

Handpiece Torque vs. Speed Performance

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Purpose:

- To perform torque vs speed and stall torque tests that will demonstrate how well various high speed dental handpieces perform under different loading scenarios.

Experimental Design:

Equipment:

- DENTAL ADVISOR Handpiece Torque Test Platform and Instron 5866 universal test machine
- Handpieces: **430 SW Torque LubeFree** [SWT] (StarDental) (n=3), **Synea TK-98L** [Syn] (a-dec) (n=3), **Stylus 180S** [Styl] (Midwest) (n=3), **Turbine Tornado LED** [TT] (Bien-Air) (n=1), and **Master-Torque Lux M8900L** [MT] (Kavo) (n=3)

Tests: Performed at manufacturer's highest recommended air pressure

- Torque vs speed curve
- Power (in watts) at a specific RPM
- Stall torque

Materials and Methods:

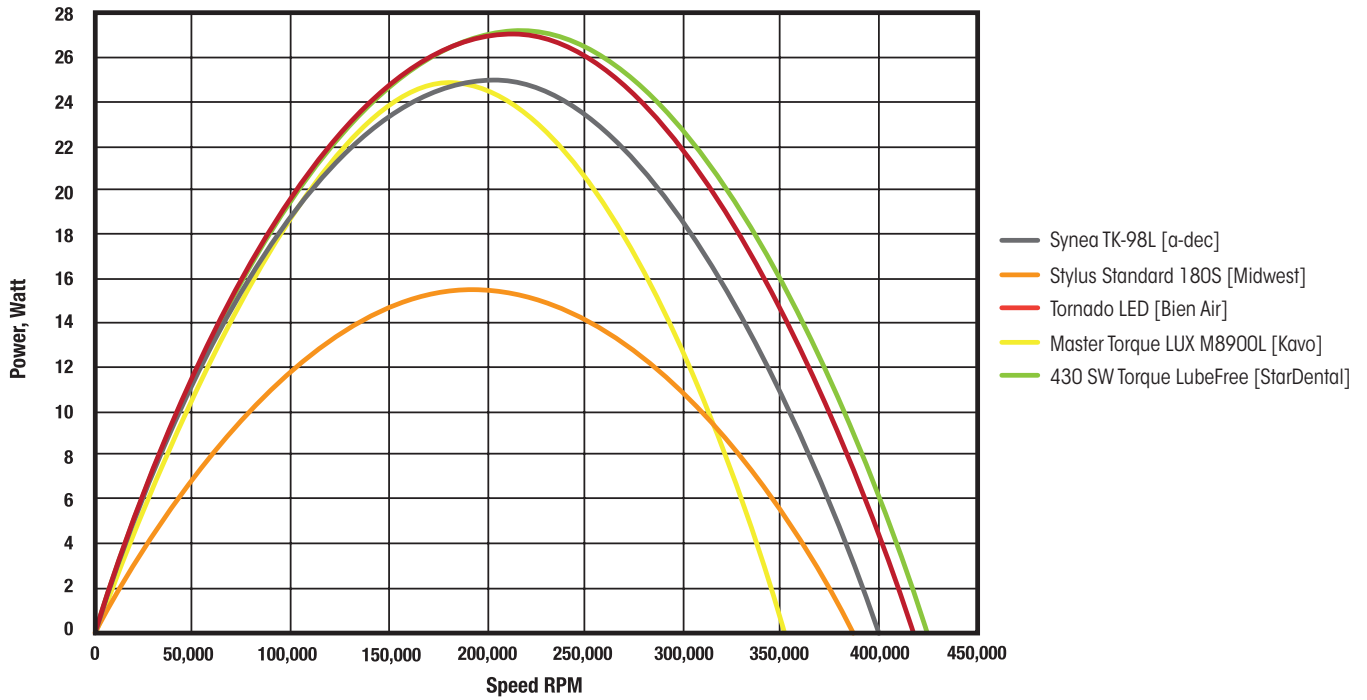
Each handpiece was attached to the test platform in a handpiece holding assembly (see attached photos). A spindle with a braking sphere was inserted into the chuck of the handpiece and the holding assembly adjusted so that the spindle was aligned with the torque sensor. The speed of the spindle was measured with a Monarch Infrared speed sensor and ACT 3 Electronic Tachometer. The torque sensor was connected to the load cell of the Instron 5866 system on which the test platform was mounted. During the testing, the handpiece was pressed downward along the axis of the spindle shaft with varying loads so that the braking sphere was pushed against the brake pad which is attached to the torque sensor. The friction of the braking sphere against the brake pad produces a torque in the torque sensor, which is registered by the load cell as a force. Several torque versus speed points were taken to define the torque versus speed curve for each handpiece. The stall torque was measured in a second test as the torque produced at the point during loading when the rotational speed of the spindle goes from maximum speed to zero.

