Promotional article

Aspiration in Dentistry

The development of surgical aspiration in the dental field

Below, is a brief chronological account of the evolution of aspiration in dentistry.

We started production half a century ago, manufacturing the first dental aspirators. Our best advisers have always been the dentists who gave us their opinions and it is to them, both our advisers and customers, that we address this brief note to highlight the situation and to express our gratitude.

Knowledge of the difficulties faced and successes that have driven us over the years will help young professionals to understand our choices. For that matter, contact with the dental profession has always been our strong point and we hope to continue to have the same opportunity in the future.

When new rotating instruments entered the world of dentistry such as turbines and micro-motors, the aspirator became the tool which, in fact, allowed the use of these new, precious instruments. Precious instruments because, the first working at a speed of two hundred thousand rev/min and the second at twenty thousand rev/min, and furthermore, without vibrations, they offered the sort of precision and speed which earlier was considered only possible in science fiction. But, these new instruments required cooling with an abundant jet of water which needed to be aspirated, not only to avoid drowning the patient but also to leave the area of surgery clearly visible and to limit contamination of the surrounding areas.

Thereafter, when paradental surgery irrepressibly entered the field, the aspirator grew from being merely a water jet interceptor to being a dental surgery aspirator (the term "dental" was used so as not to confuse the new aspirator with those already used for a long time in general surgery).

The first aspirators, constructed with brushed motors, had an excellent level of suction and an acceptable speed regulating system but they were very noisy and extremely fragile: their lifespan was calculated in days or, at most, weeks. The brushed motors were certainly delicate, and their fragility in dentistry was worsened by the humidity of the aspirated air and intensity of the work to which these machines were subjected in dental practices.

Fixed speed aspirators with induction motors, which replaced brushed motors, were sturdier and more resistant, but not really suitable to meet the requirements of a dental aspirator.

Moving from a brushed motor rotating at a speed of 18/20000 rev/min to an induction motor which at 50 Hz did not reach 3000 rev/min, the professional was disappointed in the change as suction hardly ever reached an adequate operating head and the operator felt the lack of a potentiometer to regulate the suction intensity.

Aspiration plants

During the design of dental practices and clinics, the choice of aspirator takes into account the number of treatment chairs so that, at the point of maximum use, there is no drop in suction which could place the operator in difficulties.

The fixed speed aspirator, chosen to operate all the treatment chairs in the practice, will work at cruising speed when on full load but will suffer when under-utilised. This is because the fixed speed aspirator groups create a vacuum in the plant to move a volume of air calibrated to their capacities: with a high number of inlets closed, the volume of air decreases and the vacuum in the aspirator channels increases leading operators to notice excessive amount of operating head. Moreover, the motor uses more electricity because it is drawing an air load which, without sufficient input, is difficult to move. At some point the pressure relief valve will open and an additional passage of air will partially offset the imbalance that has been created.

As these are fixed speed motors, the operation described is the only one possible but it is not the solution to the problem. As it does not reduce power consumption since it does not slow the speed of rotation of the motor, it continues to inconvenience the operator as the operating head does not remain constant. Opening the valve is a remedy but not a solution. We could say, for example, that it is like opening a window in a heated room instead of using the room thermostat; in our case, in place of the thermostat there is the need for a device that slows down the speed of rotation of the motor.

We have mentioned the major issues relating to fixed-speed induction motors used dental aspiration. There are other problems which we simply list without comment: the induction motor is heavy, bulky and noisy, also aspirators with fixed speed motors are not eco-friendly as they consume maximum power even when they are under-used and, above

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all, the practitioner is inconvenienced by the variable operating head. We could not just sit back and accept these problems.
We worked for years and the path has not been easy; some solutions were not feasible for economic reasons and others were difficult to apply.
Pressed and supported by users, we continued to study the problems and build new models of aspirators, adding valves and accessories to make them more flexible. Overall, these changes resulted in some benefit, but they did not solved all the problems.
It is said that art, poetry and classical music have reached the pinnacle of beauty, harmony and perfection, while the progress of science and technology seems to have no end. We do not know whether that is right but, except for any future innovations, our experience confirms this rule.

