RESEARCH

The Adhesion Syndrome

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Abstract

Rigid gas permeable contact lenses may adhere to the corneal epithelium. Reports of adhesion have been described with only one type of lens material. This report describes three types of lens materials, lens fitting characteristics and the interactions between the eyelid, cornea and contact lens. Various factors may be responsible for the adhesion phenomenon.

Résumé

Les lentilles cornéennes rigides perméables aux gaz ont la faculté d'adhérer à l'épithélium cornéen. Ce genre d'adhésion n'a été décrit que dans le cas d'un seul matériau optique. Le présent document décrit trois types de matériau, les caractéristiques d'ajustement de la lentille et l'interaction paupière-cornée-lentille. Le phénomène d'adhésion est attribuable à divers facteurs.

Introduction

Rigid gas permeable contact lenses may adhere to the corneal epithelium.[1,2,3] Most of the reports have implicated lens design, particularly edge lift as being responsible for lens-cornea adhesion. All lenses have been silicone/acrylates. Some practitioners have thought that the adhesion may be due to the hydrophobicity of silicone because silicone lenses are reported to adhere to the cornea[2].

History

The patient history (Table I) consists of the spectacle correction, keratometer measurements, duration of rigid lens wear and the eye with the adhesion problem. The lens parameters and lens care regimens are provided in Table II. Five patients with three different types of acrylic polymers, silicone/acrylate (Boston II), cellulose acetate butyrate (CAB), and styrene (Airlens) experienced lens-cornea adhesion problems. Two patients had Boston II lenses, two CAB lenses and one patient the Airlens. There was no relationship between right or left eye adhesion nor duration of lens wear and adhesion. The patients presented themselves for routine examinations and were asymptomatic.

Table I
Patient History

Patient	Eye	Spectacle Rx	Keratometer	Lens Worn (Years)	Lens Adhesion
J.B.	O.D.	-2.75/-1.50x180	43.50/45.50x90	P.M.M.A. (8)	O.D.
	O.S.	-2.50/-2.50x5	43.12/46.50x90	Boston II (1)	
Y.P.	O.D.	+3.00/-1.50x45	42.50/44.75x116	P.M.M.A. (10)	O.S.
	O.S.	+2.75/-0.50x120	42.75/45.00x66	C.A.B. (4)	
I.H.	O.U.	-5.00	43.50/45.00x90	BOSTON II (2)	O.S.
B.K.	O.D.	-5.50/-0.75x135	43.75/43.50x82	P.M.M.A. (3)	O.D.
	O.S.	-5.50/-1.25x165	43.75/44.25x90	AIRLENS (4)	
K.H.	O.D.	-4.75	45.00/46.50x90	C.A.B. (2)	O.S.
	O.S.	-4.00	45.75/46.50x90		

Table II
Lens Parameters and Care Regimen

Patient	Lens	Base Curve	Diam.	O.Z.D.	Thick.	Power	P.C.
J.B.	BOSTON II	BOSTON SOL'NS					
	O.D.	7.63	8.8	7.6	.19	-2.75	.2/9.0
	O.S.	7.63	8.8	7.6	.17	-3.00	.4/10.5
Y.P.	CAB	ALLERGAN					
	O.D.	7.96	9.5	8	.16	+3.50	.2/9.0
	O.S.	7.93/7.90	9.5	8	.24	+0.25	.4/10.5
I.H.	BOSTON II	ALLERGAN					
	O.U.	7.76	9	7.8	.11	-5.75	.2/8.5 .4/10.5
B.K.	AIRLENS	BARNES-HIND					
	O.D.	7.67	8.6	7.4	.13	-4.50	.2/8.5
	O.S.	7.67	8.6	7.4	.11	-5.50	.3/11.5
K.H.	CAB	BOSTON					
	O.D.	7.3	8.8	7.6	.15	-4.75	.2/9.5
	O.S.	7.26	8.8	7.6	.15	-4.25	.4/10.5

Methods

It has been suggested that the lens care regimen may be responsible for the adhesion problem. Two patients used Boston solutions, two Allergan solutions (Total and LC65) and one Barnes-Hind GP solutions. It appears that the solutions are unrelated to this problem.

It has also been suggested that the lenses were too thin (less than 0.13 mm) or fitted too flat. Only one patient had a lens thickness of less than 0.13 mm with an adhesion problem. Three patients were fitted

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on "K" and two steeper than "K". None were fitted flatter than "K". Only one patient had a hyperopic correction, one a back toric lens. The remaining patients had myopic corrections.

The edge finish on all lenses was the same in the intermediate and peripheral curve widths. The intermediate radius of curvature ranged from 8.5 to 9.0 mm and the peripheral radius of curvature from 10.5 to 11.5 mm.

All patients had histories of allergies with occasional discomfort. When the lens adhesion was noted, the patients complained of a mild sensation of dryness. The lenses, upon removal, appeared very dry.

Results

The biomicroscopic examination revealed uniocular lens adhesion to the inferior temporal quadrant of the cornea. The lens could be displaced with strong digital pressure upon which the cornea revealed multiple lesions where the intermediate and peripheral zone of the lens had adhered. With lacrimation, the lens would float and produce discomfort when centered. The upper lid hit the lens edge and displaced the lens downward and temporally until the lens adhered to the cornea and was maintained there by adhesion and blinking.

The lens was removed, cleaned and reinserted. Within seconds adhesion recurred. The lenses were blended, the edges thinned and polished. Some lenses were replaced with edge modifications. The adhesion problem improved somewhat but does recur from time to time after several weeks of wear.

Discussion

According to a recent article by E. Bennett[3] "lens desiccation with inferior positioning, a thick edge, irregular tear film and excessive edge lift may be responsible for lens-cornea adhesion". Sevigny[1] states that the "adhesion phenomenon" is produced by a negative disjoining pressure between a silicone-based lens and the corneal epithelium and creates partial or total suction. It is potentiated by tight lids and large, thin, flat-fitting lenses where the lens can flex toward the flat periphery and create minute arcuate adhesions. Sarver at the 1985 American Academy of Optometry meeting stated that adhesion occurred frequently in the morning after extended wear of the Boston IV lens. Altering the thickness and lens design produced no improvement.

The edge lift factor is responsible for creating the condition whereby the upper lid margin drives the lens to an inferior position relative to the apex of the cornea. Air is trapped between the lens and cornea, the blink does not cover the lens which creates desiccation and this creates the adhesion. Bennett[3] states that "Unfortunately, as edge lift is increased displacement of the lens inferiorally with the blink is more likely to occur, as is desiccation of the epithelium beneath the edges of the lens where tear flow is inhibited." It may be added that the patient usually blinks incompletely leaving the inferior section of the cornea dry.

Bennett[3] suggests a tetracurve lens design with steep peripheral curves and a narrow bevel. Such a lens design in a large diameter lens may sometimes resolve the adhesion problem but it is a complex problem involving the lid-lens interaction, tear film, blinking characteristics of the patient and lens design. The latter is the only controlled condition and does not always resolve the problem.

References

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2. Faat, I. Negative Pressure Under Silicone Rubber Contact Lenses. *Contacts* 1979; 23(1); 6-8
3. Bennett, E. Silicone/Acrylate Lens Design *Int. Contact Lens Clinic*. 1985; 12(1): 45-53