# Evaluating and Recording Soft Contact Lens Fit

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The fitting of soft contact lenses is a daily part of the workload of most optometrists. While there is much written on the topic, until recently there has been little scientifically derived evidence as to the key parameters with which to define soft lens fit. Most of the instruction on how to record soft contact lens fit can be found in common contact lens textbooks, but again there is no consensus on soft contact lens fit evaluation and recording. Most, such as '*Contact Lenses'* (Editors: AJ Phillips and L Speedwell)[1] and '*Essential Contact Lens Practice*' by Jane Veys, John Meyler and Ian Davies[2] imply describing movements in terms of millimetres and tightness of push-up (although it is not clear whether this is tightness or recovery speed) as a percentage.

Hence, the evaluation of soft contact lenses varies greatly between individual practitioners and the record of lenses trialled is often limited to descriptions such as "good" or "poor" which is highly subjective and of limited use in future patient aftercare. It is acknowledged that practitioners have limited time for evaluating and recording contact lens fit. However, accurate recording of contact lens fit characteristics is important, for example: legally, particularly in case of future contact lens complications; to assist in reducing the risk of contact lens discontinuations which are common;[3] and to allow the practitioner the advantage of being able to read comprehensive clinical records on previous lens fit attempts which were ultimately unsuccessful, to avoid these issues with subsequent lens fitting.

This article reports on the schematic devised from the scientific research conducted at Aston University in the United Kingdom, to better understand which are the traditionally assessed features of soft contact lens fit independently contribute and hence are critical to record. The full description of the study can be found in the journal Contact Lens and Anterior Eye by the author.[4]

**Lens Details**
It needs to be clear when reading a record card, exactly what lens the fit relates to. Hence the stated lens parameters and brand name and/or manufacturer should be clearly noted, particularly with the development of newer generations of the same lens material and brand names which cover lenses of multiple wearing modalities and optics.

*e.g. Fictitious Brand, Silicone-Hydrogel Daily Disposable 8.6BC: 14.1mm; -4.25D*

**Settling Time**
Virtually all studies that have examined lens movement at multiple time points post-insertion have shown a decrease over the initial 10 to 15 minutes.[5-8] However, movement increases again during the day's wear, with the movement after 8 hours wear shown to equate to the movement measured 5 minutes after insertion in a couple of studies.[5,7] It would therefore seem appropriate (and fortunately relatively convenient to the practitioner's limited appointment time) to assess soft lens fit about 5 minutes after insertion. If there has been a lot of tearing with lens insertion, such as in a new contact lens wearer, then the lens can tighten-up dramatically, so more time should be given before the soft contact lens is assessed.[9] This is also the case if the soft contact lenses

have been recently worn when showering or swimming, so this should be factored in if a contact lens appointment immediately follows one of these activated.[9]

**Test order and Illumination**

As lens fit can be affected by invasive techniques and stimulated tearing, the examination should be conducted under sufficient, but minimal illumination, avoiding direct illumination of the pupil where possible. Lens fit can be adequately assessed under diffuse illumination or from the indirect light scatter across the eye when using an optic section or parallel-piped slit beam. The assessment of the pre-lens tear film, to indicate lens wettability, should be evaluated first and the push-up test should be performed last.

**Pre-Lens Tear film**

Dry eyes, as determined by non-invasive break-up time, tear menisus height and the number of symptoms is an important determinate of comfort wearing contact lenses.[10] The tear film on the front surface of a contact lens, which is an on-eye measure of its wettability, appears to relate to contact lens comfort, but not to predict those who would remain comfortable in their contact lenses with continued wear.[11] This lens surface moisture is presumably responsible for limiting the friction with the upper lid and should be recorded as part of the evaluation of lens fit. Non-invasive break-up time, assessed as the number of seconds the first Purkinje image remains undistorted following a blink, is the easiest clinical on-eye measure of contact lens surface wettability (Figure 1).

