Here is a proof that the correlation between X and Y' is 1.

1. To simplify ... assume that x = (X - mean X), y = (Y - mean Y)

2. General formula for $r_{xy} = Óxy/N*ó_x*ó_y$

3. Now, in z score form, we would have ... $Óz_X*z_Y/N$

4. What if what we want is the correlation between X and Y' .... so

5. The formula would look like .... $r_{XY'}$ ... or $r_{zx\,zy'}$

6. Keep in mind that ...

$$Z_{y'} = r_{xy} * Z_x$$

and

$$ó_{zx} = ó_{zy} = 1$$

7. Now ... if the standard deviation of Z_x is 1, then the standard deviation of $r_{xy}*Z_x$ would be like having a variable (Z_x) multiplied by a constant of r ... and whenever you multiply a variable by a constant ... the standard deviation is impacted by the value of the constant. So ... since $Z_{y'} = r_{xy}*Z_x$ .... then whatever happens to the standard deviation of Z_x would also happen to $Z_{y'}$. If the constant is r ... then the standard deviation of $Z_{y'}$ would also be impacted by r ... and rather than being 1 if it were Z_z or Z_y ... would only be the size of r * 1 .... or only r.

This is a long way of saying that $ó_{y'} = r_{xy}$

8. At long last, we can now work on the r formula between X and Y'.

$r_{zx\,zy'} = Óz_x*z_{y'} / N$ .... but, in the denominator ... while the standard deviation of z_x is 1 ... and we don't need it, the standard deviation of $z_{y'}$ is not 1 ... but rather only r_{xy}. Thus, what we really have as the formula

is ....

$$r_{xy'} = Ó z_x * z_{y'} / N * r_{xy}$$

9. Continuing ... recall from 6, we could substitute $r_{xy'}*z_x$ for $z_{y'}$ and we would have ...

$$r_{zx\,zy'} = Ó z_x * r_{xy'} * z_x / N * r_{xy}$$

10. This would lead to a simplification

$$= Ó z_x * z_x * r_{xy'} / N * r_{xy}$$

11. Since the rs cancel out from top to bottom ... we would have left

$$r_{zx\,zy'} = Ó z_x z_x / N$$

12. Since z scores *are* deviation scores around the mean of 0, this means that $Ó z_x^2 / N$ is merely the average of the squared deviations using z score data ... and that is the variance ... and that = 1!

13. Finally! .... $r_{xy'} = 1$

And that is why you got the scatterplot between predictor and predictED of a straight line ...