

Overview:

This Excel spreadsheet has been developed based on the following published correspondence:

Koch DD, Wang L. Surgically Induced Astigmatism. *Journal of Refractive Surgery* 2015; 31 (8): 565.

It will automatically generate Double-angle plots of the corneal surgically induced astigmatism for OD and OS including centroid values and standard deviations, and 95% confidence ellipses of the dataset and of the centroid values.

This spreadsheet was designed to analyze the mean corneal SIA for the right and left eyes of a single surgeon that use a similar routine main incision (size & location).

Note:

Please read these instructions in their entirety before entering any data into the Excel spreadsheet and performing astigmatism analysis for IOL-based surgery. There are certain formatting conditions that, if not followed, may create unanticipated errors. None of the fields should be left blank within the spreadsheet. If any fields are left blank, errors in data analysis will occur.

System requirements:

This Excel spreadsheet has been tested with Office 365 (for PC) using Windows 10 Pro (version 1803) with a 64-bit operating system and a 3,000 x 2,000 resolution display. It was also tested with Office 365 (for Mac, version 16.37) using the Catalina Mac OS, version 10.15.4 and a 2,560 x 1,600 resolution display. For Mac users, the Excel copy icons are not functional.

Worksheets - Overview:

There are three worksheets within this Excel workbook. These worksheets, and the purpose of each, are the following:

1. **Data_Input_OD** - This worksheet provides for the input of user data for the right eyes.
2. **Data_Input_OS** - This worksheet provides for the input of user data for the left eyes.
3. **Figure** - This worksheet will automatically generate double-angle plots of the corneal SIA values of OD and OS. Centroid values, standard deviations (SD), and 95% confidence ellipses of the centroid (red) and dataset (blue) are also calculated. Mean absolute errors with standard deviations and the number of eyes that were included are also displayed.

The Data_Input Worksheets OD/OS

There are fourteen columns (Columns A-G, I-N and P) where data are entered. They are arranged in the following manner:

Column Letter	Column Title	Description
A	No.	This cell generates a row number automatically.
B	Preoperative corneal astigmatism: Kflat	This cell records the pre-operative Flat K value in diopters. The allowable data range is from 30.0 D to 60.0 D.
C	Preoperative corneal astigmatism: @flat	This cell records the pre-operative Flat Meridian value. The allowable data range is from 000° to 180°.
D	Preoperative corneal astigmatism: Ksteep	This cell records the pre-operative Steep K value in diopters. The allowable data range is from 30.0 D to 60.0 D.
E	Preoperative corneal astigmatism: @steep	This cell generates the pre-operative Steep Meridian value.
F & G	Astigmatism / @	These cells generate the pre-operative corneal astigmatism values
I	Postoperative corneal astigmatism: Kflat	This cell records the post-operative Flat K value in diopters. The allowable data range is from 30.0 D to 60.0 D.
J	Postoperative corneal astigmatism: @flat	This cell records the post-operative Flat Meridian value. The allowable data range is from 000° to 180°.
K	Postoperative corneal astigmatism: Ksteep	This cell records the post-operative Steep K value in diopters. The allowable data range is from 30.0 D to 60.0 D.
L	Postoperative corneal astigmatism: @steep	This cell generates the post-operative Steep Meridian value.
M & N	Astigmatism / @	These cells generate the post-operative corneal astigmatism values
P	Integrity check	This cell generates an integrity check for each individual row. In the case of missing data and / or if the Steep K < Flat K, an "Error" output is displayed, otherwise an "OK" output is displayed.

Additional input/output cells:

Cell F1	Incision size	F1 cell records the size of the main corneal incision in mm. The default value is set to 2.4 mm. The allowable data range is from 1.0 mm to 5.0 mm.
Cell L1	Incision location	L1 cell records the location of the main corneal incision in degrees. The default value is set to 180 / 0. The allowable data range is from 0 to 180 degrees.
Cell O1	Device	O1 cell records the name of the measuring device which was used to generate the data.

Cell S1	Error Check	S1 cell generates an integrity check for the whole spreadsheet. In case that there is an "Error" output on one or more of any individual row's integrity check, or if cells F1, L1 or O1 are left blank, an "Error" output will be displayed, otherwise an "OK" output is displayed.
Cell S2	Empty Rows	S2 cell generates an integrity check for the existence of any blank rows within the entered data that will lead to an incorrect display of the double angle plots diagrams. In case of a blank row an "Error" output is displayed, otherwise an "OK" output is displayed.
Cell S3	# of eyes "OK"	S3 cell generates the number of rows with an integrity check indicated as "OK".
Cell S4	# of eyes "Error"	S4 cell generates the number of rows with an integrity check indicated as "Error".
Cell S5	# of eyes Total	S5 cell generates the total number of cases that were entered by the user (S3+S4).

