Advances in the field of radiation oncology have, over the last two decades, resulted in a substantial improvement in the outlook for patients with carcinomas of the head and neck region. This improvement has been largely due to an increased understanding of the biology of the disease process and to the development of machines capable of optimizing radiation dose distributions. Nevertheless, there still remain a substantial number of patients in whom failure to control local disease contributes materially to their death. For the reasons outlined in the following paragraphs, particle beam radiation therapy might be expected to offer a therapeutic gain, as compared to conventional photon and electron beam therapy, in the management of these patients.

Currently, the following particle beams are being clinically tested: fast neutrons, protons, alpha particles, heavy ions (carbon, neon, argon), and negative pions. Fast neutrons are being investigated because they have radiobiological properties that are potentially superior to those of conventional X- and gamma rays. Protons and alpha particles are being studied because the dose distributions which may be achieved with these particles are superior, in many clinical situations, to those obtainable with photons or electrons. Heavy ions and pions have both a potential biological advantage and a dose distribution advantage.

1. Biological characteristics of particle beams

The biological effects of a radiation beam are dependent on the spatial distribution of the ionizing events produced in tissue. The rate at which charged particles deposit energy per unit distance is known as the linear energy transfer (LET), expressed in Kev/μm. Protons, electrons and photons are sparsely ionizing and are characterized by a low linear energy transfer.
Figure 1. The thinness of the deltopectoral flap is the reason why the author prefers it for external neck resurfacing in a cancer patient.

Figure 2. The thinness of the deltopectoral flap allows it to conform to concave cavities such as that created with resection of a tracheostomal recurrent cancer following mediastinal dissection.