The distribution of macular hard exudates is related to future visual acuity in subjects with type 2 diabetes

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Background and Aims:To examine whether the geographical distribution of hard exudates (HE) in the macula field in subjects with type 2 diabetes (T2DM) is related to subsequent visual acuity (VA).
Materials and Methods: The UK Prospective Diabetes Study (UKPDS) was a randomised clinical trial of therapies of newly diagnosed T2DM in 5102 subjects who had four field retinal photographs taken at entry and then at 3 yearly intervals. Photographs were graded using the ETDRS system. Those subjects with HE in the macular field were retrieved, digitised, and diagonal lines superimposed intersecting at the foveal centre, defining nasal, superior, temporal and inferior regions, each split into inner and outer areas, and centre. HE in each of these 9 fields were recorded as none, definite HE ETDRS standard level 2, level 3, level 4 or worse. VA was measured with LogMAR charts (5 letters per line). Association of HE score by region with VA 3 years after HE appearance was analysed using mixed models. These adjusted for age, gender, biochemical variables and duration of diabetes. Levels of HE in each sector were included in the model in a step-wise fashion, and estimates obtained for the influence of HE in each sector on subsequent VA.
Results: Of 4738 who ever had a photograph of sufficient quality taken, 746 subjects had HE recorded at level 2 or higher at any time (15.7%). Photographs for those with at least 2 good quality photographs three years apart and VA assessed at coincident visits were used in this analysis.In 168 eyes in 132 patients with newly emergent HE (i.e. with at least one earlier photographs with no evidence of HE) the distribution of HE was non uniform (table 1), Chisquared on 24 degrees of freedom=145, $p<0.0001$. In 255 subjects contributing 1 or 2 eyes over up to 21 years (833 eyes), HE level 3 or worse was associated with reduced LogMAR letter count 3 years later, in IN field 7.9 (2.6) (mean (s.e.)) letters were lost, II field 7.9 (3.0) and OI field 4.9 (2.4).
Conclusion: The geographical distribution of HE is not uniform across the macula field. Those with HE in IN, II and OI sectors of the macula field had worse vision 3 years later than those with HE elsewhere. The distribution of HE in diabetic retinopathy may be an important indicator of reduced visual acuity.

Regional distribution and severity of HE (n=no of eyes, %=proportion)

Region	Grade 0 n(%)	Grade 2 n(%)	Grade 3 n(%)	Grade 4 n (%)
Centre (C)	112(56.7%)	44(26.2%)	12(7.1%)	0(0%)
Inner superior (IS)	122(72.6%)	28(16.7%)	16(9.5%)	2(1.2%)
Outer superior (OS)	97(57.7%)	33(19.5%)	31(18.9%)	7(4.2)
Inner temporal (IT)	114(67.9%)	26(15.5%)	27(16.0%)	1(0.6%)
Outer temporal (OT)	74 (44.3%)	42 (25.2%)	38(22.8%)	13(7.8%)
Inner Inferior (II)	126(81.0%)	17(10.1%)	14(8.3%)	1(0.6%)
Outer Inferior(OI)	116(69.5%)	25(15.6%)	18(10.8%)	7(4.2%)
Inner nasal (IN)	137(81.5%)	17(10.1%)	12(7.1%)	2(1.2%)
Outer nasal (ON)	144(85.7%)	10(6.0%)	10(6.0%)	4(2.4%)

Figure 1a and 1b
Example scanned right macular image with grid applied and identity of regions within overlay grid (for right eye)