

I do not think we are keeping complete records of atrophy, which can describe the progress of MS disease. We can also use these records to demonstrate treatment success.

I propose an accurate measurement of brain atrophy in an area of white or grey matter known to be subject to it. A location is measured using bone as a reference point, say the top of the skull, or the point of a tooth. This reference is used to measure the size of the organ of interest, at a given MRI slice. As much as possible a reproducible location is used to make a size measurement.

The series of MRI measurements are repeated at intervals separated by at least a year. One MRI measurement gives the current size at a given location, of the given organ. For example the size might be measured each time to 0.5 mm accuracy.

The reason for making series measurements at the same latitude and longitude of a brain, is to assess any changes in size. That will tell us whether the organ has grown, shrunk, or stayed the same size.

The first measurement tells size alone. The second, in combination with the first, should reveal the current rate of atrophy, at the chosen location, expressed in millimeters per day. The third measurement, when compared with either of the first two, would also show a rate of atrophy.

Comparing MRI-1 and MRI-2 you get the Rate of Atrophy (RA) over the time frame t_2 minus t_1 . Call this measured rate RA_a . Comparing MRI-2 and MRI-3 you get the RA over the second interval t_3 minus t_2 . Call this measurement RA_b .

You can also, by comparing MRI-3 with MRI-1, confirm the RA at t_3 . Call this rate RA_c .

These measurements give the organ's size changes over the interval between the first two MRIs as well as the size changes between the second two MRIs. Using the overall time between first and last measurements will produce a measurement of the organ's size changes over the interval between them.

Using calculated values in the three measurements you can produce a table:

MRI number	organ size (mm)	time of MRI	RA (mm/day)
1	xx.xx	DDMMYY hh:mm:ss	0.0 at t_1
2	yy.yy	DDMMYY hh:mm:ss	RA_a at t_2
3	zz.zz	DDMMYY hh:mm:ss	RA_b at t_3

You can compare the atrophy rates at t_2 and t_3 to produce a rate of change of atrophy rates between the last two MRIs, in millimeters per day per month, for instance. The way to calculate this is to subtract RA_b from RA_a , producing delta-RA, or dRA . This will be positive if the organ's atrophy rate has worsened, 0 if there was no change, and negative if there has been a slowdown of the rate of atrophy.

The overall measurement from t_1 to t_3 is a rate of atrophy that is more averaged, over the entire three years.

dRA is the more useful measure, showing change from one year to the next.