To utilize this spreadsheet please follow these steps:

- I. The Data_Input Worksheets are the only point of data entry for the user. The Excel "protected sheet" option is turned on; hence, only unprotected cells are available to the user.
- II. Enter the size of the main corneal incision and location (cell F1 & L1).

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
1	Eye:	OD		Incision size:		2.4 mm		Incision location:				180 °		Device:	IOLM700			Error Check:	OK
2																		Empty Rows:	OK
3				Preoperative corneal astigmatism				Postoperative corneal astigmatism									Integrity	# of eyes "OK":	83
4	No.	Kflat	@flat	Ksteep	@steep	Astigmatism	@	Kflat	@flat	Ksteep	@steep	Astigmatism	@				check	# of eyes "Error":	0
5	1	42.67	23	44.75	113	2.08	113	42.65	12	44.44	102	1.79	102				OK	# of eyes Total:	83
6	2	45.43	105	46.51	15	1.08	15	45.99	106	46.73	16	0.74	16				OK		

- III. Enter the name of the measuring device that was used to generate the data (cell O1).

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
1	Eye:	OD		Incision size:		2.4 mm		Incision location:				180 °		Device:	IOLM700			Error Check:	OK
2																		Empty Rows:	OK
3				Preoperative corneal astigmatism				Postoperative corneal astigmatism									Integrity	# of eyes "OK":	83
4	No.	Kflat	@flat	Ksteep	@steep	Astigmatism	@	Kflat	@flat	Ksteep	@steep	Astigmatism	@				check	# of eyes "Error":	0
5	1	42.67	23	44.75	113	2.08	113	42.65	12	44.44	102	1.79	102				OK	# of eyes Total:	83
6	2	45.43	105	46.51	15	1.08	15	45.99	106	46.73	16	0.74	16				OK		

- IV. Insert / Edit a Record:

- a. Enter patient data starting from column B ('Kflat' column) of row number 5. Please notice, row number 5 contains data as an example, and the user should

override these data. **This row should not be deleted by the “clear content” option!**

- b. For values that are outside of the allowed range, a warning box will appear.
- c. Spaces, or blank cells are not allowed. Confirm that all data have been properly entered. If a cell is left blank, or if Ksteep is a value less than Kflat, an error message will be displayed in column P, and in cell S1. **Rows with missing data are not automatically removed from the analysis, so this should be manually corrected by the user.**

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
1	Eye:	OD		Incision size:		2.4 mm			Incision location:		180 °			Device:	IOLM700		Error Check:	Error	
2																	Empty Rows:	OK	
3		Preoperative corneal astigmatism						Postoperative corneal astigmatism						Integrity	# of eyes "OK":	80			
4	No.	Kflat	@flat	Ksteep	@steep	Astigmatism	@	Kflat	@flat	Ksteep	@steep	Astigmatism	@		check		# of eyes "Error":	3	
5	1	42.67	23	44.75	113	2.08	113	42.65	12	44.44	102	1.79	102		OK		# of eyes Total:	83	
6	2	45.43	105	46.51	15	1.08	15	45.99	106						Error				
7	3	45.97		46.53	90			45.97	155	46.53	65	0.56	65		Error				
8	4	44.43	14	45.17	104	0.74	104		172	45.24	82				Error				
9	5	42.67	137	43.27	47	0.6	47	42.47	131	44.13	41	1.66	41		OK				
10	6	44.47	16	45.05	106	0.58	106	43.9	7	44.59	97	0.69	97		OK				

- d. Blank rows within the data entry area are not allowed. If blank rows are present within the data entry area, an error message will be displayed in cell S2. **Blank data rows within the dataset will lead to an incorrect display of the double-angle plot, so this should be manually corrected by the user.**

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
1	Eye:	OS		Incision size:		2.4 mm			Incision location:		0 °			Device:	IOLM700		Error Check:	OK	
2																	Empty Rows:	Error	
3		Preoperative corneal astigmatism						Postoperative corneal astigmatism						Integrity	# of eyes "OK":	78			
4	No.	Kflat	@flat	Ksteep	@steep	Astigmatism	@	Kflat	@flat	Ksteep	@steep	Astigmatism	@		check		# of eyes "Error":	0	
5	1	41.11	147	42.54	57	1.43	57	41.01	147	42.38	57	1.37	57		OK		# of eyes Total:	78	
6	2	40.7	108	41.3	18	0.6	18	40.72	109	41.34	19	0.62	19		OK				
7	3																		
8	4	43.9	101	44.3	11	0.4	11	43.34	118	44.15	28	0.81	28		OK				
9	5	43.39	34	44.06	124	0.67	124	43.39	34	44.06	124	0.67	124		OK				

