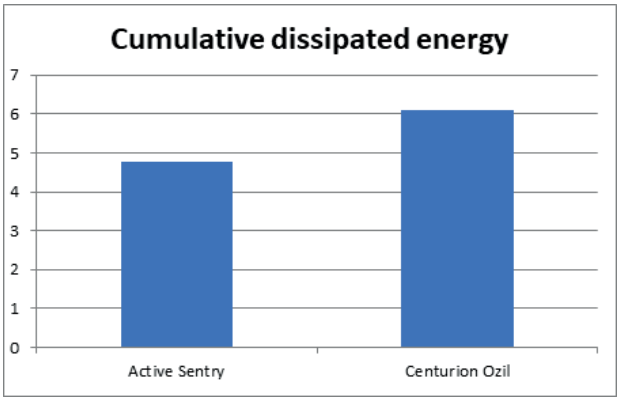
The average value of CDE in the Active Sentry group was also statistically significantly lower than in the Centurion Ozil group, specifically 4.78 (SD ± 2.83) versus 6.11 (SD ± 3.26) ($p = 0.002$) (graph 2). Similarly, the value of U/S time in the Active Sentry group was significantly lower than upon the use of the Centurion Ozil handpiece, specifically 30.1 seconds (SD ± 10.5) versus 42.2 seconds (SD ± 8.9) ($p = 0.003$) (graph 3). By contrast, the difference in the quantity of consumed BSS fluid was not statistically significant, specifically 58.17 ml (SD ± 11.2) in the Active Sentry group versus 61.12 ml (SD ± 14.7) in the Centurion Ozil group ($p = 0.173$) (graph 4). The average values of the observed parameters, including the range of values and the p value, are presented synoptically in table 1.

DISCUSSION

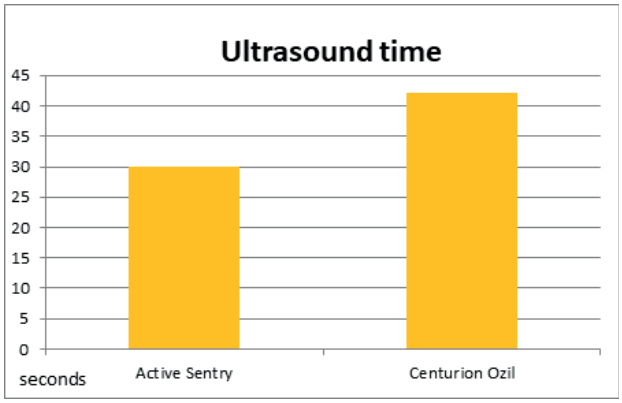
In the last 45 years, cataract surgery has changed significantly. Surgical techniques have been developed (intracapsular extraction, extracapsular extraction, pha-



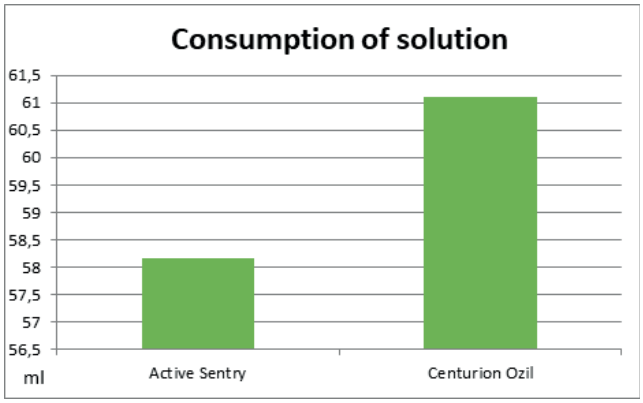
Graph 1. Comparison of average perioperative intraocular pressure (mmHg) upon use of Active Sentry and Centurion Ozil handpieces



Graph 2. Comparison of cumulative dissipated energy (unit without dimensions) upon use of Active Sentry and Centurion Ozil handpieces. This parameter is calculated according to the formula: (time of lengthwise performance x average lengthwise performance) + (time of torsional performance x 0.4 x average torsional amplitude)



