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A DEVICE FOR DISTRIBUTED TISSUE INJECTION

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[Introduction] This paper describes a simple, readily-manufacturable adaptation of the standard hypodermic needle which is more efficient and effective than the standard needle at delivering liquid suspensions and pharmaceuticals in a low-mobility tissue environment.

[Materials and Methods] A distributed tissue injection needle has been developed from the standard hypodermic needle by blocking the pointed tip and opening multiple uniformly-spaced 20 μm to 30 μm diameter holes on the circumference of the needle, along its length. The holes allow injection along the entire length of the needle instead of just at the tip. Sample needles were made from 1.5 inch, 22-gauge hypodermic needles, using a 14 watt NdYAG laser to drill four longitudal rows of 17 holes spaced evenly at 1 mm intervals. A short section of wire laser-welded into place plugged the tip. The test specimens consisted of sections of skeletal muscle taken from the leg of a pig. The specimens were 2-3 cm along the grain of the muscle by 2-3 cm by 5-6 cm. Injections of colorant were made across the grain of the muscle tissue, along the long axis of the prepared specimen. The samples were fixed in ethanol, then sliced along the direction of injection in order to measure the spread of the injected liquid.

[Results] An even spread of stain was observed along the entire length of needle which had been embedded in the muscle tissue. A roughly cylindrical distribution, 5 mm in diameter, was observed. Electron micrographs show that the manufacture of the distributed tissue injection needles is a highly repeatable process.

[Conclusion] Calculations show that, for the same volume of injected liquid, the distributed tissue injection needle should result in a lower pressure at the injection front than a standard hypodermic needle due to the higher surface area-to-volume ratio of a geometric cylinder as compared to a sphere. The advantage should be even greater as longer needles are used. Some applications of the distributed tissue injection needle, including myoblast transfer therapy for Duchenne Muscular Dystrophy and dental anesthesia, are discussed which take advantage of the distributed injection nature of the needle and the reduced pressure at the injection front.

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TEN YEARS OF BIOMEDICAL INSTRUMENTATION DESIGN IN URUGUAY

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A revision of Biomedical Instrumentation design and construction is presented. The design and construction was done as Graduate Student Projects undertaken mostly by three person groups. The analysis includes economic viability, development time and clinical satisfaction of the following prototypes:

	Prototype		Man-Hours	Cost
1	MECVENT	Pulmonary Mechanics in Newborn	1985-88 2500 MH	8800 U$S
2	TACONATAL	Auditory Neonatal Monitor	1987-89 800 MH	600 U$$
3	ADSE	Signal Interface	1988-90 900 MH	1400 U$S
4	MONSE90	Intensive Care Monitor	1989-90 1400 MH	6400 U$S
5	VESTI90	Eye Response to Visual Stimuli	1989-91 1600 MH	5300 U$S
6	AUTOVENT	Closed Loop Ventilator Control	1991-92 1900 MH	3800 U$S
7	NUCLIMAG	Nuclear Medicine Images	1992-93 1500 MH	2200 U$S

All projects (except 2 and 3) include a computer with an A/D card, the cost of which is falling with an increasing share of design and programming. A Signal storing standard, NAS_MONTEVIDEO, was developed over the years to allow sharing data files and programs amongst prototypes.

These prototypes were designed after specifications of clinical groups. The equipment offered in the international market ranges (except for TACONATAL and ADSE) sells for U$S 20000 -50000. Taking U$S 20 per Man-Hour for the sake of comparison, the costs of these prototypes are in the U$S 30000-60000 range. Additional engineering after several months of use of the prototypes allows to define pre-series equipments at a cost in the range of U$S 6000-10000 based on 10 units. This is underway for 3 prototypes with financial help from CONICYT.

The critical mass of new biomedical equipment is determining the need to establish a Testing Facility to certify both new and imported equipment.