Results:

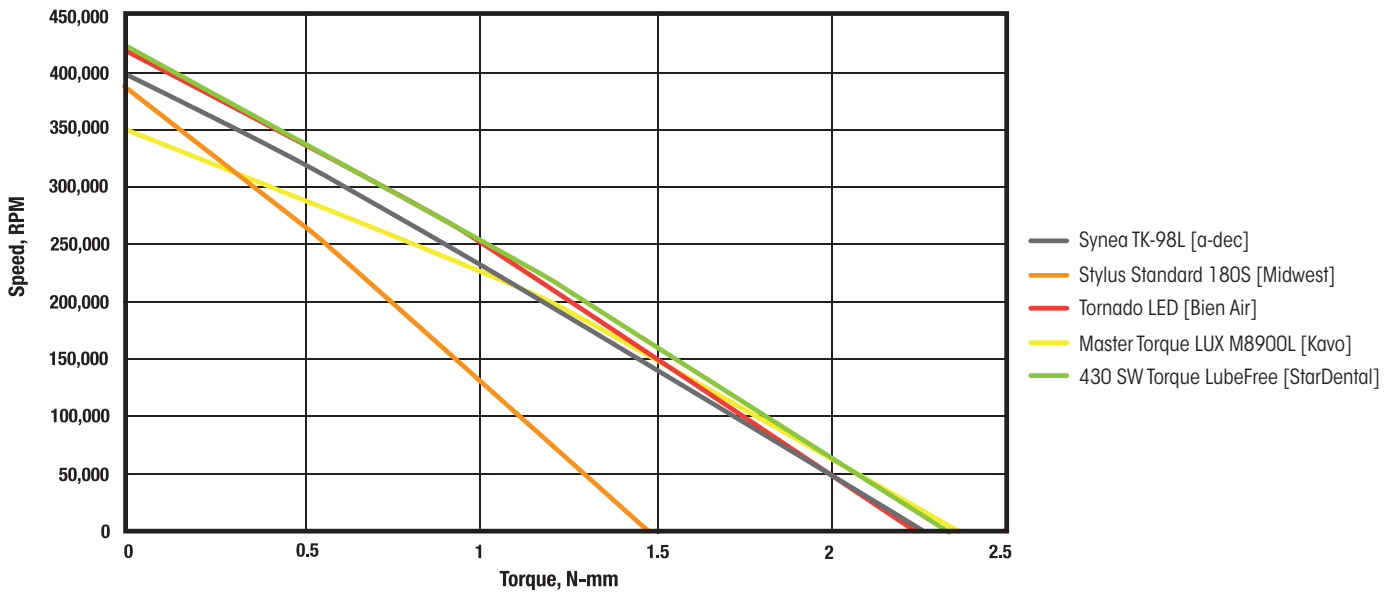
The following chart and two graphs depict a summary of the results and the best-fit line through the collection of speed versus torque data points and the average power versus speed curve for each handpiece. The bar chart shows the stall torque average (n=10) for each handpiece.

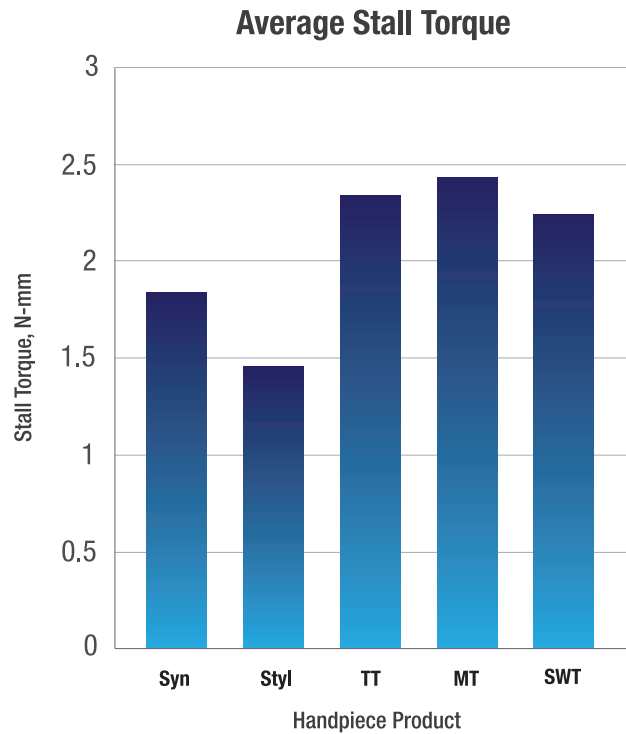
Handpiece	Manufacturer	Drive Pressure, psi	Stall Torque, N-mm	Maximum Power, Watts
430 SW Torque LubeFree	StarDental	43	2.3	27.2 @ 212367 rpm
Synea TK-98L	a-dec	40.6	1.8	25.0 @ 201120 rpm
Stylus 180S	Midwest	40	1.5	15.6 @ 194058 rpm
Turbine Tornado LED	Bien Air	43.5	2.4	27.0 @ 210993 rpm
Master Torque Lux M8900L	Kavo	41	2.4	24.8 @ 178574 rpm

Average Power vs Speed



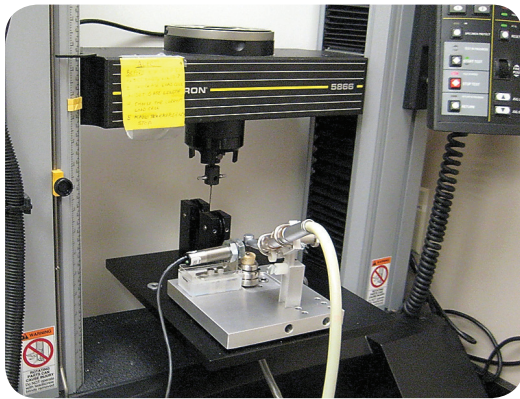
Average Speed vs Torque Curves





Conclusions:

1. MT, Syn, TT, SWT produced very similar torque versus speed curves with SWT being slightly higher than the other three handpieces.
2. The SWT and TT handpiece have equivalent highest maximum power output.
3. Below 300,000 RPM, and Styl had the lowest torque versus speed curves.
4. The stall torque for TT, MT, and SWT were similar and higher than the other two handpieces.



Full system components



Close-up of torque sensor and speed sensor