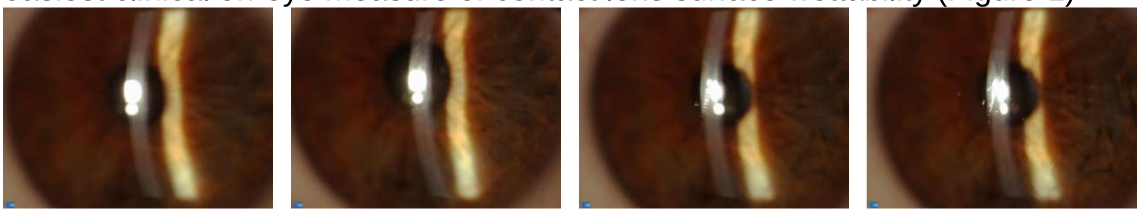

**Figure 1:** Pre-lens tear film break up with the first Purkinje image captured every 2 seconds following a blink showing the distortion in the reflection.

**Centration and Coverage**

The lens should adequately overlap the bulbar conjunctiva through 360 degrees in all positions of gaze. Centration becomes critical with more advanced optical contact lens designs such multifocals where decentration will significantly affect the ocular aberrations. Limited lens interaction with the limbal area is thought to be important: as it marks the end of the corneal avascular area, with the potential for neovascularization of the cornea occurring in response to insult of this area; and ocular stem cells have been found to principally be located at the limbus,[12] with insult from repeat crossing of a contact lens edge potentially decreasing stem cell viability. A recent study by Collins et and colleagues[13] demonstrated the impact of soft contact lenses on the limbus using high resolution Optical Coherence Tomography (OCT), even though recent work assessing the architecture of this region also using OCT has shown the traditionally characterized sharp transition in curvature between the peripheral cornea and scleral to be essentially flat.[14] Lens centration and coverage is best marked on a schematic by marking the centre of the cornea with a cross and drawing a circle to indicate the relative lens position (Figure 2). Some practitioners have indicated that they prefer to use a small ‘x’ to indicate the centre of the lens relative to the corneal centre, as this is easier to draw accurately rather than a circle. However, this does not then facilitate the use of a small mark on the edge of the lens circle to indicate any crossing of the limbus by the contact lens edge in that position (Figure 2).