Electronic and Information Technologies applied to dental surgery aspirators
The turnaround was achieved in 2005 with the new Turbo-Smart aspirator that was judged "the aspirator which the dental profession had been waiting for." The use of modern technology has allowed us to design a new concept of aspirator: an aspirator equipped with an inverter and a small computer with the appropriate software.

The inverter, technically referred to as the VSD (Variable Speed Driver), is an electrical and electronic device that optimizes the operation of electric motors; the software is an artificial intelligence that constantly monitors the aspirator as a whole. **The VSD and its software reduce the stress on motors, maintain a constant programmed operating head adapting the air capacity to demand in real time**.
With higher demand, Turbo-Smart automatically increases the speed of rotation of the aspiration unit and, vice versa, with lower demand, the aspirator spontaneously decreases the rotation speed. **Reducing motor speed results in energy savings**

Turbo-Smart version "A" is an aspirator for two treatment chairs, which includes features that allow it to be turned into version "B" for four treatment chairs with simultaneous aspiration. It is a financial choice **which allows the dentist to extend his or her practice by purchasing a password,** and the supplier to satisfy the majority of clients with only one Turbo-Smart in storage.

Self-protection
The VSD-equipped aspirators are the only ones that react to difficult situations caused by power supply or environmental problems. For example, in the event of high temperatures, the Turbo-Smart does not stop and will not be damaged. It displays the temperature on the small screen and the software reacts by lowering the operating head suction for the period of time necessary to restore the operating temperature and**,** when normal temperature is restored, the aspirator returns to working at the programmed operating head suction.

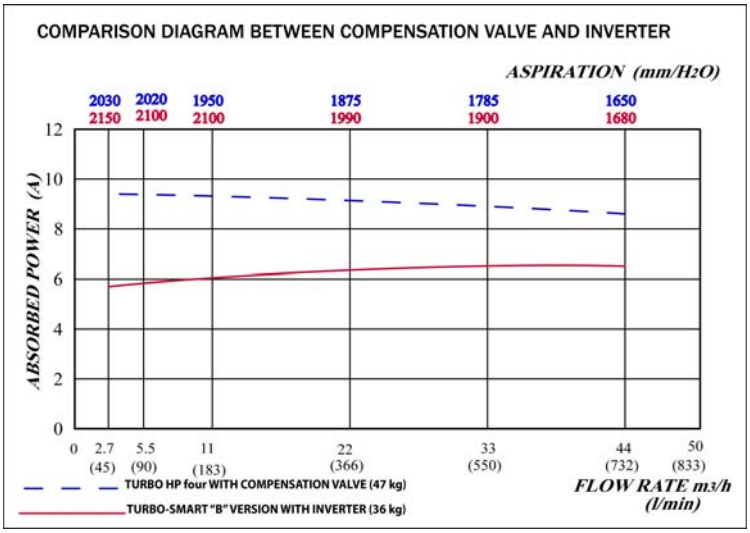
Risk of flooding In the event of a sudden wave of liquid, Turbo-Smart does not flood but enters into self-protection mode: the recirculation valve opens and the software removes part of the power to the aspirator slowing it down, the centrifugal separator absorbs the power provided by the suction unit, drainage of suctioned fluids is accelerated, and once the wave of fluid has been disposed of, the aspirator returns to normal functioning. **For power surges and overloads,** the software intervenes within predetermined limits to protect the machine while it continues to function.

Prevention
During operation, **events that are hazardous for the integrity of the machine are highlighted on the display**. Also, **the software can display information on the critical events that have occurred**. In the event of unforeseen

situations or where the criticalities last longer or are above the capabilities of the self-protection system, the machine displays both a visual and an audible alarm and, if necessary, shuts down.

