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Solving the mechanistic mystery of RGP blending - Removal versus redistribution

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Abstract

The effect of blending a rigid gas permeable (RGP) contact lens was studied, specifically concentrating upon whether the process removes lens material or if it simply redistributes it. The masses of RGP lenses were measured both before and after blending, and then analysis was performed to determine if material had been removed. Findings indicate that blending a contact lens does indeed remove lens material. This was found to be true with both silicon acrylate and fluorosilicon acrylate lenses.

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SOLVING THE MECHANISTIC MYSTERY OF RGP BLENDING--

REMOVAL VERSES REDISTRIBUTION

By

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Authors' Biographies

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Lori is a fourth year optometry student at Pacific University. She plans on practicing full scope primary care optometry in Salinas, California. Interests include vision therapy, contact lenses, and pediatric vision. Lori also enjoys playing the piano and has an Associate of the Royal Conservatory of Music of Toronto (ARCT) degree in piano performance from the University of Toronto.

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Brendon is currently a fourth year optometry student at Pacific University. He plans to embark on a career in the US Army serving military personnel and their families after graduation. Brendon interests are contact lens application and pediatric vision.

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Currently a fourth year optometry student at Pacific University, Laura is looking forward to practicing with the US Air Force after graduation. There she hopes to deliver personalized care to military personnel and their families. Interests include contact lenses and pediatric optometry. Eventually she plans to practice privately in Coos Bay, Oregon.

Abstract:

The effect of blending a rigid gas permeable (RGP) contact lens was studied, specifically concentrating upon whether the process removes lens material or if it simply redistributes it. The masses of RGP lenses were measured both before and after blending, and then analysis was performed to determine if material had been removed. Findings indicate that blending a contact lens does indeed remove lens material. This was found to be true with both silicon acrylate and fluorosilicon acrylate lenses.

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Introduction:

Blending is one of the most common in-office modifications performed on rigid gas permeable lenses. It has been found that by smoothing the junction of peripheral curves, greater comfort and lens tolerance can be achieved. Although this is a very common procedure, the authors found that little knowledge exists as to the mechanics of a blend. Specifically, does blending remove lens material, or does the process simply redistribute lens material, pressing the plastic into a rounder, smoother form?

The purpose of this study was to determine whether or not material removal occurs during blending. If material is removed, it is possible that some material was also redistributed. Like most things in the world, there may not be an all or none relationship here. However, with this research we hope to establish whether material removal is or is not a component of a blend's mechanics.

Also to be incorporated into our study is a differentiation between silicon acrylate and fluorosilicon acrylate lens materials. It is possible that each material may show unique blending mechanics.

One previous investigation into this matter was performed by Bartell, Suder, and Peterson of Pacific University in 1993. Their conclusion was that material is removed from lenses during blending, however, their sample size was much smaller than ours and no differentiation was made as to silicon acrylate and fluorosilicon acrylate material types. To our knowledge, no other research has been published on this subject.[1]

Methods:

Twenty-five fluorosilicon acrylate and 25 silicon acrylate lenses were randomly selected. Each lens was measured for base curve, overall diameter, center thickness, and power. A peripheral curve 3.0 mm flatter than the base curve was then cut into each lens. Two methods were actually used in the application of peripheral curves. All the silicon acrylate and fifteen of the fluorosilicon acrylate lenses were modified with tape covered brass tools and X-PAL polish. The remaining ten fluorosilicon acrylate lenses were modified with diamond tools, then polished with tape covered tools and X-PAL polish.

The next step involved weighing these semi-modified lenses. To ensure that the masses obtained were accurate, any excess polish was removed using Lobob cleaner. Each lens was scrubbed for exactly 30 seconds in the palm of the hand and rinsed with distilled water. After cleaning, the lenses were only handled with dry soft contact lens tweezers. The lenses were air dried for exactly 45 minutes at which time no moisture was visibly detected. Each lens was then placed on the Sartorious research scale, capable of measuring to the 0.00001 gram. Three weight measurements were taken of each lens with the scale recalibrated between measurements. The mean of the three findings was used in the data analysis. Each mean was rounded to five decimal places (Table 1 and Table 2).

After the weight was recorded, the lenses were blended using brass tools covered with new velveteen. For each "blend" the velveteen was moistened and then spun to control the water content. A single preparation of X-PAL polish was used for all blends. To insure homogenous conditions, it was stirred well before each application. The 50 lenses were blended randomly by three researchers. Therefore, the individual blending pressures were evenly distributed. The brass tools utilized were 1.35 mm flatter than each lens' base curve. The blend produced was 4.0 mm wide on each lens.

After inspection, any chipped lenses were discarded. The three lenses that chipped were all fluorosilicon acrylate.