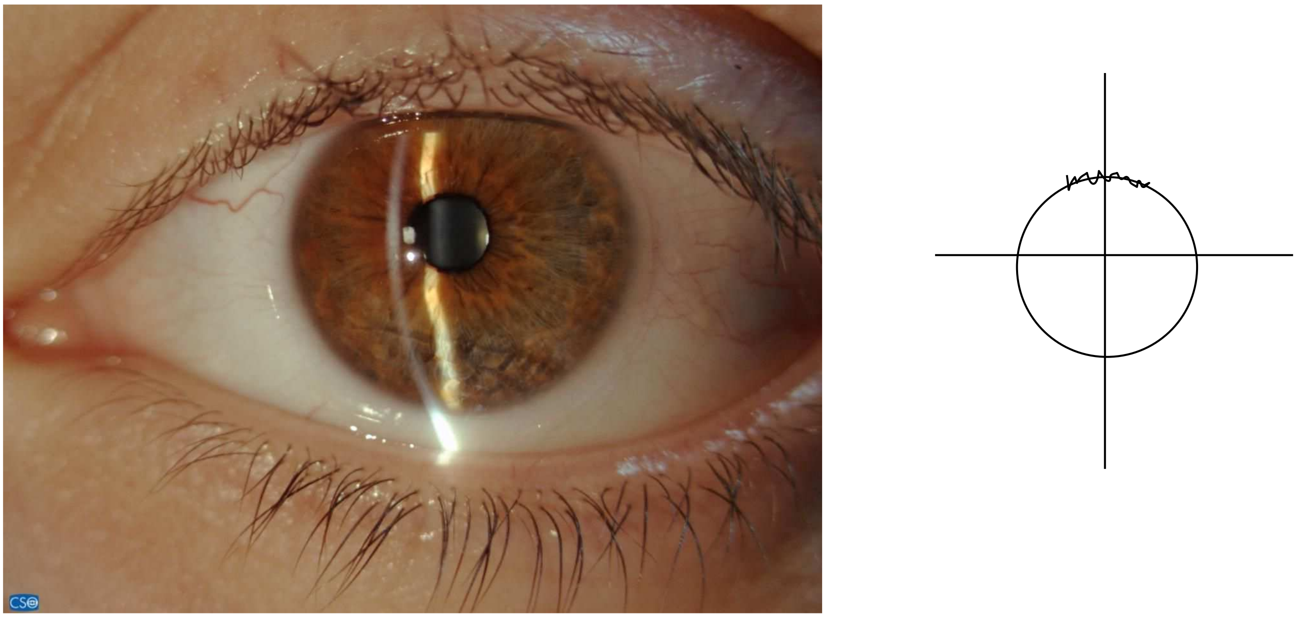

**Figure 2:** Fitting cross indicating the centre of the cornea with a circle marking the slightly inferior lens position which crosses the limbus with the superior edge.

**Comfort**

Although contact lens comfort and fit are not strongly related,[15] the prescribed lens must be comfortable for the wearer as discomfort is the major cause of discontinuations.[3] Some record discomfort on a Likert scale such as 0 (need to remove) to 10 (can't feel), while a scale with less increments may be sufficient as one is unlikely to fit an uncomfortable soft lens.

**Lens Movement**

**<u>On Blink</u>**

Our research showed that contact lens movement on blink with the patient looking up was more diagnostic of overall lens movement than movement on blink in primary gaze, as well as being easier to observe.[4] Moderate magnification of 16-25x should be used as the average movement of modern soft contact lenses is typically around one third of a millimetre. To aid the clinician if they are not used to quantifying distances through the magnified image provided by a slit lamp, this movement of the lens can be estimated compared to the proportion of lens overlap onto the sclera relative to the diameter of the contact lens and patients horizontal visible iris diameter (HVID) For example the overlap of a well centred 14.0 mm total diameter contact lens = 1.0mm if the HVID is 12mm, therefore a movement on blink of 1/3$^{rd}$ of this distance would be approximately 0.3 mm. Alternatively, the height of the slit-lamp beam can be reduced to the smallest setting (such as 0.3 mm) and this distance used as a comparator to estimate the size of movement (Figure 3). The slit width scale seems often to be uncalibrated and therefore cannot be used for this purpose.

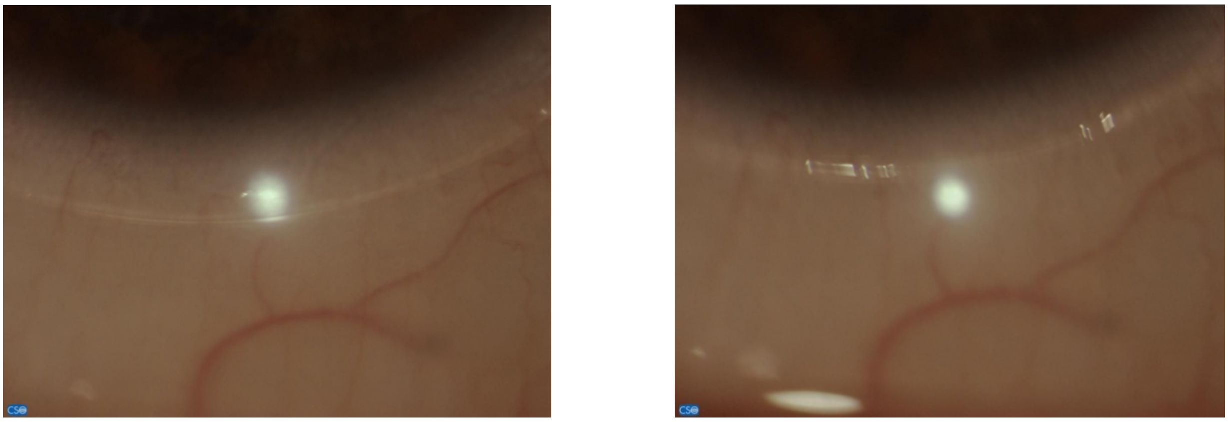

**Figure 3:** LEFT: A 0.3 mm slit beam height placed on the lower contact lens margin with patient looking up. RIGHT Immediately after the blink the lens appears located above the beam by another third of the beam height (therefore equivalent to approximately 0.4 mm).

