

Validation of multiplex STR systems for the investigation of familial relationships in difficult cases

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The purpose of this study was to evaluate the efficiency of four multiplex STR PCR Kits: SGM Plus and Profiler from Applied Biosystems and Penta BEC Multiplex and GenePrint FFFL System from Promega in family reunion testing. The SGM Plus Kit is composed of the sex marker Amelogenin and 10 STR systems: D3S1358, vWA, D16S539, D2S1338, D8S1179, D21S11, D18S51, D19S433, TH01 and FGA. The second Kit, designed as Profiler combines Amelogenin and 9 STR loci: D3S1358, vWA, FGA, TH01, TPOX, CSF1PO, D5S818, D13S317, D7S820. The third kit Penta BEC Multiplex combines three STR loci: Penta B, Penta E and Penta C, and finally the fourth kit GenePrint FFFL quadriplex system allows simultaneous amplification of four STR loci: F13A01, FESFPS, F13B and LPL. Both the Penta and the FFFL STRs provide additional power to resolve difficult cases. Practically any first-degree biological family relationship can be established with the same technique as that for paternity investigation. Conventional paternity testing usually assumes that the mother is the true biological mother. However, in family reunion testing the aim is to investigate whether the family is a true biological family, so there are several potential constellations, including the maternity and sibship, to test. The paternity, maternity, sibling and avuncular indices and the likelihood ratios were calculated using the DNA-view immigration program (Brenner C, Berkeley, CA, USA), and this calculation was based on a database constructed from the respective ethnic group. For those situations where a specific population was not available a Finnish database was used. For correcting for population substructure, an inbreeding coefficient $\Theta = 0.01$ was used. On the basis of this study the use of 18-22 STR loci is recommended for difficult familial relationship cases. Often cases with mutations, single- parent paternity cases and sibling testing without parents cannot be sufficiently resolved with SGM Plus and Profiler systems alone.