Graph 3. Comparison of total ultrasound time (seconds) upon use of Active Sentry and Centurion Ozil handpieces



Graph 4. Comparison of estimated consumed fluid (ml) during procedure upon use of Active Sentry and Centurion Ozil handpieces

Table 1. Comparison of observed parameters upon use of Active Sentry and Centurion Ozil handpieces

	CDE	U/S time seconds	Fluid BSS ml	Intraocular pressure mmHg
Active Sentry average (SD) min-max	 4,78 (± 2,83) 2,01–8,94	 30,1 (± 10,5) 10,3–55,9	 58,17 (± 11,2) 37–92	 46 (± 7,9) 27–69
Centurion Ozil average (SD) min-max	 6,11 (± 3,26) 1,2–12,8	 42,2 (± 8,9) 14,1–82,0	 61,12 (± 14,7) 40–110	 65 (± 8,4) 42–87
P value	0,002	0,003	0,173	< 0,005

CDE – cumulative dissipated energy
U/S – ultrasound
BSS – balanced salt solution
SD – standard deviation

coemulsification), and the routine implantation of intraocular lenses of various types (monofocal, multifocal, toric) has been commenced.

Today phacoemulsification of the nucleus of the lens by ultrasonic energy is the most widespread method of cataract surgery, and this is continually being developed [3,4,5,6,7,8]. In general it is possible to state that it is necessary to find a balance between maximum effectiveness and safety. The effectiveness parameters are the performance of phacoemulsification, maximum vacuum or aspiration flow. The main safety parameters include protection of the endothelial cells, short ultrasound time, stability of the anterior chamber or protection of the incision against thermal damage. For this reason, new sophisticated phacoemulsification instruments and their accessories are continually being developed (ultrasonic handpieces and prongs) [9,10,11].

The Centurion phacoemulsification instrument with Active Fluidics technology enables an increase of the effectiveness of phacoemulsification by reaching higher values of vacuum upon drainage of the turbid lens, thereby reducing the necessary ultrasonic energy in the eye [3]. At the same time it brings a reduction of the flow of fluid in the eye [3] and a reduction of the pain of the procedure for the patient [8]. The new phacoemulsification handpiece, with an integrated sensor for dynamic measurement of intraocular pressure very close to the patient's eye, communicates with the Centurion instrument. In the case that the parameters do not correspond with the preset parameters, this instrument then evens up the current values according to the preset values with the aid of Active Fluidics technology. This brings a substantial elimination of post-occlusion waves, as well as even more precise maintenance of the set intraocular pressure, ensuring higher stability of the anterior chamber even upon higher vacuum values. In our cohort, upon use of the Active Sentry handpiece it was possible to reduce perioperative intraocular pressure safely and to a significant degree during the course of phacoemulsification, specifically by 29.2 %, from an average 65 mmHg to 46 mmHg. Despite this reduction, the surgeon had a constant feeling of thorough safety of the procedure and operational comfort during surgery. At the same time, a statistically significant reduction of the average value of cumulative dissipated energy was achieved (by 21.8 %) as well as a reduction of the total ultrasound time (by 28.7 %). The difference between the estimated consumed fluid during the procedure was not statistically significant (4.8 %).

CONCLUSION

Our results confirmed that upon use of the Active Sentry handpiece, it is possible to safely and signifi-

cantly reduce intraocular pressure during the course of phacoemulsification, and to substantially eliminate post-occlusion waves. This reduction brings a number of advantages: for the patient e.g. less painful surgery, for the surgeon a far more user-friendly phacoemulsification procedure, especially in the case of risk patients (floppy iris syndrome, severe myopia). At the same time, we demonstrated a statistically significant reduction of the average values of CDE and U/S time in the Active Sentry group in comparison with the Centurion Ozil group. By contrast, the difference in the quantity of consumed fluid was not statistically significant.

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