**Lag**

Lag refers to the resistance of the lens to move with the eye on excursions away from primary gaze. If the lens is mobile, then the lens will tend to shift centration away from the direction of gaze due to the interaction between the lid anatomy, lens thickness profile and the ocular surface curvatures. Our research shows that only horizontal lag is independently diagnostic of overall lens movement.[4] Although some refer to lens sag rather than lag, this describes the distortion or geometry of the shape of the lens, not its movement, although the two parameters are related.

Due to the movement of the eye on changing gaze, the actual simultaneous dynamic movement of the lens in the opposite direction is not easy to estimate. Instead, with the patient looking straight ahead, the slit-lamp beam can be adjusted to match the width overlap of the contact lens onto the sclera (Figure 4: left). When the patient looks to the nasal and temporal side, without adjusting the width, the slit-beam can be relocated to the new overlap, for direct comparison (Figure 4: right). As the slit beam width scale is generally poorly calibrated, it is best to estimate the percentage increase in lens scleral overlap than to try and quantitate the actual lens displacement distance.

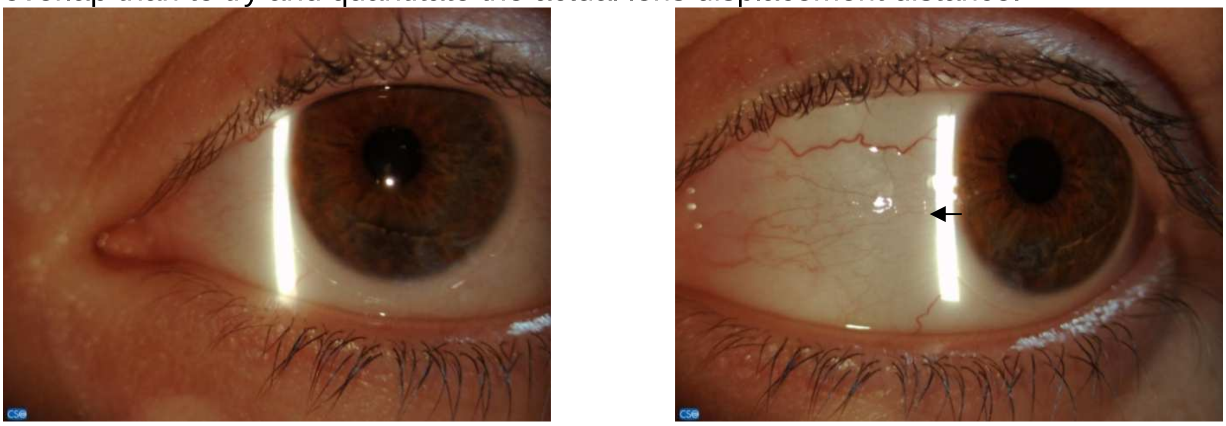

**Figure 4:** LEFT: Adjusting the slit-lamp beam with to match the lens sclera overlap in primary gaze. RIGHT: Comparison of this beam width to the overlap in temporal gaze.

**Push-up Test**

Seminal research by Graeme Young and colleagues at VisionCare Research has shown the importance of the push-up test in evaluating soft contact lens movement and adequacy of fit.[15] This finding was supported by our research, however our evaluation suggested the speed of recovery of the contact lens after push-up was more important than the difficulty in dislodging the lens examined in previous studies (Figure 5).[4] The average speed of recovery was 1.3 ± 0.7 mm / s although this would be difficult to quantify clinically. Hence some clinical experience is needed to differentiate between the lens recovering to its pre push-up position almost instantaneously, the lens dropping sluggishly over several seconds, to the optimal situation, somewhere in between.

