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Oh-oka H[1], Fujisawa M[2], Iwatsubo E[3]
1. Kobe Medical Center, 2. Kobe University, school of medicine, Kobe, JAPAN, 3. Kitakyusyu Koga Hospital

TIME PROFILE OF PHYSICAL PROPERTIES OF CATHETERS FOR INTERMITTENT SELF-CATHETERIZATION UNDER VARIOUS LOADINGS

Hypothesis / aims of study

We examined the time profile of physical properties of catheters used for intermittent self-catheterization under disinfectant solutions, exposure to artificial urine, or friction loading.

Study design, materials and methods

We studied five catheters: two silicon catheters (SI), a polyvinyl-chloride catheter (PVC), a polyurethane catheter with hydrophilic coating (PU), and a latex catheter (LA), using eight disinfectant solutions: 0.025% benzalkonium chloride, 0.025% benzethonium chloride, 0.025% benzethonium chloride/alkyl aryl polyether alcohol, 0.025% benzalkonium chloride/glycerine, 1.0% and 0.05% povidone-iodine, 0.05% povidone-iodine/glycerin, and 0.1% chlorhexidine gluconate, as follows. After friction loading of 120cmH2O, each catheter was soaked in artificial urine at 37°C for one day and then soaked in each disinfectant solution at 25°C for six days. These catheters were subjected to 1) observations of the appearance and the surface texture (x 200 and 1000), and 2) measurements of bending resistance, static friction coefficient, tensile strength and flow rate per min. using devices for each measurement. These processes were repeated for eight weeks.

Results

1) The appearance of catheters in the solutions containing povidone-iodine exhibited yellow and the discoloration became marked with time. The catheters in other disinfectant solutions did not show any remarkable changes. For the surface texture, PU catheter exhibited coating detachment in all disinfectant solutions by Week 2 and other catheters showed no obvious change except for that due to friction loading. 2) The bending resistance of SI and PVC catheters was about 2 and about 1.3 times as high as that of LA (1.65 N), respectively. With time, the hardness increased by 0 to 10% in the SI, did not change in PVC, and decreased by about 40% in LA. There were slight differences in the effects of disinfectant solutions on the bending resistance among catheters. The static friction coefficient of PU was the lowest with 0.27 N, while those of LA, PVC, and SI were 2.1, 2.4, and 3 to 3.7 times as high as PU, respectively. At Week 8, the static friction coefficients of PU, LA, PVC, and SI increased 3.7, about 4, about 1, and about 1.5 times, respectively. For the tensile strength and the breaking elongation, the PVC had the highest strength and the stable property in all solutions. PU and LA showed deterioration only in the 1.0% and 0.05 % povidone-iodine solutions. SI exhibited slight changes in its physical property due to the povidone-iodine- and glycerin-containing solutions. The flow rates of PVC and PU were the best with around 380 ml/min, while those of other catheters were around 200 ml/min. The flow rates changed slightly with time.

Interpretation of results

Overall, there were slight changes in catheter physical properties due to various loadings for eight weeks, except for discoloration due to the solutions containing povidone-iodine, deterioration in the latex catheter, and coating detachment in PU catheter.

Concluding message

SI and PVC were considered to have stable physical properties. However, caution should be taken with the safety of plasticizer in PVC.

References

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