

Altering Zirconia Implant Surgical Protocol to Achieve Higher Implant Stability

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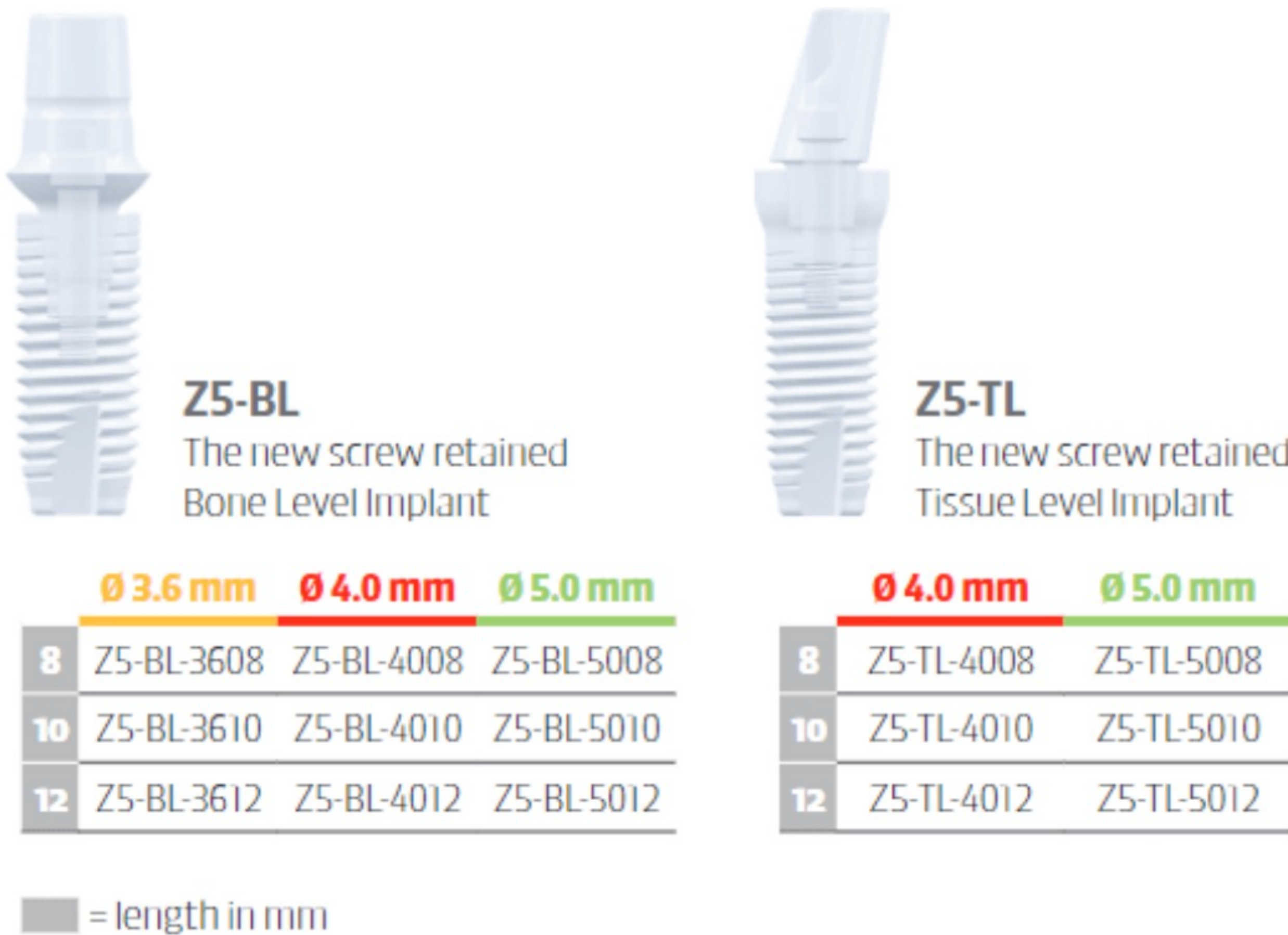
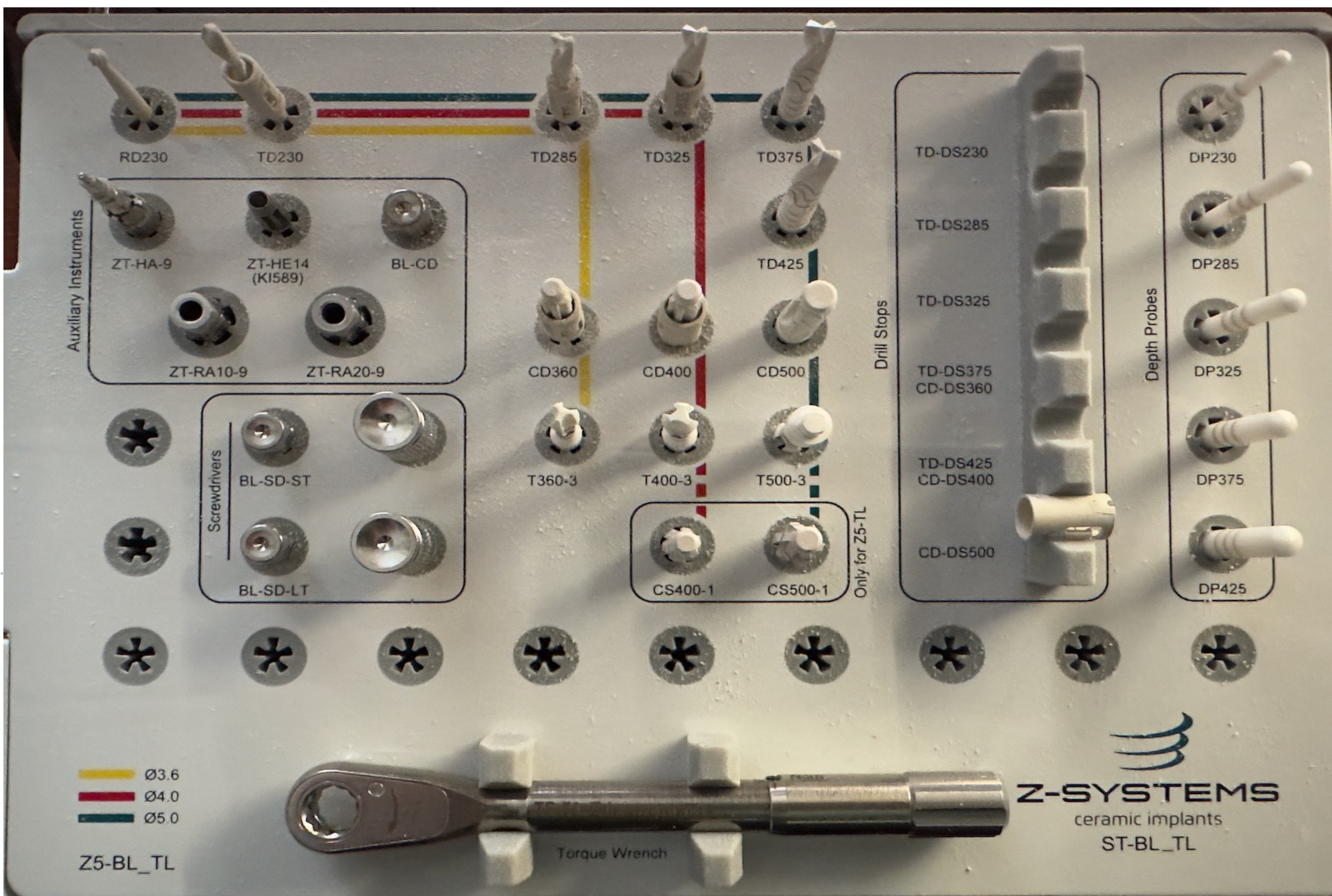
Objective