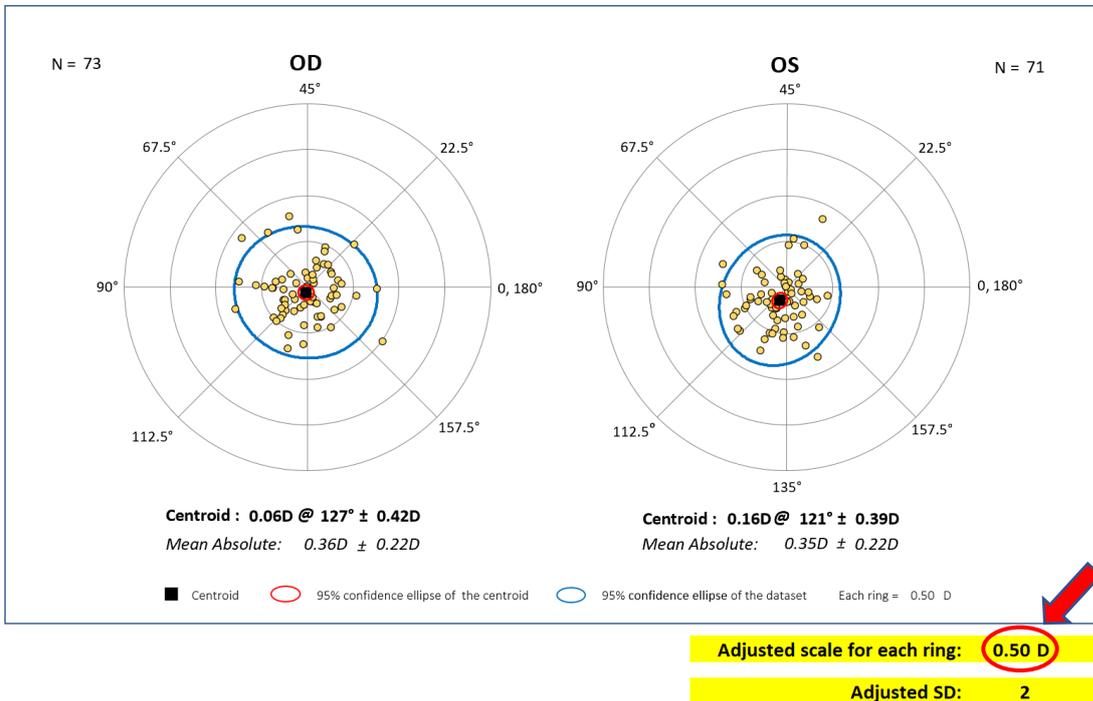
- e. Restricted Numerical Ranges: Please refer to the table above.
- f. Additional Restrictions: The Worksheets will allow a maximum input of 3000 cases.

V. Delete Row(s) / Cell(s):

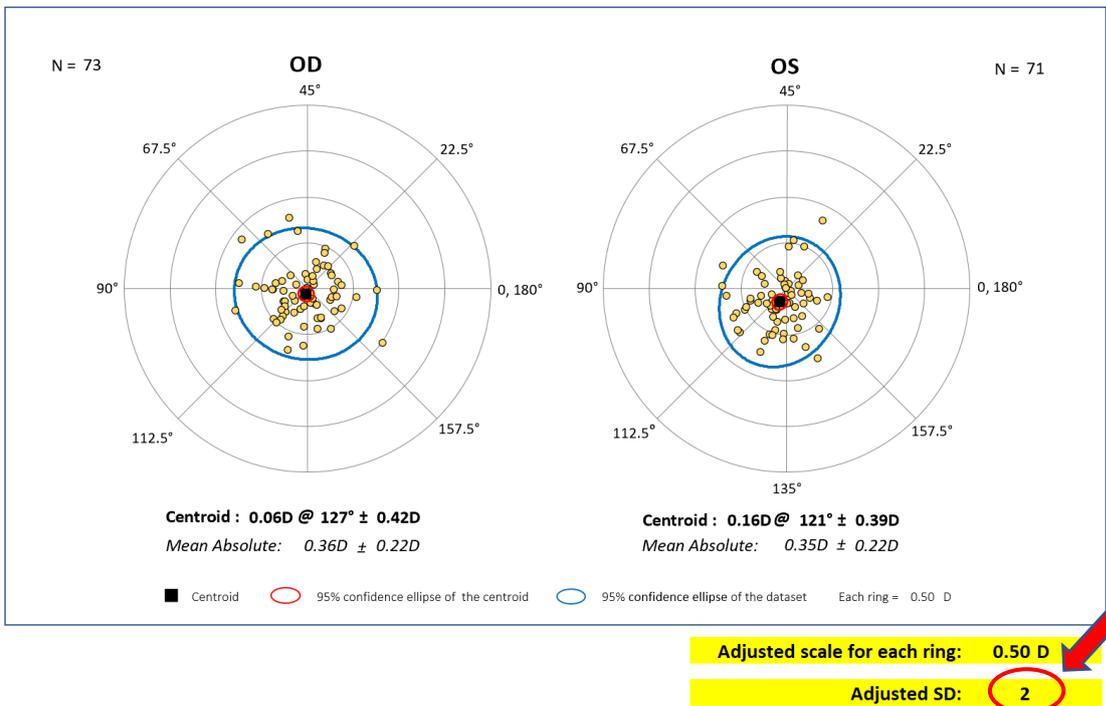
The Data_Input worksheets do not allow the user to delete rows or cells using the normal Excel Select and Delete functions. To delete entered data, the user must use the clear content option.