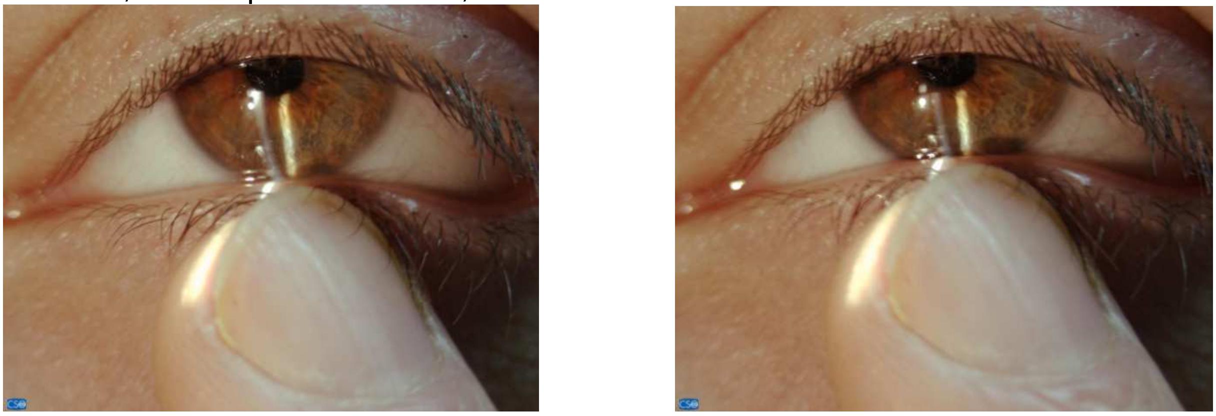

**Figure 5:** Digital displacement of the soft contact lens in the push-up test.

**Recording of Contact Lens Movement Parameters**

Movement on blink in up-gaze and lag on horizontal excursion can be recorded in millimetres, but as discussed above, the push-up recovery speed is more difficult to assess as it involves both movement and time. Wolffsohn and colleagues showed that a 3-point scale was just as descriptive of lens overall movement and recommended (Figure 6):

- if blink movement =0.25 to 0.50 mm (as in this case) then record $B^0$; if less then record $B^-$ and for more record $B^+$.
- if the sclera centration overlap increases by on average 50 to 100 % from central to nasal or temporal excursion, it should be recorded as $L^0$; if less then record $L^-$ and for more record $L^+$.
- an instantaneous drop to the original position on push-up displacement of the contact lens should be recorded as $P^+$, a slow relocation as $P^-$ and a steady relocation (2-4mm/s) as $P^0$.

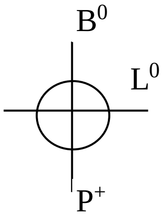


**Figure 6:** Lens schematic suggested by Wolffsohn et al., 2009 indicating a slightly low lens centration, with no limbal incursion, movement on blink in up-gaze of 0.25 to 0.50 mm, horizontal lag of 50 to 100 % and an almost instantaneous push-up recovery speed.[4]

**Outcome of Lens Evaluation**

The schematic described allows accurate but rapid recording of the key contact lens fit parameter. The decision on whether contact lenses should be trialled on the eye is based on clinical judgement, and may depend on the lens material and thickness. A sluggish push-up recovery speed usually indicates the need to change lens brand (as few parameters can be changes within the same brand and the research confirmed that even different base curves within the same brand on average did not have a significant effect on lens fit). If either movement on blink or lag is graded as 'minus', letting the lens settle for a longer period of time may confirm whether the lens is acceptable to trial or not. Comfort must also be acceptable to the patient and the acuity level achieved should be good and stable, with the prescription checked by over-refraction.

**Acknowledgements**
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