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OBTENCIÓN Y VALIDACIÓN CLÍNICA DEL ÍNDICE QUERATOMÉTRICO AJUSTADO PARA MINIMIZAR ERRORES EN CÓRNEAS CON QUERATOCONO

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Abstract

Purpose: To obtain the algorithm for calculating the keratometric adjusted index (n_{kadj}) depending on the first cornea surface (r_{1c}) that minimizes the miscalculations of the keratometric corneal power on patients with keratoconus and also to make a clinic validation of the results.

Methods: The population was classified within two groups, those patients with incipient/moderated keratoconus and patients with advanced keratoconus. The exact keratometric index ($n_{kexacto}$) was calculated, which equaled the keratometric corneal power with the one it could be obtained calculating the corneal power with Gauss equation that uses both corneal surfaces (P_k=P_c^{Gauss}). Later the algorithms for calculating the adjusted keratometric index (n_{kadj}) were obtained depending on r_{1c} for two keratoconus grades and using the two theoric eye models from Gullstrand and Le Grand. For the clinic comparison 15 incipient/moderated keratoconus and 8 advanced keratoconus were analyzed. The True Net Power was obtained by the Pentacam, being equivalent to the P_c^{Gauss} with Gullstrand's model. The average corneal power results obtained by means of a keratometric index 1.3375 ($P_{k(1.3375)}$) were compared, the one calculated with the adjusted index (P_{kadj}) and the True Net Power (P_c^{Gauss}).

Results: Among the population with incipient/moderated keratoconus, theoric values of $n_{kexacto}$ were obtained between 1.3163 and 1.3368 on Gullstrand's Model and between 1.3179 and 1.3383 on Le Grand Model. For population with advanced keratoconus the theoric values were between 1.3074 and 1.3413 on Gullstrand's Model and between 1.3091 and 1.3427 on Le Grand, with clinic values of $n_{kexacto}$ for Gullstrand's Model between 1.3238 and 1.3281. Four algorithms were calculated on a theoretical procedure, 2 for Gullstrand Model and 2 for Le Grand Model for each keratoconus group, with theoric errors associated (ΔP_c= P_{kadj} - P_c^{Gauss}) of ± 0.70 D on moderated keratoconus and ±1.40 on advanced keratoconus. Clinically the (ΔP_c) obtained for the incipient/moderated keratoconus were 0.18 ± 0.30 D, among the population with advanced keratoconus the differences were -0.46 ± 0.66 D. Demonstrating that in the population with incipient/moderated keratoconus both methods of average (P_{kadj} y P_c^{Gauss}) didn´t represent any differences between the averages (p>0.05) and also could show that both methods were concordant and exchangeable ($\Delta P_{cmáx.\ clínica}$ ϵ [-0.42, +0.77] D). Within the advanced keratoconus population in spite that differences between the averages did not exist

(p>0.05) it was not possible to conclude that both methods could be exchangeable ($\Delta P_{cmáx.\ clínica}$ ϵ [-1.75, +0.83] D). However, the committed errors were lower than 1 D.

Conclusions: The mistakes committed due to the corneal power calculation by using an only one keratometric index on one keratoconus population, can be minimized by the use of a variable keratometric index with one only dependence of the first corneal face radius value. It was clinically demonstrated that the incipient/moderated keratoconus algorithm was valid since that they found differences in between calculation methods of the power did not overcome the theoretical associated errors. On the other hand the advanced keratoconus presented maximum clinical mistakes associated of 1 D, being able to be considered valid due to the high power values.