- The aim of this study was to alter the surgical protocol of zirconia implants to achieve a **higher** insertion torque for **immediate** loading.

Material & Methods

- Zirconia Implants (Z-systems Z5-BL 3.6mmx10mm)
- Artificial polyurethane (PCF 40) blocks
- Dentsply Friadent implant motor
- Z-systems ceramic implant surgical kit
- Z-systems zirconia implants were placed into dense PCF 40 polyurethane artificial bone blocks and the insertion torque was measured for 4 experimental groups which consisted of 20 trials each.
- The surgical protocol consisted of three osteotomy drills and one drill for tapping.
- Statistical comparison was performed with t-test for test and control groups.

Two-piece implant types



• **Group 1**

- Followed the manufacturers guidelines: TD230 800rpm->TD285 600rpm->CD360 400rpm-> T360-3 15rpm **10 mm tapping.**

• **Group 2**

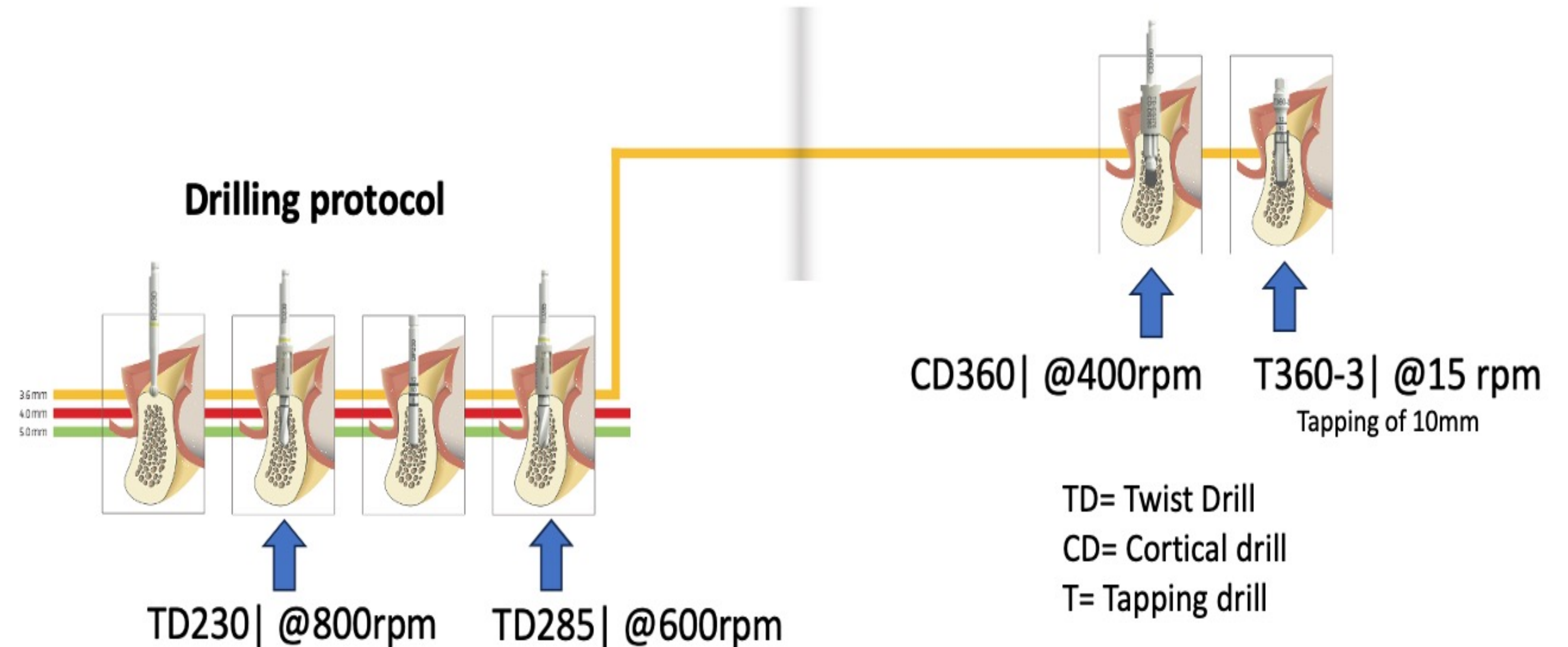
- Protocol drilling speeds were altered to 2000rpm for the 3 osteotomy drills
- TD230 2000rpm->TD285 2000rpm->CD360 2000rpm-> T360-3 15rpm **10mm tapping.**

• **Group 3**

- Manufacturers protocol was followed with the difference of 8 mm tapping depth instead of 10mm
- TD230 800rpm->TD285 600rpm->CD360 400rpm-> T360-3 15rpm **8 mm tapping.**

• **Group 4**

- Manufacturers drilling sequence was followed at 2000rpm with an 8 mm tapping depth.
- TD230 2000rpm->TD285 2000rpm->CD360 2000rpm-> T360-3 15rpm **8mm tapping.**



- Drill stops were used for each drill to ensure reproducibility of osteotomy depth.

Results

- Each experimental group consisted of 20 trials
- Insertion torque was measured for each trial and the average and standard deviation was calculated for each experimental group
- Test groups (3 and 4) showed significantly greater insertion torque ($p < 0.05$) regardless of speed (rpm) used in the drilling protocol.

	Group 1	Group 2	Group 3	Group 4
Trial #	Torque (Ncm)	Torque (Ncm)	Torque (Ncm)	Torque (Ncm)
1	15	15	32	35
2	15	15	30	35
3	15	15	35	32
4	15	15	30	32
5	15	15	35	35
6	15	15	35	32
7	15	15	35	32
8	15	15	35	35
9	15	15	35	35
10	15	15	35	35
11	15	15	35	35
12	15	15	32	35
13	15	15	35	32
14	15	15	35	35
15	15	15	35	35
16	15	15	35	35
17	15	15	35	32
18	15	15	35	35
19	15	15	32	35
20	15	15	35	32
Average	15	15	34.05	33.95
St. Deviation	0	0	1.761428846	1.468081455

Discussion

- The initial hypothesis that the high drilling speed (2,000 rpm) would have a positive impact on implant stability was not met.
- Following the conventional protocol with different drilling speed groups 1 and 2 showed low insertion torque (15Ncm), which would not be suitable for immediate loading of zirconia implants.
- By altering the protocol to an 8mm tapping depth (instead of 10mm) we found significant increase in insertion torque values (average of 34 Ncm).

Conclusion

- Within the limitations of the study by making the osteotomy tapping **shorter**, a **higher** insertion torque can be achieved, which may allow clinicians to **immediate load** zirconia dental implants.