VI. The Worksheet 'Figure' contains graphs as mentioned above.

VII. In the Worksheet 'Figure', the user can adjust the scale for each ring of the DAP by entering the desired scale; the default scale is set to 0.50 D (Cell Q41)

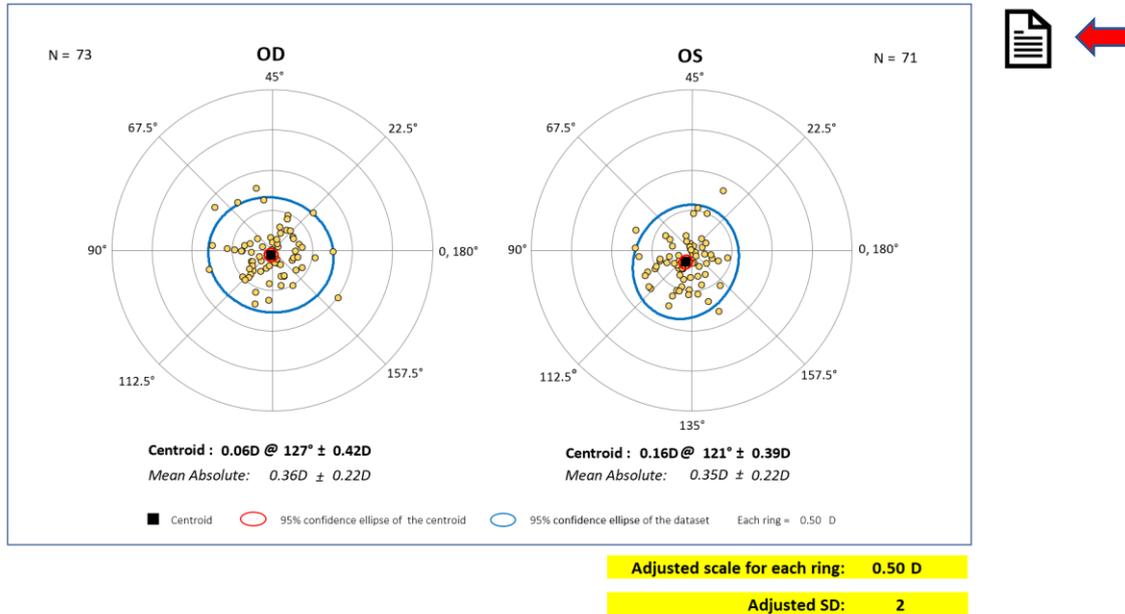


VIII. In the Worksheet 'Figure' the user can adjust the range of the corneal SIA that will be analyzed by the spreadsheet. The user can change the Adjusted SD (Cell Q43). This will generate a range by using the following formula (Adjusted SD x Standard Deviation of the X and Y components of the double angle corneal SIA values). All values outside of this range will be excluded from the analysis. The default value for cell Q43 is 2.



The 'Figure' worksheet is not protected, and the user can change its style. **Nevertheless, please be aware that this action is not recommended as it might unintentionally disrupt the proper presentation of the data.**

- IX. To copy the graph from Worksheet 'Figure', the user can either use the copy icon next to it (this option will not work properly in Office for Mac), or simply select & copy it in a standard way.



For problems, or specific question, users are welcome to contact:

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End of Excel spreadsheet instructions.