Critical period plasticity of axonal arbors of layer 2/3 pyramidal neurons in rat somatosensory cortex: layer-specific reduction of projections into deprived cortical columns.

We examined the effect of whisker trimming during early postnatal development on the morphology of axonal arbors in rat somatosensory cortex. Axonal arbors from populations of layer 2/3 pyramidal neurons in the D2 column were labeled by lentivirus-mediated expression of green fluorescent protein. Axonal projection patterns were compared between untrimmed control animals and animals with all whiskers in A-, B-, and C-rows trimmed (D- and E-rows left intact) from postnatal days 7 to 15 (termed from here on DE-pairing). Control animals had approximately symmetrical horizontal projections toward C- and E-row columns in both supra- and infragranular layers. Following DE-pairing, the density of axons in supragranular layers projecting from the labeled neurons in the D2 column was higher in E- than in C-row columns. This asymmetry resulted primarily from a reduction in projection density toward the deprived C-row columns. In contrast, no change was observed in infragranular layers. The results indicate that DE-pairing during early postnatal development results in reduced axonal projection from nondeprived into deprived columns and that cortical neurons are capable of structural rearrangements at subsets of their axonal arbors.