Wireless connection

Turbo-Smart can be connected wirelessly to the practice's computer. When requested, the computer will display a visual of the aspirator so that the operator can control and modify the aspirator's operation at any time, in a few minutes, without moving from the practice. Among the modifications the operator do, we would like to highlight the setting of the operating head suction.

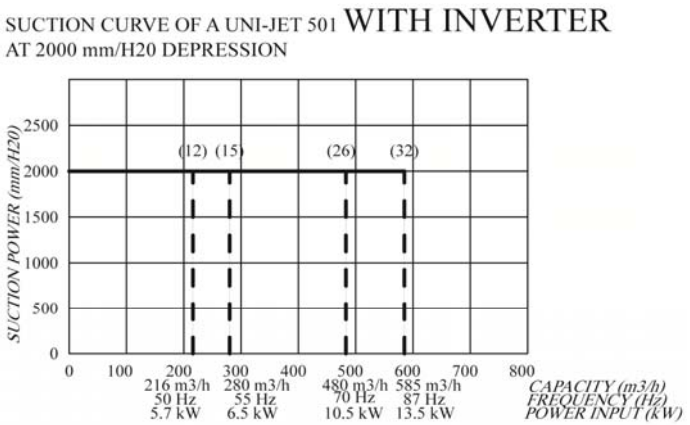


Eco-friendly Aspirators

In the working diagram below, the Turbo-Smart version "B" version weighing 36 kg and equipped with VSD and software, is compared to the Turbo HP Quattro weighing 47 kg without VSD: the Turbo-Smart does not overheat and the VSD keeps it constantly at cruising speed. At the same performance levels, we found a saving in raw materials of 11 Kg and a power saving of 690 W/h.

Centralized eco-friendly systems

The highest savings in raw materials and power are achieved with the medium and large sized Blok-Jets. The working diagrams below show the data for the two aspirator units with the same capacity and operating head suction, therefore able to do the same work: Uni-Jet 501 weighing 88 Kg with VSD and Uni-Jet 1000 weighing 155 Kg without VSD. The savings in raw materials is 67 Kg. Moreover, the former with VSD, achieves average energy savings of 5.5 kW/h.



THE NUMBERS IN BRACKETS ARE WORKING PLACES THAT CAN BE SERVICED AT THE SAME TIME.
- FIGURE CALCULATED USING AIR CONSUMPTION OF 18 m3/h (300 N l/min) PER USE -

ASPIRATOR MODEL UNI-JET 501 (88 Kg).

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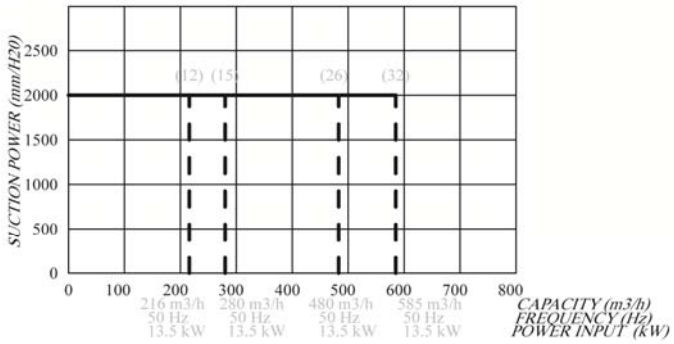
SUCTION CURVE OF A UNI-JET 1000 WITHOUT INVERTER
AT 2000 mm/H20 DEPRESSION



THE NUMBERS IN BRACKETS ARE WORKING PLACES THAT CAN BE SERVICED AT THE SAME TIME.
- FIGURE CALCULATED USING AIR CONSUMPTION OF 18 m3/h (300 N l/min) PER USE.
ASPIRATOR MODEL UNI-JET 1000 (155 Kg).

In Summary

The purpose of our research was and remains to improve the professionalism of our products and provide professionals with working instruments that are more flexible and versatile, as well as more reliable. The environmental sustainability of our products is an added bonus of which we are proud as Italians and as citizens of the world.

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