Spatial neglect (SN) is a main consequence of right hemisphere stroke. Prism adaptation (PA) to a rightward optical deviation could reduce SN manifestations and especially improve performance in article and pencil tests and in optical deviation could reduce SN manifestations and especially improve performance in article and pencil tests and in text reading (116 words). The severity of SN was most often severe (43 of 54 cases; range 2 to 83). We also presented a text of 130 words (size font 20; "courier"; 10 lines of 15 cm). We analyzed the percentage of errors. We also found partial improvement at the late sessions, independent of prisms.

We re-evaluated the efficacy of PA on reading and other clinical tests by comparing the effect of deviating and neutral prisms in the same patients.

Subjects and Methods

Subjects

Ten right-handed SN patients were recruited consecutively after a recent (mean poststroke delay 54.3 days; range 17 to 102) right hemisphere stroke (middle cerebral artery infarct; subcortical hemorrhage). Each gave written informed consent to participate in the study. They were selected for their pathological performance in >1 of the following tests: bell cancellation, line bisection (20 cm long), and Ogden scene copy. All presented with spatial dyslexia in text reading (116 words). The severity of SN was most often severe (bell omissions >12 of 15 on the left side in 8 cases; right deviation >20 mm in 8 cases). Hemianopia was observed at clinical and instrumental examination (automatic perimetry) in 6 (neglect and hemianoptic: N+H+) and absent in 4 (neglect and nonhemianoptic: N+Hgroup). They were 5 males and 5 females (mean age 55.5 years; education level 9.9 years). They were compared with 8 matched (age and education level) normal control subjects.

Tests

We first used conventional clinical SN test: bell cancellation (left–right omissions), line bisection (20 cm; right deviation in mm), and Ogden scene drawing (from 0: omission of the left tree, barrier, house, and left part of the right tree; to 10: perfect reproduction).

A special emphasis was given to reading tests. Words (list A 48; list B 48) were concrete substantives, balanced according to 3 main factors: type (noncompound, prefixed, suffixed, compound words), length (5 to 6, 7 to 8, 9 to 10 letters), and frequency in the written language (high, low). Lists A and B were equivalent and presented alternatively. Nonwords (72) were constructed from the high-frequency words by single letter substitution or addition in the left or the right part of letter strings. Items were presented in a fixed semirandom order and written in lowercase “courier” fonts on an 8×15-cm card. We analyzed the percentage of errors. We also presented a text of 130 words (size font 20; “courier”; 10 lines of 27.3 cm; 9 loosely related sentences) written on a horizontal A4 sheet and evaluated the difference between left and right omissions (%).

Procedure

Each test was presented during 6 sessions of ~35 minutes: pretest 1 (baseline), pretest 2 (1 hour pre-PA), post-test 1 (5 minutes after PA), post-test 2 (3 hours after PA), post-test 3 (1 day after PA), and post-test 4 (3 days after PA).

PA was done successively (1-week interval, counterbalanced order) with prisms deviating visual perception at 10° toward the right side or with neutral prisms (Société Peter, Lyon). During PA, subjects had to point repeatedly with the right index finger to red or green dots placed at +10° or −10° from the body midline (60 cm). At least 50 trials were performed until target was reached without final hesitation. A mask prevented subjects from viewing their arm. Immediately after PA, they were tested with 2 to 3 trials to ascertain leftward deviation more than −2.9° (3 cm) when pointing with the eyes closed to a dot previously seen, facing their body midline. The mean deviation was −4.8° (range −3.8° to −10.4°).

Statistical Analyses

We used repeated-measure ANOVAs, with group as between-subject factor (N+H+, N+H−, controls) and prism and session as within-subject factors. Post hoc analyses used the Newman–Keuls test. The α risk was P = 0.05.

Results

In conventional SN tests, the group effect was always significant. Compared with controls, SN patients from both groups showed significant higher left–right omissions in the bell cancellation test (N+H+ 8.9 of 15; N+H− 9.4; controls 0.02; P=0.0001), right deviation in line bisection (N+H+ 31 of 100 mm; N+H− 17; controls 0.06; P=0.0007), and left hemisphere stroke.
omissions in the Ogden scene drawing (N+H=6.6 of 10; N+H=1.4; controls 10; P=0.006). But the main effects of prism and session and the interactions with group were never significant.

In reading single words, factor group showed a clear tendency to significance (P=0.052) because errors (%) were more frequent in both patient groups than controls (N+H=17.0%; N+H=7.2%; controls 0.4%). Errors decreased with sessions (P=0.001), and the group×session interaction (P=0.002) was explained by the more severe reduction at post-tests 3 and 4 in both patient groups (Figure). However, the group×session×prism interaction was not significant, showing that this phenomenon was present with each prism. The main effect of prism was not significant.

In reading single nonwords, the group effect (P=0.009) was related to more frequent errors in both patient groups than controls (N+H=52.7%; N+H=28.2%; controls 1.8%). We found a main effect of session (P=0.009) because of a reduction of errors at post-tests 3 and 4. But the main effect of prism and the group×session×prism interaction were not significant.

For reading a text, the group effect was significant (P=0.0001) on left–right omissions, which were greater in patients than controls (global: N+H=54.0%; N+H=4.2%; controls 0.05%). The main effects of the other factors and the interactions were not significant.

At an individual level, the negative results were relatively homogenous and independent of the severity of SN; no patient showed definite and selective improvement using deviating prisms.

Discussion
In this study of 10 stroke patients with SN, we failed to confirm the positive effect of PA, which has been reported on “paper and pencil” tests using symbol cancellation, line bisection, or scene drawing.1,2,7 Furthermore, PA did not improve neglect dyslexia. Reduction of errors in text reading has been reported in 1 study1 at the immediate and late (2 hours) post-tests. Positive effect has also been reported on single word and nonword reading.2,3 However, in a more recent report,4 authors did not find definite efficacy when patients had hemianopia in addition to SN.

It seems unlikely that our negative results were related to prisms, PA training, or tests, which were similar to those used by other authors. The post-PA effect measured by index finger pointing was comparable.2–4 Furthermore, the absence of effect was not related to the presence of hemianopia.4 One important point was that we showed partial improvement with repetition of tests, independent of the quality of prisms, which was more evident at later sessions. It could be related to a learning effect or an increase of vigilance or sustained attention, both of which have an important relationship with SN.8 This could account for the improvement reported in previous series, in which the effect of deviating prisms was not systematically compared with that of neutral prisms in the same patients.

It must also be emphasized that other authors did not find effectiveness on spatial attention tasks,3 and that poor generalization has been reported when PA used an upper-limb reaching task compared with a walking task.9 This later result suggests that PA be performed using more global tasks to draw clearer conclusions about its efficacy in SN patients.

References