At the time of the second weighing, the lenses were again cleaned with Lobob cleaner for 30 seconds, ant then air dried for 45 minutes. Three weight measurements were again recorded and the mean of the three was used in data analysis. The mean was again rounded to 5 decimal places (Table 1 and Table 2).

Results:

According to our results, blending a rigid gas permeable contact lens does indeed remove material. This is supported by a measured loss of mass ranging from 0.16807% to 4.16971% for the silicon acrylate lenses, and 0.71485% to 7.11563% for the fluorosilicon acrylate lenses (Table 1) and (Table 2).

The silicon acrylate lenses lost an average of1.74869% and the fluorosilicon acrylate lenses lost an average of 2.10467%. These data show that fluorosilicon acrylate lenses lost more mass from blending than silicon acrylate. The standard deviation for the silicon acrylate lenses was 1.03522 and 1.31864 for the fluorosilicon acrylate lenses.

Two lenses in the study gained a very small percentage of mass. One was a silicon acrylate lens and the other was a fluorosilicon acrylate lens. No explanation can be found for this result.

Each lens was examined under the lighted magnifier, and visibly chipped lenses were discarded. There may have been some that visibly did not appear chipped and were included in the study, thus resulting in the large loss of mass indicated in the upper range of fluorosilicon acrylate lenses.

TABLE 1 SILICON ACRYLATE LENSES

	BEFORE BLEND	AFTER BLEND	% CHANGE
1	0.01154	0.01135	-1.64645
2	0.01189	0.01179	-0.84104
3	0.02577	0.02537	-1.55219
4	0.02521	0.02489	-1.26934
5	0.01272	0.01240	-2.51572
6	0.01306	0.01294	-0.91884
7	0.01335	0.01302	-2.47191
8	0.01325	0.01300	-1.88679
9	0.01303	0.01265	-2.91635
10	0.01138	0.01113	-2.19684
11	0.01140	0.01120	-1.75439
12	0.01190	0.01188	-0.16807
13	0.01280	0.01237	-3.35938
14	0.01479	0.01459	-1.35227
15	0.01218	0.01178	-3.28407
16	0.01281	0.01252	-2.26386
17	0.02117	0.02089	-1.32263
18	0.01859	0.01828	-1.66756
19	0.01412	0.01403	-0.63739
20	0.01415	0.01386	-2.04947
21	0.01701	0.01685	-0.94062
22	0.01367	0.01310	-4.16971
23	0.01463	0.01459	-0.27341
24	0.01010	0.00994	-1.58416
25	0.02992	0.02894	-3.27540
26	0.03165	0.03133	-1.01106
27	0.01751	0.01753	+0.11422

Mean=1.74869
S.D.=1.03522

TABLE 2 FLUOROSILICON ACRYLATE LENSES

	BEFORE BLEND	AFTER BLEND	% CHANGE
1	0.01608	0.01584	-1.49254
2	0.01602	0.01574	-1.74782
3	0.01504	0.01456	-3.19149
4	0.01254	0.01231	-1.83413
5	0.01349	0.01320	-2.14974
6	0.01334	0.01313	-1.57421
7	0.01197	0.01173	-2.00501
8	0.01235	0.01212	-1.86235
9	0.01359	0.01328	-2.28109
10	0.01560	0.01501	-3.78205
11	0.01446	0.01421	-1.72891
12	0.01635	0.01607	-1.71254
13	0.01519	0.01491	-1.84332
14	0.01172	0.01137	-2.98635
15	0.01259	0.01250	-0.71485
16	0.01112	0.01093	-1.70863
17	0.01050	0.01052	+0.19048
18	0.01574	0.01462	-7.11563
19	0.01535	0.01519	-1.04235
20	0.01390	0.01347	-3.09353
21	0.02575	0.02534	-1.59223
22	0.02510	0.02462	-1.91235
23	0.01237	0.01211	-2.10186
24	0.01220	0.01205	-1.22951

Mean=2.10467
S.D.=1.31864

Calculations done excluding lens #18

Mean=1.88680
S.D.=0.82172

Discussion:

The results of the analyzed data show a change in the masses of the lenses after blending. This was true for both the silicon acrylate and fluorosilicon acrylate lenses. An overall comparison of the two material types indicated a greater loss of mass for the fluorosilicon acrylate lenses than for the silicon acrylate lenses.

Blending an RGP lens smooths the junction of peripheral curves and generally results in increased comfort for the patient. This study only determined if material was removed and not if material was removed and redistributed. Further research in this area would be valuable. The use of a corneal topographer may be indicated for presenting an image of the contact lenses curvature before and after the material is removed from blending. This might indicate if there is a redistribution of material combined with the removal.

References:

1. Bartell, U., Suder, R., and Peterson, J. Does blending an RGP lens move or remove plastic?. Unpublished thesis Pacific University, 1994.